Project Manual

Madison Fire Station 14

City of Madison Fire Department

Bid Documents

Volume 1 of 2

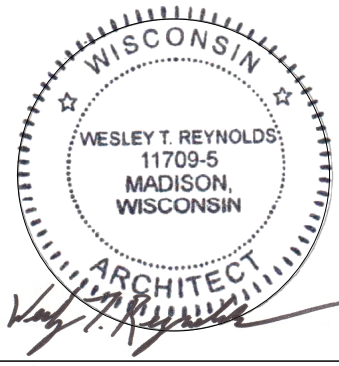
November 3, 2017

Madison Project No. 17451
Madison Contract No. 8027
OPN Project No. 17207000

OPN ARCHITECTS

ARCHITECT OF RECORD:

OPN ARCHITECTS



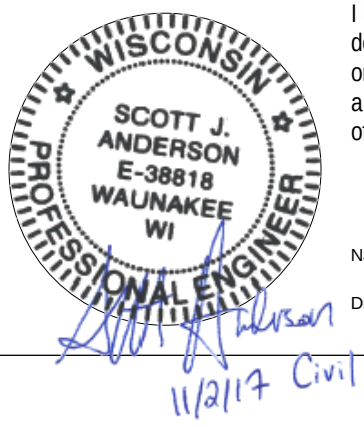
I hereby certify these plans and specifications were prepared by me or under my direct personal supervision and that I am a duly Registered Architect under the laws of the State of Wisconsin.

Name: WESLEY REYNOLDS

Dicipline: ARCHITECT

CIVIL ENGINEER:

SNYDER & ASSOCIATES, INC.



I hereby certify that this civil engineering document and the related work was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

Name: SCOTT ANDERSON

Dicipline: CIVIL ENGINEER

STRUCTURAL ENGINEER:

IMEG CORP.

I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

Name: ABBY A. PERTZBORN

Dicipline: STRUCTURAL ENGINEER

MECHANICAL / ELECTRICAL ENGINEER:

IMEG CORP.

I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

Name: PAUL HANSEN

Dicipline: MECHANICAL ENGINEER

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DIVISION 26 – ELECTRICAL

SECTION 00 31 00

AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.1 EXISTING CONDITIONS

A. Copies of the following reports are provided for infomational purposes:
   1. Wetland Delineation Report: Entitled Wetland Delineation Report - Fire Station #14, dated August 8, 2013, prepared by NES Ecological Services.
      a. A copy of this report is included after this section.
   2. 2013 Geotechnical Report: Entitled Preliminary Geotechnical Exploration Report - Proposed Fire Station No. 14 & Fire Training Facility, dated August 9, 2013, prepared by CGC, Inc.
      a. A copy of this report is included after this section.
   3. 2017 Addendum to Geotechnical Report: Entitled Geotechnical Exploration Report - Proposed Fire Station No. 14, dated July 13, 2017, prepared by CGC, Inc.
      a. A copy of this report is included after this section.
   4. Siesmic Testing Report: Entitled Seismic Site Classification at the Proposed Madison Fire Station, Madison, Wisconsin, dated August 3, 2017, prepared by GEI Consultants.
      a. A copy of this report is included after this section.
   5. Helical Pier Bore and Geotechnical Report: Entitled Supplemental Geotechnical Exploration Report Proposed Fire Station No. 14 - Helical Pier Alternative, dated September 26, 2017, prepared by CGC, Inc.
      a. A copy of this report is included after this section.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

WETLAND DELINEATION REPORT
FIRE STATION #14

Prepared for

City of Madison - Engineering
210 Martin Luther King Jr. Boulevard, Room 406
Madison, Wisconsin 53703-3345
Project #15220004

Authored By:

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August 8, 2013

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NES ECOLOGICAL SERVICES
A Division of Robert E. Lee & Associates, Inc.

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INTRODUCTION

NES Ecological Services (NES) – A Division of Robert E. Lee & Associates, Inc., under contract with the City of Madison, conducted a wetland delineation within the Fourth Addition to World Dairy Center (Lots 34,35,36, Part of Lot 51, 52 & 53) in the City of Madison, Dane County, Wisconsin (Appendix A). The area investigated is approximately 14.6 acres in size and contains approximately 0.49 acre of wetland. The delineation was conducted to detect wetland resources that may be impacted during the construction of a proposed municipal fire station and training center.

NES is a natural resources firm focusing entirely on issues associated with wetlands, native habitat restoration and wildlife management. NES staffs ecologists specializing in wetlands, botany, and wildlife who are well qualified to assist individuals, companies, and municipalities with a variety of wetland services, ecological surveys, natural resource planning, and native habitat restoration projects. The wetland ecologists involved with this project are Theran Stautz and Troy Anderson. Mr. Stautz has a B.S. in Forest Science and over seven years of wetland delineation, monitoring and restoration experience. Mr. Anderson has fifteen years of restoration ecology experience.

Mr. Stautz is a Wisconsin Department of Natural Resources (WDNR) Assured Wetland Delineator.

PRE-FIELD REVIEW

An initial review of the United States Geological Survey (USGS) Topographic Map (National Geographic Society, 2013), the Wisconsin Department of Natural Resources (WDNR) Surface Water Data Viewer (2013), 1995, 2000, 2005 and 2010 Dane County orthophotos, the Natural Resource Conservation Service (NRCS) Web Soil Survey (2013), the NRCS Official Soil Series Descriptions, and the NRCS Hydric Soils List of Wisconsin was performed prior to the wetland delineation in order to gain familiarity with the site's topography, existing wetland vegetation and soils data.

Topography

The USGS topographic map indicates the project area is flat (Appendix A).

Past Land Uses

Based on the 1995 and 2000 aerial photographs, it appears that several businesses occupied the project area. Several lots are cleared in the 2005 photograph and Dairy Drive has been constructed. The 2010 photograph indicates that all the lots have gone fallow.

Wetland Mapping

The WDNR Wetlands Inventory indicates the presence of a forested/emergent wetland (T3/E1K) and narrow-leaved emergent wetland (E2K) within the project area (Appendix B).

Mapped Soils

The NRCS Web Soil Survey indicates the presence of five soil series within the site (Table 1 and Appendix B). A description of these soils can be found in Appendix C.

Table 1. Mapped Soil Units within Project Area.

Soil Series	Hydric Inclusion*	Drainage	Percent Composition On-Site**
Houghton muck (Ho) †	--	Very poorly drained	9.2
Palms muck (Pa) †	--	Very poorly drained	0.6
Sable silty clay loam, 0-3% slopes (SaA) †	--	Poorly drained	24.7
Virgil silt loam, gravelly substratum 0-3% slopes (VwA)	Wetter soils	Somewhat poorly drained	45.9
Wacousta silty clay loam (Wa) †	--	Very poorly drained	19.5

* NRCS Wisconsin Hydric Soils List (2013)
**Source: Calculated using NRCS Web Soil Survey website (2013).
† NRCS Listed Hydric Soil

Precipitation

The wetland delineation was conducted during the middle part of the growing season, which tends to be a drier period due to less frequent precipitation events and increased evapotranspiration. Based on the data displayed in Table 2, the summer of 2013 was much wetter than normal (102%). In the two weeks prior to conducting field work, 1.66" of precipitation was recorded.

Table 2. Summary of Precipitation between April and June, 2013 in the Madison Area, Wisconsin.

Category	April	May	June
Recorded Precipitation	5.83	6.57	10.86
Average Monthly Precipitation	3.40	3.55	4.54
Amount Above/Below Average	+2.43	+3.02	+6.32

Precipitation values are measured in inches
Source: National Weather Service website – 2013 (Appendix D).

METHODOLOGY

Wetland boundaries were established based on a combination of the routine and comprehensive wetland delineation method as defined in the *Regional Supplement to the 1987 Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions* (NC/NE Supplement) (USACE ERDC, 2012).

Equipment & Materials Utilized:
Base Maps
NC/NE Supplement Data Forms
Compass
25-foot tape
Soil Auger
Sharp Shooter Spade
Munsell Soil Color Charts (Munsell Color, 2010)

Vegetation, soils and hydrology data were collected and recorded on NC/NE Supplement Data Forms (Appendix E) at a total of nine sample plots. These plots were chosen because NES felt they adequately covered and characterized the subject areas.

Vegetation

At each sample plot, the percent cover for each species within the vicinity of the plot was visually estimated and recorded on the NC/NE Supplement data forms. Herbaceous, shrub/sapling/vine and tree layers were measured within 5-foot, 15-foot and 30-foot radius plots, respectively. Dominant species were then determined by applying the 50/20 rule and Prevalence Index and their wetland indicator status was taken from *The National Wetland Plant List: 2013 wetland ratings* (Lichvar, 2013). After the indicators were applied, a decision regarding the dominance of hydrophytic vegetation was made.

Soils

At the sample plots, a soil pit was dug with a spade to a depth of at least 20", where possible. One plot could not to be excavated to that depth due to the presence of compacted soil. The presence and abundance of mottling, matrix color, and texture were then recorded for each of the soils found. The Munsell Soil Color Charts were used to determine the hue, value and chroma of all soils that were observed when moist.

The profiles were also observed to determine the presence of hydric indicators that are listed in the NC/NE Supplement. The presence or absence of these indicators was then used to determine if hydric soils exist at the sample plot.

Hydrology

Prior to conducting the on-site investigation, all available background data were reviewed to determine the presence of saturated soil conditions or standing water. If present, surface water depths were measured and recorded at each sample plot; however, if standing water was absent, the presence of free standing water and/or soil saturation within the excavated soil pit was measured. Soil pits are typically left open for at least one hour prior to recording data. In addition to measuring water depths, the site was investigated for other primary and secondary indicators listed on the data forms.

RESULTS

Site Description

Current Land Uses

The project area is located in a fallow area north of Femrite Drive and on the east and west sides of Dairy Drive. Several gravel roads and concrete pads remain from the business that was formerly on-site.

Water Features/Hydrology

Primary wetland hydrology indicators A1 (Surface Water), A2 (High Water Table), A3 (Saturation), C1 (Hydrogen Sulfide Odor) and/or C3 (Oxidized Rhizospheres along Living Roots) were present at the wetland plots during the investigation. Secondary wetland hydrology indicators D2 (Geomorphic Position) and D5 (FAC-Neutral Test) were also present.

Soils

Two wetland plots matched the A4 (Hydrogen Sulfide) and one plot matched the F6 (Redox Dark Surface) Hydric Soil Indicators.

One upland plot matched the A12 (Thick Dark Surface) Hydric Soil Indicator, but it was considered a relic due to the lack of wetland hydrology during an extremely wet period.

Plant Communities

Five communities (three upland and two wetland) were identified on-site (Table 3).

Table 3. Summary of Plant Communities.

Upland Communities	Wetland Communities
Fallow Field	Wet Meadow
Forest	
Meadow	

Findings

Wetland Communities

The delineation conducted by NES during a site visit on July 17, 2013 resulted in the identification of one wetland (Appendix F).

Wetland 1, a wet meadow (E2K), is 0.49 acre in size (Plots 2, 5 and 7). The wetland corresponds with the emergent wetland mapped by the Wisconsin Wetland Inventory.

Plot 2: Dominant vegetation is *Phalaris arundinacea*. The Dominance Test and Prevalence Index is 100% and 2.020. Surface water is 1 inch deep. Primary wetland hydrology indicators A1, A2, A3 & C3 and secondary indicators D2 & D5 are present. The soil matches the F6 NRCS Hydric Soil Indicator.

Plot 5: Dominant vegetation is *P. arundinacea*. The Dominance Test and Prevalence Index is 100% and 2.000. The water table is present at 13 inches and saturation is present at 10 inches below the surface. Primary wetland hydrology indicators A3 & C1 and secondary indicators D2 & D5 are present. The soil matches the A4 NRCS Hydric Soil Indicator.

Photo 1 – Wetland 1, looking west from Agriculture Drive.

Photo 2 – Wetland 1, looking east from Plot 5.

Plot 7: Dominant vegetation is *P. arundinacea*. The Dominance Test and Prevalence Index is 75% and 2.039. Surface water is 2 inches deep. Primary wetland hydrology indicators A1, A2, A3 & C1 and secondary indicators D2 & D5 are present. The soil matches the A4 NRCS Hydric Soil Indicator.

The wetland boundary was established based on wetland hydrology, hydric soil, topography and professional judgment.

Photo 3 – Wetland 1, looking south from NE corner of project area.

CONCLUSION

Wetland boundaries established on the property are NES' best estimate of their locations based upon the conditions and field indicators observed at the time of our site investigation. Our wetland boundaries are seldom changed; however, the regulating agencies (USACE, WDNR and other local governing units) decide their ultimate location. As a result, our wetland boundaries could be adjusted slightly during an agency review. Weather factors and the time of year reviewed are just two factors that could change a wetland's appearance and result in a boundary change. Because changes could occur, it is NES' policy to recommend to all our clients that they receive agency concurrence from both the WDNR and the USACE.

However, since Mr. Stautz is a Professional Wetland Delineator assured by the WDNR, he will not need WDNR concurrence. The WDNR has thoroughly reviewed his education, field experience and report preparation capabilities and accepted him into their program, which means automatic concurrence on any project in which he is the lead field investigator and report author. As part of the program requirements, however, he is still required to send a copy of the report to the WDNR in Madison. Unfortunately, the USACE does not yet have a similar program so we will send them a copy of the report to ensure they agree with the wetland boundary established by NES. Agency concurrence will also guarantee that this delineation is valid for the next five years.

LITERATURE CITED

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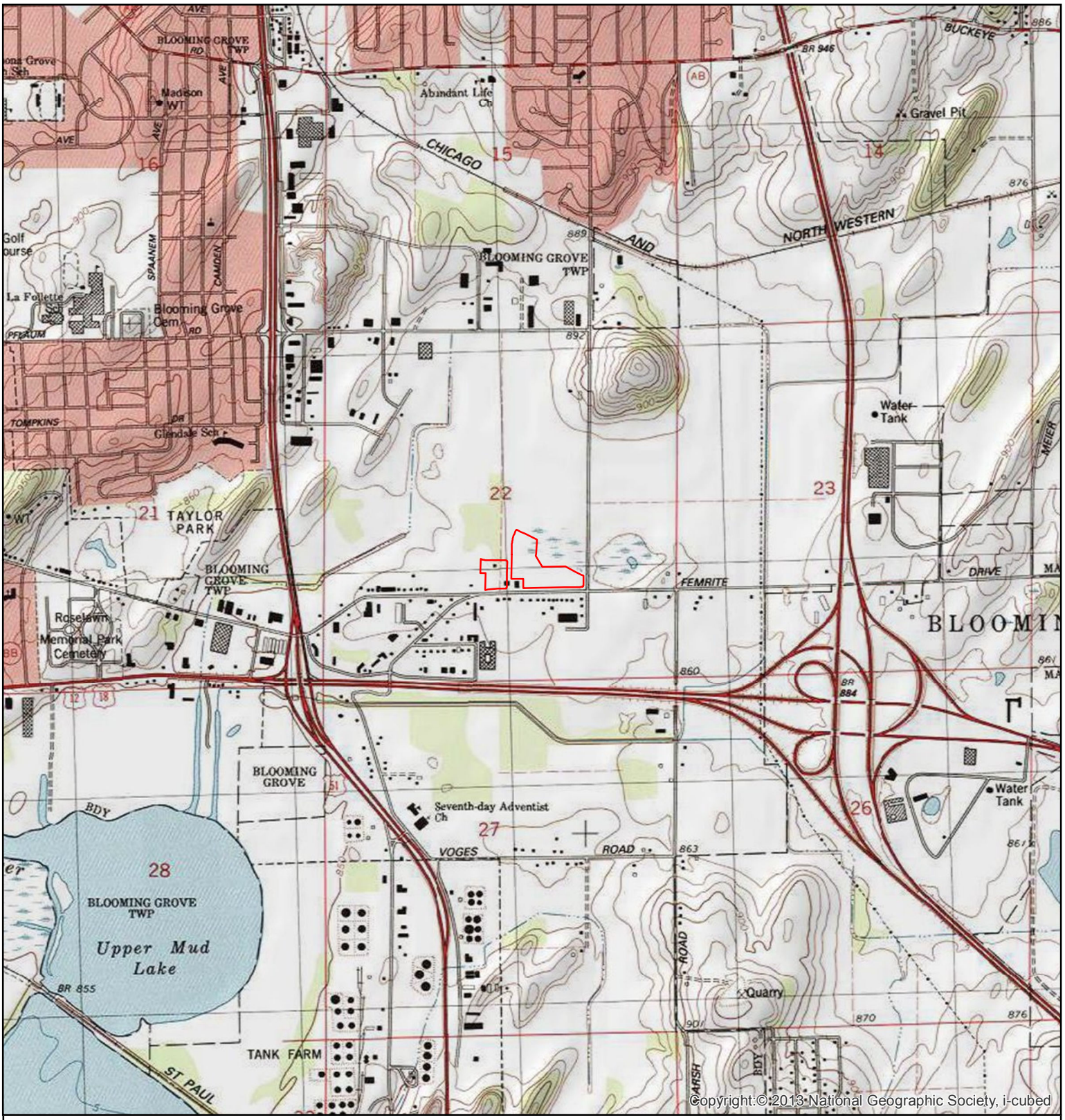
A

APPENDIX A

Site Location



Legend

Project Area (+/- 14.6 acres)

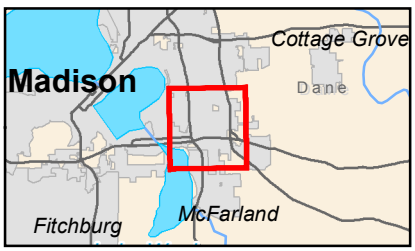
Located in part of the S 1/2,
Section 22, T7N, R10E,
City of Madison, Dane County,
Wisconsin

0 1,000 2,000
Feet

Document Path: Z:\Data\Jobs\Wetlands\Madison, City of\Fire Station 4\Maps\AppA.mxd

Appendix A
Site Location

City of Madison
Fire Station #14
Project No. 15220004
City of Madison, Dane County, Wisconsin



Extent of large view shown in red.

N

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August 6, 2013

B

APPENDIX B

Soil Survey of Dane County and Wisconsin Wetland Inventory

Legend

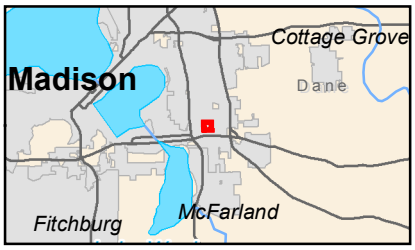
- Project Area (+/- 14.6 acres)
- Soil Map Unit
- Upland
- Wetland
- Filled or Drained Wetland

0 100 200

Feet

Appendix B
Soil Survey of Dane County and Wisconsin Wetland Inventory

City of Madison
Fire Station #14
Project No. 15220004
City of Madison, Dane County, Wisconsin



Extent of large view shown in red.

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August 6, 2013

C

APPENDIX C

Natural Resource Conservation Service Official Soil Series Descriptions

LOCATION HOUGHTON MI+IA IL IN MN WI

Established Series
Rev. LWB-WEF-RAB
06/2011

HOUGHTON SERIES

The Houghton series consists of very deep, very poorly drained soils formed in herbaceous organic materials more than 130 cm (51 inches) thick in depressions on lake plains, outwash plains, ground moraines, end moraines, and floodplains. Slope ranges from 0 to 2 percent. Mean annual precipitation is about 889 mm (35 inches), and mean annual temperature is about 10.0 degrees C (50 degrees F).

TAXONOMIC CLASS: Euic, mesic Typic Haplosaprists

TYPICAL PEDON: Houghton muck, on a level area in a cultivated field. (Colors are for moist soils unless otherwise stated.)

Oa1--0 to 23 cm (9 inches); black (N 2.5/) broken face and rubbed muck (sapric material); about 5 percent fiber, a trace rubbed; weak coarse subangular blocky structure; neutral [pH 7.0 in KCl]; abrupt smooth boundary.

Oa2--23 to 33 cm (9 to 13 inches); black (N 2.5/) broken face, very dark brown (7.5YR 2/2) rubbed muck (sapric material); about 5 percent fiber, a trace rubbed; weak medium granular structure; neutral [pH 7.0 in KCl]; abrupt smooth boundary.

Oa3--33 to 61 cm (13 to 24 inches); dark reddish brown (5YR 3/2) broken face, dark reddish brown (5YR 2/2) rubbed muck (sapric material); about 15 percent fiber, less than 5 percent rubbed; massive, breaking to thick platy fragments; neutral [pH 7.0 KCl]; abrupt smooth boundary.

Oa4--61 to 81 cm (24 to 32 inches); black (5YR 2/1) broken face and rubbed muck (sapric material); about 10 percent fiber, a trace rubbed; massive; about 1 percent woody fragments; neutral [pH 7.0 in KCl]; clear wavy boundary.

Oa5--81 to 122 cm (32 to 48 inches); dark reddish brown (5YR 2/2) broken face, black (5YR 2/1) rubbed muck (Sapric material); about 20 percent fiber, less than 10 percent rubbed; massive, breaking to thick platy fragments; neutral [pH 7.0 in KCl]; abrupt smooth boundary.

Oa6--122 to 203 cm (48 to 80 inches); dark reddish brown (5YR 2/2) broken face and rubbed muck (sapric material); about 10 percent fiber, less than 10 percent rubbed; massive; slightly sticky; about 15 percent mineral soil; neutral [pH 7.0 in KCl].

TYPE LOCATION: Clinton County, Michigan; about 3 miles northeast of the village of Bath; 200 feet north and 400 feet east of the southwest corner of sec. 12, T. 5 N., R. 1 W.; USGS Bath topographic quadrangle; lat. 42 degrees 49 minutes 43.4 seconds N. and long. 84 degrees 52 minutes 56.9 seconds W.; NAD 27.

RANGE IN CHARACTERISTICS:
Thickness of the organic material: more than 130 cm (51 inches)
Organic fibers: derived primarily from herbaceous plants, but some layers contain as much as 30 percent woody material
Woody fragment content: averages less than 15 percent by volume in the control section
Reaction: very strongly acid to slightly alkaline throughout

Oa horizon:
Hue: 5YR to 10YR, or is neutral
Value: 2, 2.5 or 3
Chroma: 0 to 3
Organic material: dominantly muck (sapric material), or to lesser extent mucky peat (hemic material) that has a combined thickness of less than 25 cm (10 inches) or peat (fibric material) that is less than 13 cm (5 inches) thick

Some pedons have coprogenous material or marly material below 130 cm (51 inches).

COMPETING SERIES: These are the Carlisle, Catden, Lena, Peteetneet, Saltese, and Semiahmoo series. Carlisle soils derived dominantly from woody materials and contain an average of 15 to 30 percent woody fragments in the control section. Lena soils contain carbonates throughout the control section. Peteetneet soils are not massive in the bottom tier. Saltese soils have lenses of diatomaceous earth and volcanic ash within a depth of 130 cm (51 inches). Semiahmoo soils are in areas with warm dry summers and mild moist winters, and typically are more acidic throughout the control section.

GEOGRAPHIC SETTING: Houghton soils are in closed depressions on lake plains, outwash plains, ground moraines, end moraines, and flood plains. Slope gradients are less than 2 percent. Houghton soils formed in herbaceous organic materials more than 130 cm (51 inches) thick. Mean annual precipitation ranges from 762 to 1067 mm (30 to 42 inches). Mean annual temperature ranges from 8.9 to 11.7 degrees C (48 to 53 degrees F).

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Adrian, Edselton, Edwards, Moston, Muskego, Palms, and Willette soils. Edselton and Edwards soils are underlain by marly material at depths of 41 to 130 cm (16 to 51 inches). Moston, and Muskego soils are underlain by coprogenous material at depths of 41 to 130 cm (16 to 51 inches). Poorly or very poorly drained mineral soils are commonly associated along the margins of the bogs.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Very poorly drained. Depth to the seasonal high water table ranges from 61 cm (2 feet) above the surface in ponded phases to 30 cm (1 foot) below the surface between September and June in normal years. Potential for surface runoff is very slow or ponded. Saturated hydraulic conductivity is moderately high or high. Permeability is moderately slow to moderately rapid.

USE AND VEGETATION: A considerable area of these soils is used for cropland or pasture. Common

crops are onions, lettuce, potatoes, celery, radishes, carrots, mint, and some corn. Native vegetation is primarily of marsh grasses, sedges, reeds, buttonbrush, and cattails, with some water-tolerant trees near the margins of the bogs.

DISTRIBUTION AND EXTENT: Mostly in MLRAs 95B, 98, 111B, and 111C, and to lesser extent in MLRAs 89, 95A, 96, 97, 99, 103, 104, 105, 108A, 108B, 108C, 110, 111A, 111C, 111D, and 115C in Michigan, Wisconsin, Indiana, Iowa, Minnesota, and Illinois. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Indianapolis, Indiana.

SERIES ESTABLISHED: Roscommon County, Michigan, 1924.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Muck (sapric material): from the surface to a depth of 203 cm (80 inches) (Oa1, Oa2, Oa3, Oa4, Oa5, Oa6 horizons).

ADDITIONAL DATA: Soil Interpretation Record - (MI0024, MI0291 (PONEED), MI0532 (SLOPING), MI0390 (MAAT>50), MI0383 (FREQUENTLY FLOODED).

National Cooperative Soil Survey
U.S.A.

LOCATION PALMS MI+IA IL IN MA MN NY PA VA WI

Established Series
Rev. LWB-WEF-DAG
08/2012

PALMS SERIES

The Palms series consist of very deep, very poorly drained soils formed in herbaceous organic materials 41 to 130 cm (16 to 51 inches) thick and the underlying loamy deposits in closed depressions on moraines, lake plains, till plains, outwash plains, and hillside seep areas, and on backswamps of flood plains. Slope ranges from 0 to 6 percent. Mean annual precipitation is about 889 mm (35 inches), and mean annual temperature is about 10.0 degrees C (50 degrees F).

TAXONOMIC CLASS: Loamy, mixed, euic, mesic Terric Haplosaprists

TYPICAL PEDON: Palms muck, on 1 percent slope under marsh vegetation at an elevation of 198 meters (648 feet) above mean sea level. (Colors are for moist soil unless otherwise stated.)

Oa1--0 to 36 cm (14 inches); black (10YR 2/1) broken face and rubbed muck (sapric material); about 5 percent fiber, less than 5 percent rubbed; moderate medium granular structure; slightly sticky; about 20 to 25 percent mineral material; slightly acid [pH 6.5 in water]; abrupt smooth boundary.

Oa2--36 to 71 cm (14 to 28 inches); black (10YR 2/1) broken face and rubbed muck (sapric material); about 5 percent fiber, less than 5 percent rubbed; massive parting to weak coarse subangular blocky structure; slightly sticky; 10 to 20 percent mineral material; strongly acid [pH 5.5 in water]; clear smooth boundary.

Oa3--71 to 89 cm (28 to 35 inches); black (N 2.5/) rubbed muck (sapric material); about 5 percent fiber, less than 5 percent rubbed; massive; slightly sticky; 10 to 20 percent mineral material; moderately acid [pH 6.0 in water]; abrupt smooth boundary. [Combined thickness of the Oa horizon is 41 to 130 cm (16 to 51 inches).]

Cg--89 to 203 cm (35 to 80 inches); gray (10YR 5/1) clay loam; massive; friable; common medium distinct dark yellowish brown (10YR 4/4) masses of oxidized iron in the matrix; neutral in upper part, slightly effervescent; moderately alkaline in lower part.

TYPE LOCATION: Gratiot County, Michigan; north of the flood plain of the Maple River and about 200 feet south of the upland; 1,420 feet south and 820 feet west of the northeast corner of sec. 27, T. 9 N., R. 2 W.; USGS Pompeli topographic quadrangle; lat. 43 degrees 8 minutes 31.3 seconds N. and long. 84 degrees 31 minutes 34.7 seconds W., NAD 27; UTM Zone 16, 701165 easting and 4779557 northing, NAD 83.

RANGE IN CHARACTERISTICS:
Depth to the loamy C horizon: 41 to 130 cm (16 to 51 inches)

Organic material: derived primarily from herbaceous plants, but some layers contain as much as 15 percent woody material

Surface tier (Oa1 or Oap horizon):
Hue: 5YR to 10YR, or is neutral
Value: 2, 2.5, or 3
Chroma: 0 to 2
Organic material: dominantly muck (sapric material), or less commonly mucky peat (hemic material)
Reaction: strongly acid to slightly alkaline

Subsurface and bottom tiers (Oa, Oe, or Oi horizons):
Hue: 5YR to 10YR, or is neutral
Value: 2 to 4
Chroma: 0 to 3
Organic material: some pedons have thin layers less than 25 cm (10 inches) thick of mucky peat (hemic material) or thin layers less than 13 cm (5 inches) thick of fibric material; some pedons have a thin layer of sedimentary peat above the C horizon.
Reaction: strongly acid to slightly alkaline, some pedons have carbonates

Some pedons have a thin A horizon above the C horizon.

C or Cg horizon:
Hue: 10YR to 5Y, 5GY, or is neutral
Value: 3 to 7
Chroma: 0 to 4
Texture: loamy very fine sand, sandy loam, fine sandy loam, loam, silt loam, silty clay loam, clay loam, or sandy clay loam, or the gravelly analogues of these textures; thin strata of fine sand, loamy sand, or silt in some pedons
Clay content: upper 30 cm (12 inches) averages between 10 and 35 percent clay
Rock fragment content: 0 to 25 percent gravel to stones
Reaction: moderately acid to moderately alkaline; some pedons contain carbonates

Sandy substratum, gravelly substratum, and overwash phases are recognized.

COMPETING SERIES: These are the Klossner, Linwood, Medo, Natchaug, Philbon, and Shalcar series. Klossner soils have A horizons directly below the organic matter that is more than 20 cm (8 inches) thick. Linwood soils formed mainly in woody fibers. Medo soils have less than 10 percent clay in the lower one third of the series control section. Natchaug soils are in areas where the mean annual precipitation is greater than 1092 mm (43 inches). Philbon soils have dominantly fibric and hemic material in the upper 30 cm (12 inches). Shalcar soils have a difference between mean annual summer and mean annual winter temperatures that is less than 26 degrees F.

GEOGRAPHIC SETTING: Palms soils are in closed depressions on lake plains, till plains, outwash plains, moraines, and hillside seep areas, and in backswamps on flood plains. Slope ranges from 0 to 6 percent. Palms soils formed herbaceous organic materials and the underlying loamy deposits. The soils on nearby uplands are generally loamy. Mean annual temperature ranges from 8.9 to 11.7 degrees C (48 to 53 degrees F). Mean

annual precipitation ranges from 762 to 1092 mm (30 to 43 inches). Frost-free period is 120 to 180 days. Elevation is 177 to 466 meters (580 to 1,530 feet) above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: The Houghton soils are the most common associate and are on similar landform positions. Poorly drained or very poorly drained loamy mineral soils are at the edges of the bogs and are adjacent to Palms soils.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Very poorly drained. Depth to the top of an apparent seasonal high water table ranges from 30 cm (1 foot) above the surface to 30 cm (1 foot) below the surface between November and May in normal years. Potential for surface runoff is negligible. Saturated hydraulic conductivity is moderately high or high in the organic material and moderately high in the loamy material. Permeability is moderately slow to moderately rapid in the organic material and moderate or moderately slow in the loamy material.

USE AND VEGETATION: Most areas of this soil are in marsh vegetation of grasses, reeds, and sedges; and alder, aspen, willow, and dogwood. Some areas have been drained and are used for pasture, corn, and some truck crops.

DISTRIBUTION AND EXTENT: MLRAs 89, 95A, 95B, 97, 98, 99, 101, 102A, 103, 104, 105, 108A, 108B, 110, 111A, 111B, 111C, 111D, 115C, 127, 140, 142, 144A, 144B, and 145 in the southern parts of lower Michigan, Wisconsin, Illinois, Indiana, Iowa, Massachusetts, Minnesota, New York, and other northeastern states. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: AMHERST, MASSACHUSETTS

SERIES ESTABLISHED: Sanilac County, Michigan; 1955.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Muck (sapric material) from the surface to a depth of 89 cm (35 inches) (Oa1, Oa2, and Oa3 horizons).
Terric feature: mineral material from a depth of 89 to 203 cm (35 to 80 inches) (Cg horizon).

ADDITIONAL DATA: Lab characterization data is available from the National Soil Survey Laboratory, Lincoln, NE.

National Cooperative Soil Survey
U.S.A.

LOCATION SABLE IL+IA IN WI

Established Series
Rev. JCD-KDH-AAC
02/2011

SABLE SERIES

The Sable series consists of very deep, poorly drained, moderately permeable soils formed in loess on nearly level broad summits of moraines and stream terraces. Slope ranges from 0 to 2 percent. Mean annual temperature is about 10.6 degrees C (51 degrees F)., and mean annual precipitation is about 889 mm (35 inches).

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Typic Endoaquolls

TYPICAL PEDON: Sable silty clay loam - nearly level in a cultivated field at an elevation of about 223 meters (732 feet) above mean sea level. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 20 cm (0 to 8 inches); black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine and medium granular structure; firm; moderately acid; abrupt smooth boundary.

A--20 to 48 cm (8 to 19 inches); black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine angular blocky structure; firm; few fine spherical dark reddish brown (5YR 3/2) very weakly cemented iron-manganese concretions throughout; slightly acid; clear smooth boundary. [Combined thickness of A horizon ranges from 25 to 51 cm (10 to 20 inches).]

AB--48 to 58 cm (19 to 23 inches); very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine angular blocky structure; firm; few faint very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine spherical dark reddish brown (5YR 3/2) very weakly cemented iron-manganese concretions throughout; slightly acid; clear smooth boundary.[0 to 15 cm (0 to 6 inches) thick]

Bg--58 to 74 cm (23 to 29 inches); dark gray (10YR 4/1) silty clay loam; moderate fine and medium subangular blocky structure; firm; common faint very dark gray (10YR 3/1) organic coatings on faces of peds; common fine and medium spherical dark reddish brown (5YR 3/2) very weakly cemented iron-manganese concretions throughout; common medium distinct brown (10YR 5/3) masses of oxidized iron-manganese in the matrix; few medium faint dark grayish brown (10YR 4/2) iron depletions in the matrix; neutral; clear smooth boundary.

Btg1--74 to 97 cm (29 to 38 inches); grayish brown (2.5Y 5/2) silty clay loam; moderate medium and coarse subangular blocky structure; firm; few distinct dark gray (10YR 4/1) clay films on faces of peds; many fine and medium spherical dark reddish brown (5YR 3/2) very weakly cemented iron-manganese concretions throughout; many medium prominent yellowish brown (10YR 5/6) masses of oxidized iron in the matrix; neutral; clear wavy boundary.

Btg2--97 to 119 cm (38 to 47 inches); gray (N 5/0) silt loam; weak medium prismatic structure parting to weak medium and coarse angular blocky; firm; few distinct grayish brown (10YR 5/2) clay films on faces of prisms; common fine spherical dark reddish brown (5YR 3/2) very weakly cemented iron-manganese concretions throughout; many medium prominent yellowish brown (10YR 5/6) masses of oxidized iron in the matrix; slightly alkaline; gradual smooth boundary. [Combined thickness of the B horizon ranges from 33 to 117 cm (13 to 46 inches).]

Cg--119 to 152 cm (47 to 60 inches); gray (N 6/0) silt loam; massive; friable; many medium prominent yellowish brown (10YR 5/6) masses of oxidized iron in the matrix; slightly effervescent; slightly alkaline.

TYPE LOCATION: Warren County, Illinois; about 3 miles northwest of Roseville; 97 feet west and 1,281 feet south of the northeast corner, sec. 14, T. 9 N., R. 3 W.; USGS Kirkwood East topographic quadrangle; lat. 40 degrees, 46 minutes, 22.5 seconds N., long. 90 degrees, 41 minutes, 34.2 seconds W.; UTM Zone 15T 0694708 easting and 4516111 northing, NAD 83.

RANGE IN CHARACTERISTICS:
Depth to the base of the cambic horizon: 102 to 152 cm (40 to 60 inches)
Thickness of the mollic epipedon: 31 to 61 cm (12 to 24 inches) and extends into the upper part of the B horizon in some pedons.
Particle-size control section: averages between 27 and 35 percent clay
Average sand content in the series control section: commonly less than 5 percent, but ranges to 8 percent.
Depth to carbonates: greater than 102 cm (40 inches)
Mean annual soil temperature: 8.9 to 13.3 degrees C (48 to 56 degrees F)
Special features: Krotovina are common features in many pedons.

Ap or A horizon:
Hue: 10YR, 2.5Y, 5Y or n (neutral)
Value: 2 to 3
Chroma: 0 or 1
Texture: commonly silty clay loam, but in some pedons it is silt loam.
Clay content: less than 35 percent
Reaction: moderately acid to neutral

AB or BA horizon;
Hue; 10YR, 2.5Y, 5Y or N (neutral)
Value: 2 to 3
Chroma: 0 or 1
Texture: silty clay loam
Reaction: moderately acid to neutral

Btg, Bg, BC, and/or BCg horizons;
Hue: 10YR, 2.5Y, 5Y or N (neutral)
Value: 3 to 6
Chroma: 0 to 2
Texture: silty clay loam in the upper part and silty clay loam or silt loam in the lower part

Clay content: 24 to 35 percent
Reaction: moderately acid to neutral except that the lowest subhorizons in some pedons range to slightly alkaline.
Content of total phosphorous: lowest values in the upper part of the B horizon and is less than 400 ppm.

Cg horizon:
Hue: 10YR, 2.5Y, 5Y or N (neutral)
Value: 3 to 6
Chroma: 0 to 2
Texture: typically silt loam, but includes silty clay loam in the upper part in some pedons.
Clay content: 20 to 28 percent
Reaction: neutral to moderately alkaline
Other features: Some pedons do not have carbonates in the upper part of the Cg horizon.

An overwash phase is recognized where recent deposition from adjacent higher parts of the landscape has buried the original A horizon. A stratified substratum phase is also recognized. (see remarks.)

COMPETING SERIES: These are the Chalmers, Chetomba, Dolbee, Drummer, Dunham, Elpaso, Elvira, Garwin, Gillett Grove, Hartsburg, Madelia, Marcus, Mascoutah, Maxcreek, Maxfield, Maxmore, Ossian, Patton, Pella, Rushmore, and Wacousta series. Chalmers soils have less than 20 percent clay in the lower part of the series control section. Chetomba, Drummer, Dunham, Elpaso, Elvira, Gillett Grove, Maxcreek, Maxfield, Maxmore, Pella, and Rushmore soils average more than 8 percent sand in the lower part of the series control section. Dolbee soils formed in alluvium and have a less systematic increase or decrease in silt- and clay-size particles with depth. Garwin soils are higher in total phosphorus and organic phosphorus, contain less clay films and dark coatings on faces of prisms in the lower part of the B horizons, are lower in iron oxides in the lower part of the B and C horizons, and contain more total clay sized particles to a depth of 152 cm (60 inches). Hartsburg, Madelia, and Wacousta soils have carbonates within a depth of 102 cm (40 inches). Marcus average more than 35 percent clay in the surface layer. Mascoutah and Patton soils have a mean annual soil temperature of more than 13.3 degrees C (56 degrees F). Ossian soils have lower clay content in the upper 76 to 122 cm (2 1/2 to 4 feet) of the sola, have a less pronounced structural development in the B horizon, and in general have a less systematic increase or decrease in silt- and clay-size particles in the sola.

GEOGRAPHIC SETTING: Sable soils are on level or nearly level summits of loess-covered moraines and stream terraces. Typically, they are on broad interstream divides of till plains, and less commonly on unglaciated hills and on terraces. Slope gradients range from 0 to 2 percent. Sable soils formed entirely in loess. Mean annual temperature ranges from 7.8 to 12.2 degrees C (46 to 54 degrees F)., mean annual precipitation ranges from 760 to 1020 mm (30 to 40 inches), frost free days range from 140 to 180 days, and elevation ranges from 104 to 311 meters (340 to 1020 feet) above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Denny, Ipava, Muscatune, Osco, and Tama soils. The poorly drained Denny soils are in shallow closed depressions and have an albic horizon and an argillic horizon. Also, they contain more than 35 percent clay in the particle-size control section. The somewhat poorly drained Ipava and Muscatune soils are commonly on narrow interstream divides, near the edges of broad divides, or on slightly higher or more sloping positions. The moderately well drained Osco soils and well drained Tama soils are on narrow or rounded crests and more sloping parts of the landscape.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Poorly drained. Where drained, the depth to an apparent seasonal high water table is 15 cm (0.5 foot) above the surface to 31 cm (1.0 foot) below the surface at some time between January and May in most years. In the few remaining undisturbed areas, the depth to an apparent seasonal high water table is 15 cm (0.5 foot) above the surface to 15 cm (0.5 foot) below the surface at some time between November and June of most years. The potential for surface runoff is negligible. Saturated hydraulic conductivity is moderately high to high (4.23 to 14.11 micrometers per second). Permeability is moderate.

USE AND VEGETATION: Most areas are used to grow corn and soybeans. Some areas are used to grow small grain and meadow crops. Native vegetation is marsh grasses and sedges.

DISTRIBUTION AND EXTENT: These soils are in Illinois, Wisconsin, Iowa, and Indiana. Sable soils are extensive, over 608,000 acres have been correlated in MLRAs 95B, 104, 105, 108A, 108B, 110, 111D, and 115C.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Indianapolis, Indiana

SERIES ESTABLISHED: Livingston County, Illinois, 1938.

REMARKS: The overwash phase and the stratified substratum phase will be evaluated during the update of MLRA 108 to determine where best to correlate these soils.

Additional Data: For lab analysis refer to Soil Survey Nos. S57IL-94-l-(1-8) in SSIR-19. Lab data from the University of Illinois Pedology lab for an additional 35 pedons is available in the state office.
Diagnostic horizons and features recognized in this pedon are:
mollic epipedon -- the zone from the surface to a depth of 58 cm (23 inches) (Ap, A, and AB horizons);
cambic horizon -- the zone from 58 to 119 cm (23 to 47 inches) (Bg, Btg1, and Btg2 horizons);
Aquic conditions -- redox concentrations and/or depletions from the surface to a depth of 152 cm (60 inches) (assumed to extend to 203 cm (80 inches).

National Cooperative Soil Survey
U.S.A.

LOCATION VIRGIL IL+WI

Established Series
Rev. JCD-SKH-SLE
03/2011

VIRGIL SERIES

The Virgil series consists of very deep, somewhat poorly drained soils on outwash plains, stream terraces, or till plains. These soils formed in loess or other silty material and in the underlying loamy outwash or sandy loam till. Slope ranges from 0 to 6 percent. Mean annual air temperature is about 8.3 degrees C (47 degrees F). Mean annual precipitation is about 890 mm (35 inches).

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Udollic Endoaqualfs

TYPICAL PEDON: Virgil silt loam on a northeast facing, 1 percent slope in a cultivated field at an elevation of about 233 meters (765 feet) above mean sea level. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 18 cm (0 to 7 inches); black (10YR 2/1) silt loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary. [18 to 25 cm (7 to 10 inches) thick]

E--18 to 33 cm (7 to 13 inches); dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to moderate fine granular; friable; many fine roots; few faint black (10YR 2/1) organic coatings on faces of peds and on surfaces along root channels; few fine distinct brown (7.5YR 4/4) masses of oxidized iron-manganese in the matrix; strongly acid; clear smooth boundary. [5 to 20 cm (2 to 8 inches) thick]

Bt1--33 to 43 cm (13 to 17 inches); grayish brown (10YR 5/2) and brown (10YR 5/3) silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; common distinct light gray (10YR 7/2) (dry) clay depletions on faces of peds; few fine distinct black (10YR 2/1) iron-manganese concretions throughout; few fine distinct brown (7.5YR 4/4) masses of oxidized iron-manganese and few prominent strong brown (7.5YR 5/6) masses of oxidized iron in the matrix; strongly acid; clear smooth boundary.

Bt2--43 to 64 cm (17 to 25 inches); grayish brown (10YR 5/2) and brown (10YR 5/3) silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; common faint dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) clay films on faces of peds; common faint light gray (10YR 7/2) (dry) clay depletions on faces of peds; few fine distinct black (10YR 2/1) iron-manganese concretions throughout; few fine distinct brown (7.5YR 4/4) masses of oxidized iron-manganese and prominent strong brown (7.5YR 5/6) masses of oxidized iron in the matrix; strongly acid; gradual smooth boundary.

Btg1--64 to 89 cm (25 to 35 inches); light brownish gray (2.5Y 6/2) silty clay loam; moderate fine and medium subangular blocky structure; firm; few fine roots; many faint grayish brown (2.5Y 5/2) clay films on faces of peds; few distinct light gray (10YR 7/2) (dry) clay depletions on faces of peds; many fine prominent black (10YR 2/1) iron-manganese concretions hroughout; common fine prominent strong brown (7.5YR 5/6 and 7.5YR 5/8) masses of oxidized iron in the matrix; strongly acid; clear smooth boundary.

Btg2--89 to 112 cm (35 to 44 inches); light brownish gray (2.5Y 6/2) silty clay loam; moderate medium and coarse subangular and angular blocky structure; firm; few fine roots; common faint grayish brown (2.5Y 5/2) clay films on faces of peds; few distinct light gray (10YR 7/2) (dry) clay depletions on faces of peds; many fine prominent black (10YR 2/1) iron-manganese nodules and concretions throughout; many medium prominent brown (7.5YR 4/4) masses of oxidized iron-manganese and strong brown (7.5YR 5/6) masses of oxidized iron in the matrix; moderately acid; clear smooth boundary.

Btg3--112 to 124 cm (44 to 49 inches); grayish brown (2.5Y 5/2) silty clay loam; weak medium and coarse angular blocky structure; firm; few fine roots; few prominent gray (N 5/) clay films on faces of peds; many fine prominent black (10YR 2/1) iron-manganese nodules and concretions throughout; many medium prominent brown (7.5YR 4/4) masses of oxidized iron-manganese and strong brown (7.5YR 5/6) masses of oxidized iron in the matrix; moderately acid; clear smooth boundary. [Combined thickness of the Bt and Btg horizons is 51 to 102 cm (20 to 40 inches)]

2Btg4--124 to 147 cm (49 to 58 inches); grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) loam; weak coarse angular blocky structure; firm; few prominent dark gray (N 4/) clay films on faces of peds; few fine prominent black (10YR 2/1) iron-manganese concretions throughout; many medium prominent brown (7.5YR 4/4) masses of oxidized iron-manganese and strong brown (7.5YR 5/6) masses of oxidized iron in the matrix; neutral; gradual smooth boundary. [10 to 43 cm (4 to 17 inches) thick]

2C--147 to 152 cm (58 to 60 inches); brown (10YR 4/3) and dark yellowish brown (10YR 4/4) sandy loam; massive; friable; common fine distinct dark gray (10YR 4/1) and gray (10YR 5/1) iron depletions in the matrix; moderately alkaline.

TYPE LOCATION: Stephenson County, Illinois; about 1 mile south of Freeport; 1,346 feet east and 300 feet south of the northwest corner of sec. 8, T. 26 N., R. 8 E.; USGS Freeport East topographic quadrangle; lat. 42 degrees 16 minutes 20 seconds N., and long. 89 degrees 36 minutes 23 seconds W., UTM Zone 16T, 0285052 easting and 4683325 northing; NAD 83.

RANGE IN CHARACTERISTICS:
Thickness of the solum: typically 122 to 152 cm (48 to 60 inches) but ranges from 107 to 178 cm (42 to 70 inches).
Depth to the horizon with more than 40 percent sand: commonly 114 and 127 cm (45 and 50 inches), but ranges from 102 to 152 cm (40 to 60 inches).
Depth to carbonates: 114 to 178 cm (45 to 70 inches)
Particle-size control section (weighted average): 27 to 35 percent clay

A or Ap horizon:
Hue: 10YR

Value: 2 or 3
Chroma: 1 or 2
Texture: silt loam
Reaction: slightly acid to slightly alkaline

E or Eg horizon:
Hue: 10YR
Value: 4 to 6
Chroma: or 2
Texture: silt loam
Reaction: strongly acid to neutral
Other features: Some pedons have redoximorphic features.

Bt and/or Btg horizons:
Hue: 10YR, 2.5Y or 5Y
Value: 4 to 6
Chroma: 2 to 4
Texture: silty clay loam
Clay content: averages 27 to 35 percent
Sand content: averages less than 10 percent
Reaction: strongly acid to slightly acid, but some pedons range to slightly alkaline in the lower part.
Redoximorphic features have hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 2 to 8.

2Bt, 2Btg, 2BC, and/or 2BCg horizons:
Hue: 10YR, 2.5Y or 5Y
Value: 4 to 6
Chroma: 2 to 8
Texture: loam, sandy loam, clay loam, silt loam or silty clay loam
Average sand content: 20 to 60 percent
Content of rock fragments: less than 10 percent
Redoximorphic features: It has redoximorphic features throughout. It typically has low chroma colors in the matrix and higher chroma in the redoximorphic features.
Reaction: moderately acid to slightly alkaline

2C or 2Cg horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6
Chroma: 2 to 8
Texture: sandy loam, loam, sandy clay loam, loamy sand, clay loam, silt loam or is sandy loam till
Sand content: 20 to 80 percent
Content of rock fragments: less than 15 percent
Reaction: slightly acid to moderately alkaline

COMPETING SERIES: These are the Atterberry, Bethalto, Canoe, Curran, Emery, Franklin, Koszta, Millbrook, Mulvey, and Wauconda series. Atterberry, Bethalto, Canoe, and Koszta series average less than 20

percent sand in the lower part of the series control section. Curran soils average less than 27 percent clay in the middle part of the series control section. Emery soils do not have a layer in the lower part of the series control section that has more than 25 percent sand. Millbrook, Franklin, and Wauconda soils have horizons with more than 10 percent sand within a depth of 102 cm (40 inches). Mulvey soils average less than 15 percent clay and greater than 15 percent gravel in the lower part of the series control section.

GEOGRAPHIC SETTING: Virgil soils are nearly level or gently sloping low broad summits on outwash plains, stream terraces, and till plains. Slope ranges from 0 to 6 percent. These soils formed in 102 to 152 cm (40 to 60 inches) of loess or other silty sediments and in the underlying loamy outwash or sandy loam till. The dominant clay mineral in the loess is smectite, and in the outwash or till is illite. Summers are hot and winters are cold. Mean annual air temperature ranges from 6.7 to 12.2 degrees C (44 to 54 degrees F). Mean annual precipitation ranges from 760 to 1070 mm (30 to 42 inches). Frost-free days range from 120 to 190 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Batavia, Drummer, Elburn, Emery, Harvard, Kendall, Millbrook, Plano, St. Charles, and Thorp soils. The well drained Batavia soils are on adjacent, slightly higher parts of the landscape. The poorly drained Drummer soils are on lower parts of the landscape and have a mollic epipedon. Elburn soils have a mollic epipedon and are on similar parts of the landscape nearby but generally are on broad landscape areas farther from the drainageways. Emery soils are on adjacent dissected till plains and average less than 20 percent sand in the lower part of the series control section. The well drained Harvard soils are on adjacent, slightly higher parts of the landscape and formed in loess less than 102 cm (40 inches) thick. Kendall soils are on similar parts of the landscape nearby but generally are adjacent to or nearer the drainageways and do not have a dark colored surface layer. Millbrook soils are on similar parts of the stream terraces and outwash plains where the loess is thinner. The well drained Plano soils have a mollic epipedon and are on adjacent, slightly higher parts of the landscape. The well drained St. Charles soils are on adjacent, slightly higher parts of the landscape and do not have dark colored surface layer. The poorly drained Thorp soils have a mollic epipedon and are on lower parts of the landscape.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Somewhat poorly drained. An intermittent apparent high water table is at a depth of 31 to 61 cm (1.0 to 2.0 feet) below the surface in most years. Saturated hydraulic conductivity is moderately high or high (4.23 to 14.11 micrometers per second) in the upper part of the solum and high (14.11 to 42.34 micrometers per second) in the lower part. Permeability is moderate in the upper part of solum and ranges moderate to moderately rapid in the lower part. The potential for surface runoff is low to medium as related to slope.

USE AND VEGETATION: Most areas are cultivated. Corn, soybeans, small grain, and forages for hay are the principal crops. Native vegetation is mixed grasses and trees.

DISTRIBUTION AND EXTENT: Northern Illinois and southern Wisconsin. LRR's K and M, MLRA's 95A, 95B, 108A, 108B and 115C. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Indianapolis, Indiana

SERIES ESTABLISHED: Kendall County, Illinois, 1941.

REMARKS: A gravelly substratum phase is recognized. This soil will be investigated during MLRA update

activities. Possibly a new series will be developed.

Diagnostic horizons recognized in this pedon are:
Ochric epipedon -from a depth of 0 to 33 cm (0 to 13 inches) (Ap and E horizons)
Albic horizon--from a depth of 18 to 33 cm (7 to 13 inches) (E horizon)
Argillic horizon--from a depth of 33 to 150 cm (13 to 59 inches) (Bt1, Bt2, Btg1, Btg2, Btg3, 2Btg4, and 2C horizons)
Udic moisture regime; Mesic temperature regime.

National Cooperative Soil Survey
U.S.A.

LOCATION WACOUSTA IA+MN WI

Established Series
Rev. TEF-RJW-TWN
08/2007

WACOUSTA SERIES

The Wacousta series consists of very deep, very poorly drained soils formed in silty lacustrine sediments. These soils are in broad depressions and swales on till plains, moraines, and stream terraces. Slope ranges from 0 to 2 percent. Mean annual air temperature is about 8 degrees C. Mean annual precipitation is about 775 millimeters

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Typic Endoaquolls

TYPICAL PEDON: Wacousta silty clay loam, in a depression with a slope of less than 1 percent, in a cultivated field. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 20 centimeters; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak fine and medium granular structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.

A--20 to 43 centimeters; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; many fine and medium roots; neutral; abrupt smooth boundary. (Combined thickness of the A horizon is 20 to 49 centimeters.)

Bg--43 to 64 centimeters; dark gray (5Y 4/1) silty clay loam; weak medium subangular blocky structure; friable; many fine and medium roots; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; neutral; clear smooth boundary. (5 to 15 centimeters thick)

Cg1--64 to 104 centimeters; gray (5Y 5/1) silt loam; massive; friable; common fine and medium roots; few fine rounded light gray (10YR 7/2) carbonate concretions; common medium prominent yellowish red (5YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.

Cg2--104 to 150 centimeters; gray (5Y 5/1) silt loam; massive; friable; few fine and medium roots; few fine black (10YR 2/1) iron-manganese concretions; few fine rounded light gray (10YR 7/2) carbonate concretions; common coarse prominent strong brown (7.5YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.

Cg3--150 to 200 centimeters; light olive gray (5Y 6/2) silt loam; massive; friable; thin strata of loam and sandy loam textured material at 152 to 170 centimeters; few fine and medium rounded light gray (10YR 7/2) carbonate concretions; common coarse prominent yellowish red (5YR 5/8) redoximorphic concentrations; strongly effervescent; moderately alkaline.

TYPE LOCATION: Major Land Resource Area (MLRA) 103-Central Iowa and Minnesota Till Prairies, Humboldt County, Iowa subset; located about 1,500 feet north and 150 feet east of the southwest corner of section 6, T. 92 N., R. 29 W.; USGS Bode topographic quadrangle; lat. 42 degrees 48 minutes 30 seconds N.

and long. 94 degrees 19 minutes 28 seconds W., NAD 83.

RANGE IN CHARACTERISTICS:
Thickness of the mollic epipedon--20 to 49 centimeters
Depth to carbonates--30 to 50 centimeters
Clay content of the particle-size control section (weighted average)--24 to 35 percent
Sand content of the particle-size control section (weighted average)--5 to 15 percent

Ap or A horizon:
Hue--10YR, 2.5Y, or is neutral
Value--2
Chroma--0 or 1
Texture--silty clay loam, silt loam, or mucky silt loam
Clay content--15 to 40 percent
Sand content--5 to 20 percent
Reaction--slightly acid to slightly alkaline

Maximum clay content is typically in the lower part of the A horizon or in the Bg horizon

Bg horizon:
Hue--5Y
Value--4 to 6
Chroma--1 or 2
Texture--silty clay loam, silty clay, clay loam, or silt loam
Clay content--15 to 45 percent
Sand content--5 to 45 percent
Reaction--neutral or slightly alkaline

Cg horizon:
Hue--5Y
Value--5 or 6
Chroma--1 or 2
Texture--silt loam or silty clay loam
Clay content--18 to 30 percent
Sand content--5 to 15 percent
Rock fragment content--0 percent
Reaction--slightly alkaline or moderately alkaline
Moist bulk density--1.30 g/cc to 1.40 g/cc

Some pedons have a 2Cg horizon below a depth of 150 centimeters with stratified textures of loam, silt loam, very fine sandy loam or clay loam

COMPETING SERIES: These are the Chalmers, Chetomba, Dolbee, Drummer, Dunham, Elpaso, Elvira, Garwin, Gillett Grove, Hartsburg, Madelia, Marcus, Mascoutah, Maxcreek, Maxfield, Maxmore, Ossian, Patton, Pella, Rushmore, and Sable series.
Chalmers--have clay content of 12 to 18 percent in the lower third of the series control section
Chetomba--have a sand content of more than 15 percent fine sand or coarser in the lower third of the series

control section
Dolbee--do not have carbonates within a depth of 125 centimeters
Drummer--do not have carbonates within a depth of 100 centimeters
Dunham--have a rock fragment content of 15 to 70 percent in the lower third of the series control section
Elpaso--do not have carbonates within a depth of 90 centimeters and have a rock fragment content of 1 to 10 percent in the lower third of the series control section
Elvira--do not have carbonates within a depth of 125 centimeters
Garwin--do not have carbonates within a depth of 125 centimeters
Gillett Grove--have a moist bulk density range of 1.6 g/cc to 1.8 g/cc in the lower third of the series control section
Hartsburg--have a sand content that averages less than 5 percent in the particle-size control section
Madelia--do not have carbonates within a depth of 50 centimeters
Marcus--do not have carbonates within a depth of 60 centimeters
Mascoutah--do not have carbonates within a depth of 100 centimeters
Maxfield--do not have carbonates within a depth of 100 centimeters
Maxcreek--do not have carbonates within a depth of 65 centimeters
Maxmore--have a moist bulk density range of 1.75 g/cc to 1.90 g/cc in the lower third of the series control section
Ossian--do not have carbonates within a depth of 100 centimeters
Patton--do not have carbonates within a depth of 100 centimeters
Pella--have stratified materials with a sand content that averages more than 10 percent in the lower third of the series control section
Rushmore--have a moist bulk density range of 1.6 g/cc to 1.8 g/cc in the lower third of the series control section
Sable--do not have carbonates within a depth of 100 centimeters

GEOGRAPHIC SETTING:
Parent material--silty lacustrine sediments
Landform--broad depressions and swales on till plains, moraines, and stream terraces
Slopes--0 to 2 percent
Elevation--200 to 400 meters above sea level
Mean annual air temperature--6 to 10 degrees C
Mean annual precipitation--585 to 965 millimeters
Frost-free period--150 to 200 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Harps, Nicollet, Okoboji, and Webster soils.
Harps--are at slightly higher landscape positions on rims of depressions and have a sand content that averages 30 to 55 percent in the particle-size control section
Nicollet--are at higher landscape positions on slightly convex rises and have a sand content that averages 20 to 55 percent in the particle-size control section
Okoboji--are on landscape positions similar to that of the Wacousta soils and have a mollic epipedon 60 to 150 centimeters thick
Webster--are at slightly higher landscape positions on flats and have a sand content that averages more than 15 percent in the particle-size control section

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--very poorly drained--in undrained conditions, a frequently saturated zone occurs at the surface

to a depth of 0.3 meters during the wettest periods of years when precipitation is within one standard deviation of the 30 year mean of annual precipitation
Saturated hydraulic conductivity--1.00 to 10.00 micrometers per second
Ponding--frequently ponded for long duration

USE AND VEGETATION:
Where drained, these areas are cultivated. The principal crops are corn, soybeans, and small grain. The native vegetation is big bluestem, western wheatgrass, sedges, blue grama and other species of the tall grass prairie that are tolerant of excessive wetness.

DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains
Physiographic Province--Central Lowland
Physiographic sections--Western lake section and Eastern lake section
MLRAs--Central Iowa and Minnesota Till Prairies (103) and Southern Wisconsin and Northern Illinois Drift Plain (95B)
LRR M;--central and north-central Iowa, south-central Minnesota, and southern Wisconsin
Extent--moderate

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Humboldt County, Iowa, 1958.

REMARKS:
Particle-size control section--the zone from a depth of 25 to 100 centimeters;
series control section--the zone from the surface of the soil to a depth of 150 centimeters.

Diagnostic horizons and features recognized in this pedon include:
mollic epipedon--the zone from the surface of the soil to a depth of 43 centimeters (Ap and A horizons);
cambic horizon--the zone from a depth of 43 to 64 centimeters (Bg horizon);
aquic moisture regime.

The type location was moved because the previous location had been disturbed.

Cation-exchange activity class is inferred from lab data from similar soils in the surrounding area.

Taxonomy version--Keys to Soil Taxonomy, tenth edition, 2006.

National Cooperative Soil Survey
U.S.A.

D

APPENDIX D

NOAA Online Precipitation Data for the Madison Area, Wisconsin

NOWData - NOAA Online Weather Data

Madison Area (ThreadEx Station)
Monthly Totals/Averages
Precipitation (inches)
Year: 2013

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2013	2.87	2.41	2.41	5.83	6.57	10.86	1.66	-	-	-	-	-	32.61

This station's record may include data from more than one, possibly incompatible, locations. It reflects the longest available record for the Madison Area.

Official data and data for additional locations and years are available from the Regional Climate Centers and the National Climatic Data Center.

NOWData - NOAA Online Weather Data

Madison Area (ThreadEx Station)
Monthly Totals/Averages
Precipitation (inches)
Years: 1981-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	1.23	1.45	2.19	3.40	3.55	4.54	4.18	4.22	3.13	2.40	2.39	1.75	34.42

This station's record may include data from more than one, possibly incompatible, locations. It reflects the longest available record for the Madison Area.

Official data and data for additional locations and years are available from the Regional Climate Centers and the National Climatic Data Center.

NOWData - NOAA Online Weather Data

Madison Area (ThreadEx Station)
Observed Daily Data
Month: Jul 2013

Day	MaxT	MinT	AvgT	HDD	CDD	Pcpn	Snow	Snwg
1	79	55	67.0	0	2	0.00	0.0	0
2	76	54	65.0	0	0	0.00	0.0	0
3	73	53	63.0	2	0	0.00	0.0	0
4	82	60	71.0	0	6	0.00	0.0	0
5	84	67	75.5	0	11	0.00	0.0	0
6	85	67	76.0	0	11	0.00	0.0	0
7	89	70	79.5	0	15	0.00	0.0	0
8	88	72	80.0	0	15	0.53	0.0	0
9	85	71	78.0	0	13	1.13	0.0	0
10	79	60	69.5	0	5	T	0.0	0
11	81	56	68.5	0	4	0.00	0.0	0
12	82	56	69.0	0	4	0.00	0.0	0
13	83	64	73.5	0	9	0.00	0.0	0
14	87	60	73.5	0	9	0.00	0.0	0
15	90	66	78.0	0	13	T	0.0	0
16	92	74	83.0	0	18	T	0.0	0
17	93	74	83.5	0	19	T	0.0	0
18	92	75	83.5	0	19	0.00	0.0	0
19	M	M	M	M	M	M	M	M
20	M	M	M	M	M	M	M	M
21	M	M	M	M	M	M	M	M
22	M	M	M	M	M	M	M	M
23	M	M	M	M	M	M	M	M
24	M	M	M	M	M	M	M	M
25	M	M	M	M	M	M	M	M
26	M	M	M	M	M	M	M	M
27	M	M	M	M	M	M	M	M
28	M	M	M	M	M	M	M	M
29	M	M	M	M	M	M	M	M
30	M	M	M	M	M	M	M	M
31	M	M	M	M	M	M	M	M
Smry	84.4	64.1	74.3	2	173	1.66	0.0	0.0

This station's record may include data from more than one, possibly incompatible, locations. It reflects the longest available record for the Madison Area.

Official data and data for additional locations and years are available from the Regional Climate Centers and the National Climatic Data Center.

E

APPENDIX E

Northcentral/Northeast Supplement Wetland Delineation Data Forms

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 1

Investigator(s): Stautz/Anderson **Section, Township, Range:** **S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): Footslope **Local relief (concave, convex, none):** convex **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Houghton muck (Ho) **NWI classification:** UPL

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ◉	No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). Although hydrophytic vegetation is dominant and hydric soil is present, the lack of wetland hydrology during a time when precipitation is 102% above normal indicates the sample plot is located in an upland fallow field.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 28	**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. The presence of only one secondary indicator at the sample plot does not provide evidence of wetland hydrology.

VEGETATION - Use scientific names of plants

Sampling Point: 1

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1. Populus tremuloides	0	☐	0.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Sapling/Shrub Stratum (Plot size: 15')				
1. Acer negundo	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10		**= Total Cover**	
Herb Stratum (Plot size: 5')				
1. Phalaris arundinacea	100	☑	90.1%	FACW
2. Cirsium arvense	10	☐	9.0%	FACU
3. Rubus occidentalis	1	☐	0.9%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	111		**= Total Cover**	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0		**= Total Cover**	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	100	x 2 =	200	
FAC species	10	x 3 =	30	
FACU species	10	x 4 =	40	
UPL species	1	x 5 =	5	
Column Totals:	121	(A)	275	(B)

Prevalence Index = B/A = 2.273

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-13	10YR	2/1							Loam	
13-23	2.5Y	2.5/1							Clay Loam	
23-29	5Y	4/2		2.5Y	5/6	5%	C	M	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☑ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

The soil at the sample plot matches the A12 Indicator (Thick Dark Surface) described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 2

Investigator(s): Stautz/Anderson **Section, Township, Range:** **S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): Toeslope **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Houghton muck (Ho) **NWI classification:** E2H

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ◉	No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉	No ○	

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). The sample plot is located in a wet meadow.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 1		
Water Table Present?	Yes ◉	No ○	Depth (inches): 0		
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 0	**Wetland Hydrology Present?**	Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. The presence of four primary and two secondary indicators at the sample plot provides evidence of wetland hydrology.

VEGETATION - Use scientific names of plants

Sampling Point: 2

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Herb Stratum (Plot size: 5')				
1. Phalaris arundinacea	100	☑	99.0%	FACW
2. Cirsium arvense	1	☐	1.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	101		**= Total Cover**	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0		**= Total Cover**	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	100	x 2 =	200	
FAC species	0	x 3 =	0	
FACU species	1	x 4 =	4	
UPL species	0	x 5 =	0	
Column Totals:	101	(A)	204	(B)

Prevalence Index = B/A = 2.020

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-4	10YR	2/1		10YR	4/6	2%	C	PL	Loam	
4-20	10YR	2/1							Loam	
20-26	2.5Y	4/3							Sand	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☑ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

The soil at the sample plot matches the F6 Indicator (Redox Dark Surface) described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 3

Investigator(s): Stautz/Anderson **Section, Township, Range: S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): Footslope **Local relief (concave, convex, none):** flat **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Sable silty clay loam, 0-3% slopes (SaA) **NWI classification:** UPL

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ○	No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). Although hydrophytic vegetation is dominant the lack of wetland hydrology and hydric soil indicates the sample plot is located in an upland forest.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. No evidence of wetland hydrology was observed at the sample plot.

VEGETATION - Use scientific names of plants

Sampling Point: 3

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30')				
1. Salix nigra	40	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	40		**= Total Cover**	
Sapling/Shrub Stratum (Plot size: 15')				
1. Acer negundo	60	☑	84.5%	FAC
2. Lonicera tatarica	10	☐	14.1%	FACU
3. Fraxinus pennsylvanica	1	☐	1.4%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	71		**= Total Cover**	
Herb Stratum (Plot size: 5')				
1. Alliaria petiolata	90	☑	89.1%	FACU
2. Leonurus cardiaca	1	☐	1.0%	UPL
3. Arctium minus	5	☐	5.0%	FACU
4. Parthenocissus quinquefolia	5	☐	5.0%	FACU
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	101		**= Total Cover**	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0		**= Total Cover**	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	40	x 1 =	40	
FACW species	1	x 2 =	2	
FAC species	60	x 3 =	180	
FACU species	110	x 4 =	440	
UPL species	1	x 5 =	5	
Column Totals:	212	(A)	667	(B)

Prevalence Index = B/A = 3.146

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-14	10YR	2/1						Loamy Sand	
14-20	5YR	4/1	50%					Clay Loam	
14-20	N	2.5/1	30%					Clay	
14-20	10YR	4/2	20%					Sandy Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

The soil at the sample plot does not meet any of the criteria described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 4

Investigator(s): Stautz/Anderson **Section, Township, Range:** **S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): Footslope **Local relief (concave, convex, none):** convex **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Houghton muck (Ho) **NWI classification:** UPL

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ○	No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). Although hydrophytic vegetation is dominant and hydric soil is present, the lack of wetland hydrology during a time when precipitation is 102% above normal indicates the sample plot is located in an upland fallow field.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. The presence of only one secondary indicator at the sample plot does not provide evidence of wetland hydrology.

VEGETATION - Use scientific names of plants

Sampling Point: 4

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30')				
1. Acer negundo	20	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	20		**= Total Cover**	
Sapling/Shrub Stratum (Plot size: 15')				
1. Acer negundo	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	5		**= Total Cover**	
Herb Stratum (Plot size: 5')				
1. Phalaris arundinacea	100	☑	98.0%	FACW
2. Ambrosia trifida	1	☐	1.0%	FAC
3. Cirsium arvense	1	☐	1.0%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	102		**= Total Cover**	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0		**= Total Cover**	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	100	x 2 =	200	
FAC species	26	x 3 =	78	
FACU species	1	x 4 =	4	
UPL species	0	x 5 =	0	
Column Totals:	127	(A)	282	(B)

Prevalence Index = B/A = 2.220

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-12	10YR 2/1						Sandy Loam	
12-20	2.5Y 4/2						Sand	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

The soil at the sample plot does not meet any of the criteria described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 5

Investigator(s): Stautz/Anderson **Section, Township, Range: S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): Toeslope **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Houghton muck (Ho) **NWI classification:** E2K

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ◉	No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉	No ○	

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). The sample plot is located in a wet meadow.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☑ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):		
Water Table Present?	Yes ◉	No ○	Depth (inches):	13	
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches):	10	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. The presence of two primary and two secondary indicators at the sample plot provides evidence of wetland hydrology.

VEGETATION - Use scientific names of plants

Sampling Point: 5

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Herb Stratum (Plot size: 5')				
1. Phalaris arundinacea	100	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100		**= Total Cover**	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0		**= Total Cover**	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	100	x 2 =	200	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	100	(A)	200	(B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-9	10YR	3/1		10YR	3/6	1%	C	PL	Loam	
9-20	2.5Y	4/2	75%						Sand	
9-20	2.5Y	4/1	25%						Sand	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☑ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

The soil at the sample plot matches the A4 Indicator (Hydrogen Sulfide) described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 6

Investigator(s): Stautz/Anderson **Section, Township, Range:** **S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): Footslope **Local relief (concave, convex, none):** convex **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Houghton muck (Ho) **NWI classification:** UPL

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ○	No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). Although hydrophytic vegetation is dominant and hydric soil is present, the lack of wetland hydrology during a time when precipitation is 102% above normal indicates the sample plot is located in an upland fallow field.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 25	**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. The presence of only one secondary indicator at the sample plot does not provide evidence of wetland hydrology.

VEGETATION - Use scientific names of plants

Sampling Point: 6

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Herb Stratum (Plot size: 5')				
1. Phalaris arundinacea	100	☑	90.9%	FACW
2. Cirsium arvense	10	☐	9.1%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	110		**= Total Cover**	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0		**= Total Cover**	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	100	x 2 =	200	
FAC species	0	x 3 =	0	
FACU species	10	x 4 =	40	
UPL species	0	x 5 =	0	
Column Totals:	110	(A)	240	(B)

Prevalence Index = B/A = 2.182

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-25	N	2.5/1						Loam	
25-28	2.5Y	5/3						Sand	
25-28	2.5Y	3/2						Sandy Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

The soil at the sample plot does not meet any of the criteria described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 7

Investigator(s): Stautz/Anderson **Section, Township, Range:** **S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): Toeslope **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Houghton muck (Ho) **NWI classification:** E2K

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ◉	No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉	No ○	

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). The sample plot is located in a wet meadow.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☑ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches):	2	
Water Table Present?	Yes ◉	No ○	Depth (inches):	0	
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches):	0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. The presence of four primary and two secondary indicators at the sample plot provides evidence of wetland hydrology.

VEGETATION - Use scientific names of plants

Sampling Point: 7

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	**= Total Cover**		
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	**= Total Cover**		
Herb Stratum (Plot size: 5')				
1. Phalaris arundinacea	100	☑	98.0%	FACW
2. Cirsium arvense	2	☐	2.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	102	**= Total Cover**		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0	**= Total Cover**		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	100	x 2 =	200	
FAC species	0	x 3 =	0	
FACU species	2	x 4 =	8	
UPL species	0	x 5 =	0	
Column Totals:	102	(A)	208	(B)

Prevalence Index = B/A = 2.039

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-11	10YR	2.5/1						Loam	
11-20	2.5Y	4/2	80%					Sandy Clay Loam	
11-20	2.5Y	3/2	20%					Sandy Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☑ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

The soil at the sample plot matches the A4 Indicator (Hydrogen Sulfide) described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 8

Investigator(s): Stautz/Anderson **Section, Township, Range:** **S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): Undulating **Local relief (concave, convex, none):** flat **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Virgil silt loam, gravelly substratum, 0-3% slopes (VwA) **NWI classification:** UPL

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). The sample plot is located in an upland meadow.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. No evidence of wetland hydrology was observed at the sample plot.

VEGETATION - Use scientific names of plants

Sampling Point: 8

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Herb Stratum (Plot size: 5')				
1. Elymus repens	5	☐	4.4%	FACU
2. Poa pratensis	100	☑	88.5%	FACU
3. Phalaris arundinacea	1	☐	0.9%	FACW
4. Lotus corniculatus	5	☐	4.4%	FACU
5. Solidago canadensis	2	☐	1.8%	FACU
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	113		**= Total Cover**	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0		**= Total Cover**	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	1	x 2 =	2	
FAC species	0	x 3 =	0	
FACU species	112	x 4 =	448	
UPL species	0	x 5 =	0	
Column Totals:	113	(A)	450	(B)

Prevalence Index = B/A = 3.982

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is not hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-7	2.5Y	3/2						Sandy Loam	
7-18	10YR	4/4						Sandy Clay Loam	gravel
18+								Compacted Soil	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

The presence of a compacted soil layer at 18" did not allow the observation of a complete soil profile. The soil at the sample plot does not meet any of the criteria described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Fire Station #14 **City/County:** Madison/Dane **Sampling Date:** 17-Jul-13

Applicant/Owner: City of Madison **State:** WI **Sampling Point:** 9

Investigator(s): Stautz/Anderson **Section, Township, Range:** **S.** 22 **T.** 7N **R.** 10E

Landform (hillslope, terrace, etc.): **Local relief (concave, convex, none):** **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): LRR K **Lat.:** **Long.:** **Datum:**

Soil Map Unit Name: Virgil silt loam, gravelly substratum, 0-3% slopes (VwA) **NWI classification:** UPL

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ○ No ◉ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○	No ◉	
Hydric Soil Present?	Yes ○	No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks: (Explain alternative procedures here or in a separate report.)

Hydrologic conditions are not typical for this time of year (see hydrology remarks section). The sample plot is located in an upland meadow.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Precipitation in the Madison Area for April-June was 102% above normal. 1.66" of precipitation were recorded in the two weeks prior to field work. No evidence of wetland hydrology was observed at the sample plot.

VEGETATION - Use scientific names of plants

Sampling Point: 9

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		**= Total Cover**	
Herb Stratum (Plot size: 5')				
1. Dipsacus fullonum	2	☐	1.6%	FACU
2. Poa pratensis	90	☑	73.8%	FACU
3. Solidago canadensis	20	☐	16.4%	FACU
4. Cirsium arvense	10	☐	8.2%	FACU
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	122		**= Total Cover**	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
	0		**= Total Cover**	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	122	x 4 =	488	
UPL species	0	x 5 =	0	
Column Totals:	122	(A)	488	(B)

Prevalence Index = B/A = 4.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definitions of Vegetation Strata:

Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

Dominant vegetation was determined through application of the 50/20 rule. Vegetation at the sample plot is not hydrophytic.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-5	2.5Y	3/3							Clay Loam	
5-16	10YR	4/3							Clay Loam	
16-20	10YR	4/6		7.5YR	5/6	2%	C	M	Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils : [3]

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L, M)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

The soil at the sample plot does not meet any of the criteria described in the Regional Supplement to the Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regions (2012).

F

APPENDIX F

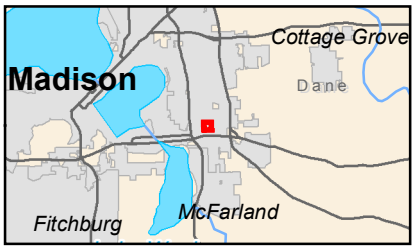
Site Survey

Legend

- Sample Plot
- Project Area (+/- 14.6 acres)
- Wetland (+/-0.49 acre)

Appendix F
Site Survey

City of Madison
Fire Station #14
Project No. 15220004
City of Madison, Dane County, Wisconsin



Extent of large view shown in red.

0 100 200
Feet

N

NES ECOLOGICAL SERVICES
A Division of Robert E. Lee & Associates, Inc.

Document Path: Z:\Data\Jobs\Wetlands\Madison, City of\Fire Station 4\Maps\AppF.mxd

August 6, 2013

CGC, Inc.

Construction • Geotechnical
Consulting Engineering/Testing

August 9, 2013
C13064-7

Mr. Randy Wiesner
City Engineering, Management Section
210 Martin Luther King Jr. Blvd, Room 115
Madison, WI 53703

Re: Preliminary Geotechnical Exploration Report
Proposed Fire Station No. 14 & Fire Training Facility
Femrite Drive and Dairy Drive
Madison, Wisconsin

Dear Mr. Wiesner:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the *preliminary* geotechnical exploration program for the proposed Fire Station No. 14 and Fire Training Facility. The purpose of this exploration program was to evaluate the subsurface conditions within the five parcels being considered for purchase by the City for this project and to provide preliminary geotechnical recommendations regarding site preparation, foundation, floor slab, and pavement design/construction, as well as stormwater infiltration potential. We are sending you one paper copy of this report and can provide a paper copy upon request.

PROJECT DESCRIPTION

We understand that five parcels along Femrite Drive and Dairy Drive in the World Dairy Center are being considered to house Fire Station No. 14 and Fire Training Facilities. The project potentially will include the following components, with a brief description, as available:

- Fire Station No. 14, which would be a slab-on-grade (no basement) building with masonry and steel stud construction,
- Classroom and Administrative space, which would be similar construction to the fire station,
- Burn Training Structure consisting of a three-story concrete structure, and
- Physical Fitness Training Building of unspecified building type and structural system.

The locations, elevations, loads of the structures have not been determined at this time, although buildings will likely not be located near the high-pressure gas line easement traversing along the southern to middle portions of the area. Associated with these structures would be pavement areas for both light-duty and heavy-duty traffic loading. Stormwater management areas will also be incorporated into the development.

SITE CONDITIONS

The proposed project area involves five parcels located north of Femrite Drive and east and west of Dairy Drive. The two lots west of Dairy Drive (3202 and 3218 Dairy Drive) are vacant grass-covered sites that extend from Prairie Dock Drive to Femrite Drive that generally have flat to gently-sloping site grades. An east-west running

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drainage ditch exists between these lots, as well as long the east property line. The three parcels east of Dairy Drive (3101 and 3201 Dairy Drive and 5152 Femrite Drive) form an essentially 'L-shaped' area that extends from Blazing Star Drive south to Femrite Drive and then east to Agriculture Drive. A small parcel exists at the northeast corner of Dairy Drive and Femrite Drive that contains an occupied single-story structure with related parking area that is not included in the project area. The north and east legs of the L-shaped parcel are bounded by a wetland, which is owned by the City. The area east of Dairy Drive is a mixture of grass-covered land in the northern and southern portions, with moderately to heavily-wooded land adjacent to the wetland and fairly widespread on the 3201 Dairy Drive parcel. Site grades appear to slope down gently to the east. The parcels at 3101 Dairy Drive and 5152 Femrite Drive do not appear to have been previously developed, but the parcel at 3201 Dairy Drive includes an asphalt drive off of Femrite Drive and evidence that previous structures existed, but have been demolished; there is also evidence that some grading (cutting and filling) has occurred on the 3201 Dairy Drive property. A 50-ft wide easement for a large high pressure gas line traverses the south end of the 5152 Femrite Drive and 3201 Dairy Drive properties and the north end of the 3218 Dairy Drive property.

SUBSURFACE CONDITIONS

Subsurface conditions on site were explored by drilling a total of 20 Standard Penetration Test (SPT) soil borings to planned depths of 10 to 30 ft below existing site grades at locations selected by the City of Madison and located in the field by Burse Survey and Engineering (Burse). Note that Boring 3 was offset 75 ft east due to a fallen tree blocking the path to the boring, and this boring was extended to 35 ft due to very loose to loose soil conditions at 30 ft. Boring 5 was also offset 10 ft east due to downed tree blocking the path to the boring. The borings were drilled on July 22 through 25, 2013 by Badger State Drilling (under subcontract to CGC) using ATV-mounted CME-750 and truck-mounted D-120 rotary drill rigs equipped with hollow-stem augers, mud rotary equipment and automatic SPT hammers. The boring locations are shown in plan on the Soil Boring Location Map attached in Appendix B. Ground surface elevations at the boring locations were surveyed by Burse.

The subsurface profiles at the boring locations varied somewhat at shallow depths due to previous site grading, but the profiles were fairly similar with depth. A generalized soil profile included the following strata, in descending order:

- 4 to 18 in. of ***topsoil/topsoil fill***, except in Borings 8, 9 and 13 where topsoil was absent at the surface; over

- 1 to 5.5 ft of ***fill*** or ***possible fill*** in Borings 8, 9, 10, 13 through 18 and 20 consisting of loose to medium dense sand with variable silt, clay and gravel content or soft to very stiff silty to lean clay with topsoil and wood/roots in some locations; followed by

- 1.5 to 5.5 ft of soft to hard ***lean clay*** with variable sand content or loose to medium dense ***clayey sand***; this layer was not encountered in Borings 2, 8, 9 and 10; followed by

- Very loose to dense ***sand*** with variable silt content and scattered silt seams or ***sandy silt*** to the maximum depth explored.

As exceptions to the above profile, 1-ft thick clay layers were encountered between sand layers in Borings 2 and 3. Additionally, 3.5-ft thick ***probable buried topsoil layers*** were encountered below the fill in Borings 8 and 9. The organic content (as measured by loss-on-ignition) on the buried topsoil layer ranged from 6.5% to 9.1%, where soils with loss on ignition exceeding 4% are considered organic.

The shallow clay layer ranged from soft to very stiff, with moisture contents that ranging from 17.0% to 29.5% on representative samples.

Groundwater was encountered in the borings during or shortly after drilling at 3.5 to 8.5 ft below existing site grades. Groundwater was generally shallowest on the eastern end of the area and slightly deeper to the west. Groundwater levels can be expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration, the level of nearby streams and lakes, the pumping rate of nearby wells and other factors. A more detailed description of the site soil and groundwater conditions is presented on the Soil Boring Logs attached in Appendix B.

DISCUSSION AND PRELIMINARY RECOMMENDATIONS

Subject to the limitations described below and based on the subsurface exploration, it is our opinion that these sites are generally suitable for the proposed construction and that structures can likely be supported by conventional spread footing foundations. However, the following soil issues exist at the site that will impact foundation, floor slab and pavement design and construction:

- Widespread presence of very loose to loose sands;
- Scattered areas of soft to medium stiff clay;
- Existing fill and buried topsoil in some areas; and
- Shallow groundwater table;

The extent to which the above soil conditions will impact building and pavement design and the strategies that can be used to address the soil issues will depend on the following:

- Building location and elevation;
- Foundation and floor slab loads; and
- Pavement grades and traffic loads.

With the above soil conditions and as of yet unknown building and pavement information in mind, our *preliminary* geotechnical recommendations regarding site preparation, foundation, floor slab, and stormwater infiltration design/construction are presented in the following subsections. Additional information regarding the conclusions and reeommendations presented in this report is discussed in Appendix C.

1. Site Preparation

We recommend that the topsoil/vegetation and pavement be stripped/removed at least 10 ft beyond the proposed construction areas, including areas required for cuts and fills beyond building footprints or pavement limits. The topsoil can be stockpiled on-site and re-used as fill in landscaped areas. Trees and tree roots should be removed in conjunction with topsoil stripping. Topsoil thicknesses varied from 0 to 18 in. the borings, but thicker topsoil deposits could be encountered due to previous grading activities.

Where areas containing fill (e.g, on the two parcels east of Dairy Drive and the large parcel at the northeast corner of Dairy Drive and Femrite Drive) fall within building footprints, we recommend that follow-up soil borings and/or test pits be completed to better determine the extent and composition of the fill. Although the fill will likely need to be removed below foundations, suitably firm, non-organic fill may be able to remain in-place below floor slab areas. *Note that 3.5 ft of buried topsoil was encountered below 2.5 to 5.5 ft of fill in Borings 8 and 9. If these areas will be within building footprints, we recommend that the fill and buried topsoil be undercut/removed during the initial site preparation, as the buried topsoil is considered unacceptable for foundation and floor slab support.*

Remnants of former buildings (slabs, foundations, foundation walls, abandoned utilities, etc.) that are located within planned building areas should be removed, with grade restored with granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557). Old foundations and slabs can potentially remain in-place in landscape and pavement areas provided slabs are broken up to allow drainage, are at least 2 ft below the bottom of the base course layer in the pavement section and do not interfere with new utility installation.

Prior to fill placement (where needed) or where the site is at-grade, the soils exposed below the topsoil should be carefully checked for soft/yielding areas by proof-rolling with a loaded tri-axle dump truck or other large rubber-tired piece of construction equipment (e.g., loaded scraper, off-road dump truck or front-end loader). If soft/yielding areas are encountered, these areas should be undercut and replaced with compacted granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557). Alternatively, 3-in. dense graded base can be used to stabilize soft clay subgrades and/or to restore grades in undercut areas. If groundwater is encountered at the bottom of the undercut, a 6 to 12 in. thick layer of compacted crushed clear stone will likely be required to stabilize the soils prior to subsequent granular fill placement. If the clear stone layer exceeds 12 in., the stone layer should be overlain by a non-woven geotextile fabric (e.g., Mirafi 160N or equivalent) to prevent migration of soil into the clear stone.

As an alternative to undercutting/stabilization in pavement areas, the shallow clayey soils could potentially be aerated (dried) and then recompacted to create a stable platform for fill placement. However, drying and recompacting is highly weather dependent and could require multiple cycles of drying and recompacting to create an adequate subgrade. Lime stabilization could also be eonsidered for improving the soft clay soils. We can provide additional details, if needed, but we recommend that the project budget include a generous contingency and schedule for improving, stabilizing or undercutting/replacing the soils within proposed buildings and parking lots.

Fill placement (where required) to establish grades can then proceed. We recommend using granular soils (i.e.,

compact in most weather conditions. The shallow clay soils, as well as the slightly deeper sands that contained significant silt and clay are not recommended as structural fill within the building because moisture conditioning will be required to achieve desired compaction levels, which could delay construction progress. Clay/silt soils may be used as fill in landscaped areas or in the lower portion of deeper fills in pavement areas provided the soils are adequately dried back to facilitate compaction. We recommend that fill/backfill be compacted to at least 95% compaction (ASTM D1557) in accordance with our Recommended Compacted Fill Specifications presented in Appendix D. Periodic field density tests should be taken by CGC staff within the fill/backfill to document the adequacy of compactive effort.

Based on the presence of slightly to moderately compressible soft to medium stiff clay and very loose to loose sands across the site, if site grades will be raised by more than about 1 to 2 ft, we recommend that the fill be placed to the floor slab subgrade elevation or pavement subgrade elevation early in the construction sequence to allow the clay soils to mostly consolidate under the weight of the fill prior to beginning building construction. (Note that settlement of the very loose to loose sands will also occur under the weight of the new fill, but settlement of sand will occur more quickly than consolidation of clay soils, so as long as fill placement occurs early in the eonstruction sequence, settlement of the sands should occur prior to beginning building construction.) If thicker fills are expected a time-delay (i.e., on the order of several weeks to a few months) between fill placement and beginning building construction may be required. We can provide additional details as the project details develop and after supplemental borings are completed.

2. Preliminary Foundation Design

Based on the preliminary soil borings, it is our opinion that proposed structures can generally be supported on reinforced concrete spread footing foundations proportioned using a fairly low bearing pressure. The allowable bearing pressure will be limited by the very loose to loose sands and soft to medium stiff soils and may necessitate undercutting in some locations. (As noted above, we have assumed that the buried topsoil layer in Borings 8 and 9 will be undercut and replaced with compacted granular backfill.) Where high foundation loads exist, the bearing pressure could be increased by using an intermediate foundation system such as rammed aggregate piers (RAPs) or a mat foundation could be used to distribute the loads over a larger area resulting in a low overall foundation contact pressure. Another strategy to potentially increase the bearing pressure in the loose sands would be to conduct pressuremeter testing during a supplemental drilling phase, which has been shown on numerous projects in the Madison area to increase the bearing pressure in granular soils compared to conventional methods based solely on SPT blow counts (N-values). We can provide additional details about alternative foundation support systems and follow-up pressuremeter testing, if needed.

In general, the soils on the three lots east of Dairy Drive were relatively looser/softer than the on the two sites west of Dairy Drive. Assuming that unsuitable soils will be undercut below foundations, a relatively low bearing pressure in the range of 1,000 to 2,000 psf will likely feasible on the sites east of Dairy Drive, with a slightly higher bearing pressure range of 2,000 to 3,000 psf possible on the two sites west of Dairy Drive, as the clays are slightly stiffer and sands are slightly denser. The bearing pressure on the east end of the site can likely be increased if site grades are raised such that the footings bear on at least 2 ft of well-compacted granular fill over firm/stable natural soils. Additional parameters should be used for foundation design:

- Minimum foundation widths:
  - -- Continuous wall footings: 18 in.
  - -- Column pad footings: 30 in.

- Minimum footing depths:
  - -- Exterior/perimeter footings: 4 ft
  - -- Interior footings: no minimum requirement

Undercutting below footing grade will be required where very loose/disturbed sands or silts or native clays with pocket penetrometer readings (an estimate of the unconfined compressive strength of cohesive soils) of less than 0.5 tsf for a 1,000 psf bearing pressure to 1.5 tsf for a 3,000 psf bearing pressure are encountered at or slightly below footing grade. Such soils were located in numerous borings. Where undercutting is required, the base of the undercut excavation should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. Undercut depths are difficult to determine without more specific building locations and elevations, but undercut depths could be on the order of 3 to 8.5 ft below existing site grades.

Assuming that the bottom of the undercut is above the groundwater table, footing grade can be restored with granular backfill compacted to at least 95% (ASTM D1557). Alternatively, 3-in. dense graded base could be placed/compacted to re-establish footing grade. Where the base of the undercut extends near or below the water table, the soils at the bottom of the excavation should be stabilized with a 6 to 12 in. layer of compacted crushed clear stone. If the clear stone layer exceeds 12 in., the stone layer should be covered in a non-woven geotextile fabric (e.g., Mirafi 160N or equivalent). CGC should be present during footing excavations to check whether subgrades are satisfactory for the design bearing pressure and to advise on corrective measures, where necessary.

Based on the presence of shallow groundwater at this site, dewatering will likely be required in advance of and during some footing excavations, especially on the sites east of Dairy Drive where the undercut or footing excavations may extend near to a few feet below the water table. For groundwater drawdowns of less than 1 to 2 ft, dewatering can likely be controlled using pumps operating from filtered sump pits. Groundwater drawdowns of more than 1 to 2 ft typically require deep wells or closely-spaced well points. A stone layer may be required at the bottom of the excavation to stabilize the expected very moist to wet soil, and *supplemental* dewatering can be completed with submersible pumps operating from the stone layer.

We recommend using a smooth-edged backhoe bucket for footing excavations. Additionally, granular soils exposed at footing grade should be recompacted with a large vibratory plate compactor prior to formwork/concrete placement to densify soils loosened during the excavation process. Soils potentially suseeptible to disturbance from compaction (e.g., silty or clayey soils) should be hand trimmed. Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should be on the order of 1.0 and 0.5 in., respectively.

3. Floor Slabs

We anticipate that the soils exposed at floor slab subgrade within the building areas will consist of native clays or sands and granular fill where grades will be raised. In our opinion, the soft to medium stiff clays are considered marginal for slab support and will likely require partial undercutting and stabilization during slab preparation if not already completed during earlier site preparation activities. Prior to slab construction, the subgrades should be thoroughly proof-rolled/recompacted as described in the Site Preparation section of this report to densify soils that may become disturbed or loosened during construction activities. Areas that do not proof-roll satisfactorily or that remain loose after recompaction should be undercut and replaced with compacted 3-in. dense graded base or granular fill. The design subgrade modulus is based on a recompacted subgrade such that non-yielding conditions are developed. To serve as a capillary break, the final 4 to 6 in. of soil placed below the slab should consist of well-graded sand or gravel with no more than 5 percent by weight passing a No. 200 U.S. standard sieve. A subgrade modulus of 100 pci may be used for slab design on adequately stabilized native clay or recompacted sand fill. Note that some structural engineers require a 4 to 6 in. layer of dense graded base (e.g., 1.25-in. crushed aggregate base course) below the slab to increase the subgrade modulus. If 6 in. of dense graded base is included below the floor slab, the subgrade modulus can be increased to 150 pci. Fill and base layer material below the floor slab should be placed as described in the Site Preparation section of this report. To further minimize the potential for moisture migration, a 15-mil plastic vapor barrier can be also be utilized below the slab. The slab should be structurally separate from the foundations and have construction joints and reinforcement for crack control.

Note that in areas of high slab loads more extensive undercutting/replacement may be required to minimize long-term settlement from the higher slab loads. We recommend that if higher slab loads are anticipated, these areas be carefully explored with follow-up soil borings/test pits to better evaluate the ability of the soils to support the higher slab loads or determine remedial measures.

4. Seismic Design Category

As discussed above, the granular soils on the three sites east of Dairy Drive are slightly looser than the granular soils on the two sites west of Dairy Drive. East of Dairy Drive it is our opinion that the average soil/rock properties in the upper 100 ft of the site (based on SPT blow counts (N-values) of less than 15 blows/ft, on average, in the granular soils underlying the site) may be characterized as a soft soil profile. This characterization would place the site in Site Class E for seismic design according to the International Building Code (see Table 1613.5.2). The average SPT blow counts in the granular soils west of Dairy Drive generally exceed 15 blows/ft, which would classify the site as having a stiff soil profile with Site Class D.

5. Preliminary Pavement Design

We anticipate that the subgrade soils within the pavement areas will likely consist of native or fill soils that include significant areas of marginal soft to stiff cohesive soils or variable fill soils. Where grades are raised, pavement subgrades may consist of newly-placed granular fill soils. Pavement subgrades should be proof-rolled with a loaded tri-axle dump truck, as described in the Site Preparation section of this report, and stabilized as needed with 3-in. dense graded base or replaced with compacted granular fill.

As discussed in the Site Preparation section of this report, the presence of marginal shallow soils across the site will likely either necessitate an extensive program of drying/recompacting the native clays or partially undercutting the soft soils and restoring grade with 3-in. dense graded base, perhaps in combination with triaxial or biaxial geogrid. For budgetary purposes, we recommend that a contingency for a stabilization layer consisting of triaxial or biaxial geogrid (Tensar TX-5 or BX-1100 or equivalent) and 8 to 12 in. of 3-in. dense graded base be included. (Note that if standing water exists at the surface, the 3-in. dense graded base will likely need to be substituted with 3-in. clear stone.) If the soil conditions prove to be better than anticipated, the stabilization can be reduced or potentially eliminated, but if the soil conditions are worse, the stabilization section may need to be increased. We assume that the portions of the parking lot used primarily as automobile parking will experience light to moderate traffic loads (e.g., 1 to 5 equivalent 18-kip single-axle loads per day - ESALs), and the drive lanes used to access the loading docks will experience heavier traffic loads (of up to about 10 ESALs). The variable clay soils will control the pavement thickness design. Accordingly, the pavement sections tabulated below were selected assuming a CBR of approximately 0.5 to 1.0 for the native clays that improves to 3 to 5 with the inclusion of a stabilization layer and a design life of 20 years.

TABLE 1
RECOMMENDED PAVEMENT SECTIONS

Material	Thickness (in.)		WDOT Specification[1]
	Car Parking/Drives (1 to 5 ESALs)	Truck Drives (< 10 ESALs)	
Bituminous upper layer	1.75	1.75	Section 460, Table 460-1, 12.5 mm
Bituminous lower layer	1.75	2.25	Section 460, Table 460-1, 19.0 mm
Dense graded base	10.0	12.0	Sections 301 and 305, 31.5mm and 75mm
Stabilization Layer (4)	8.0	12.0	Section 305, 75 mm
Geogrid Reinforcement	Possibly	Yes	Tensar TX-5 or BX-1100
TOTAL THICKNESS	21.5	28.0	

Notes:

1. Wisconsin DOT *Standard Specifications for Highway and Structure Construction*, latest edition, including supplemental specifications, but excluding Section 460.3.2 relating layer thickness to aggregate size.

2. Compaction requirements:
   - Bituminous concrete: Refer to Section 460-3.
   - Base course: Refer to Section 301.3.4.2, Standard Compaction

3. Mixture Type E-0.3 bituminous pavement is recommended for car parking and drives and E-1 is recommended for truck drives; refer to Section 460, Table 460-2 of the *Standard Specifications.*

4. Stone stabilization may be reduced or deleted if subgrades proof-roll satisfactory during pavement subgrade preparation. Alternatively, the stone stabilization layer may need to be increased if very soft soil conditions are encountered.

Where pavement areas will experience heavier concentrated loads from fire trucks and related equipment, we recommend that rigid concrete pavement be used in pavement areas. Similarly, we recommend that dumpster pads or loading dock pads be constructed of concrete pavement. We recommend that rigid concrete pavement be designed using a subgrade modulus of 100pci, which assumes that concrete pavement will be underlain by a minimum of 6 in. of well-compacted dense graded base over a firm (adequately proof-rolled) subgrade. Depending on actual traffic loads, concrete pavement thickness is typically 6 to 9 in., and we recommend a minimum concrete pavement thickness of 6 in.

Note that if traffic volumes are greater than those assumed, CGC should be allowed to review the recommended pavement section and adjust them accordingly. The pavement design assumes a stable/non-yielding subgrade and a regular program of preventative maintenance. Alternative pavement designs may prove applicable and should be reviewed by CGC. If there is a delay between subgrade preparation and placing the base course, the subgrade should be recompacted.

6. Stormwater Infiltration Potential

Based on the soil borings, it is our opinion that this site will have very limited stormwater infiltration potential due to the generally shallow groundwater, as well as shallow silty clay loam soils that generally extended below the topsoil to near the groundwater depth in many locations. The natural clay also generally had redoximorphic features (redox or mottling), which indicates seasonal or past saturation and is considered a limiting layer to stormwater infiltration. According to NR151.12, this site may qualify as "exempted" based on estimated infiltration rates of less than 0.6 in./hr. The site may also be classified "excluded" based on less than 3 ft below of separation between the bottom of the infiltration basin and the high water level (or redox in the clay). In some areas sand soils with relatively high permeability had scattered silt loam seams, which will limit the infiltration rate.

having an infiltration rate greater than or equal to the design infiltration rate. Another strategy that could be implemented for sand soils with scattered silt loam seams would be to thoroughly mix the soil to break up the silt loam seams down to the groundwater level such that the mixed soil would have a particle size distribution and infiltration rate that would likely approach sandy loam or loamy sand. We recommend that gradations on samples of the mixed soil be completed during construction to document that the mixed soil has an appropriate gradation for the design infiltration rate.

The following parameters should be considered for design of infiltration features:

Infiltration Potential: The following infiltration parameters were estimated using Table 2 of the WDNR Conservation Practice Standard 1002, *Site Evaluation for Storm Water Infiltration*. The estimated infiltration rates are as follows:

- Silty clay loam 0.04 in./hr
- Silt loam 0.13 in./hr
- Loam 0.24 in./hr
- Sandy loam 0.5 in./hr
- Loamy sand 1.63 in./hr
- Sand 3.6 in./hr

Note that the infiltration rates should be considered very approximate. The Wisconsin Department of Safety and Professional Services soil evaluation forms for the borings are included in Appendix E.

Groundwater: Groundwater was encountered in the borings during or shortly after drilling at 3.5 to 8.5 ft below existing site grades. Redoximorphic features were also encountered in most of the shallow natural clays, which indicates seasonal or past saturation at levels above the water table. Groundwater levels should be expected to vary, as previously discussed.

Bedrock: Bedrock was not encountered in the borings to maximum depth explored.

During construction of the proposed buildings, pavement and related site work, appropriate erosion control should be provided to prevent eroded soil from contaminating the infiltration areas. Where appropriate, the basin design should include pretreatment to remove fine-grained soils (silt/clay) from stormwater prior to entering the infiltration area. Additionally, a regular maintenance plan should be developed to remove silt/clay soils that may accumulate in the bottom of the infiltration basin over time. Failure to adequately control fine-grained soils from entering the infiltration area or failure to regularly remove fine-grained soils that accumulate at the base of the infiltration basin will likely cause the basin to fail. Refer to WDNR Conservation Praetice Standard 1002 and NR 151 for additional information.

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties that could be encountered on the site are discussed below:

- Due to the potentially sensitive nature of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.

- Earthwork construction during the early spring or late fall could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.

- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards.

- Based on observations made during the field exploration, groundwater infiltration into footing, undercut and utility excavations should be expected, and dewatering strategies were previously discussed. Additional water accumulating at the base of excavations as a result of precipitation or seepage should be controlled and quickly removed using pumps operating from filtered sump pits.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation, floor slab and pavement subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

- Topsoil stripping/subgrade proof-rolling within the construction areas;
- Fill/backfill placement and compaction;
- Foundation excavation/subgrade preparation; and
- Concrete placement.

SUPPLEMENTAL GEOTECHNICAL EXPLORATION

The preliminary soil borings were intended to provide an overview of the soil conditions across the sites and identify potential geotechnical concerns, such as the widespread very loose to loose sands, areas of marginal clay, areas with buried topsoil and shallow groundwater. Supplemental soil borings are recommended to provide more specific geotechnical recommendations as the project progresses and the locations and elevations of the building, pavement and stormwater management areas are determined. We would be happy to provide additional details and develop a supplemental geotechnical scope at the appropriate time.

* * * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

David A. Staab, P.E., LEED AP
Consulting Professional

William W. Wuellner, P.E.
Senior Geotechnical Engineer

Encl:
Appendix A - Field Exploration
Appendix B - Soil Boring Location Map
Logs of Test Borings (20)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications
Appendix E - Perimeter Drain Details
Appendix F - Wisconsin Dept. of Safety and Professional Services – Soil Evaluation Forms (20 Borings)

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

A total of 20 Standard Penetration Test (SPT) soil borings were drilled to planned depths of 10 to 30 ft below existing site grades at locations selected by the City of Madison and located in the field by Burse Survey and Engineering (Burse). Note that Boring 3 was offset 75 ft east due to a fallen tree blocking the path to the boring, and this boring was extended to 35 ft due to very loose to loose soil conditions at 30 ft. Also, Boring 5 was offset 10 ft east due to downed tree blocking the path to the boring. The borings were drilled on July 22 through 25, 2013 by Badger State Drilling (under subcontract to CGC) using ATV-mounted CME-750 and truck-mounted D-120 rotary drill rigs equipped with hollow-stem augers, mud rotary equipment and automatic SPT hammers. The boring locations are shown in plan on the Soil Boring Location Map attached in Appendix B. Ground surface elevations at the boring locations were surveyed by Burse.

In each boring, soil samples were obtained at 2.5 foot intervals to a depth of 10 ft and at 5 ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

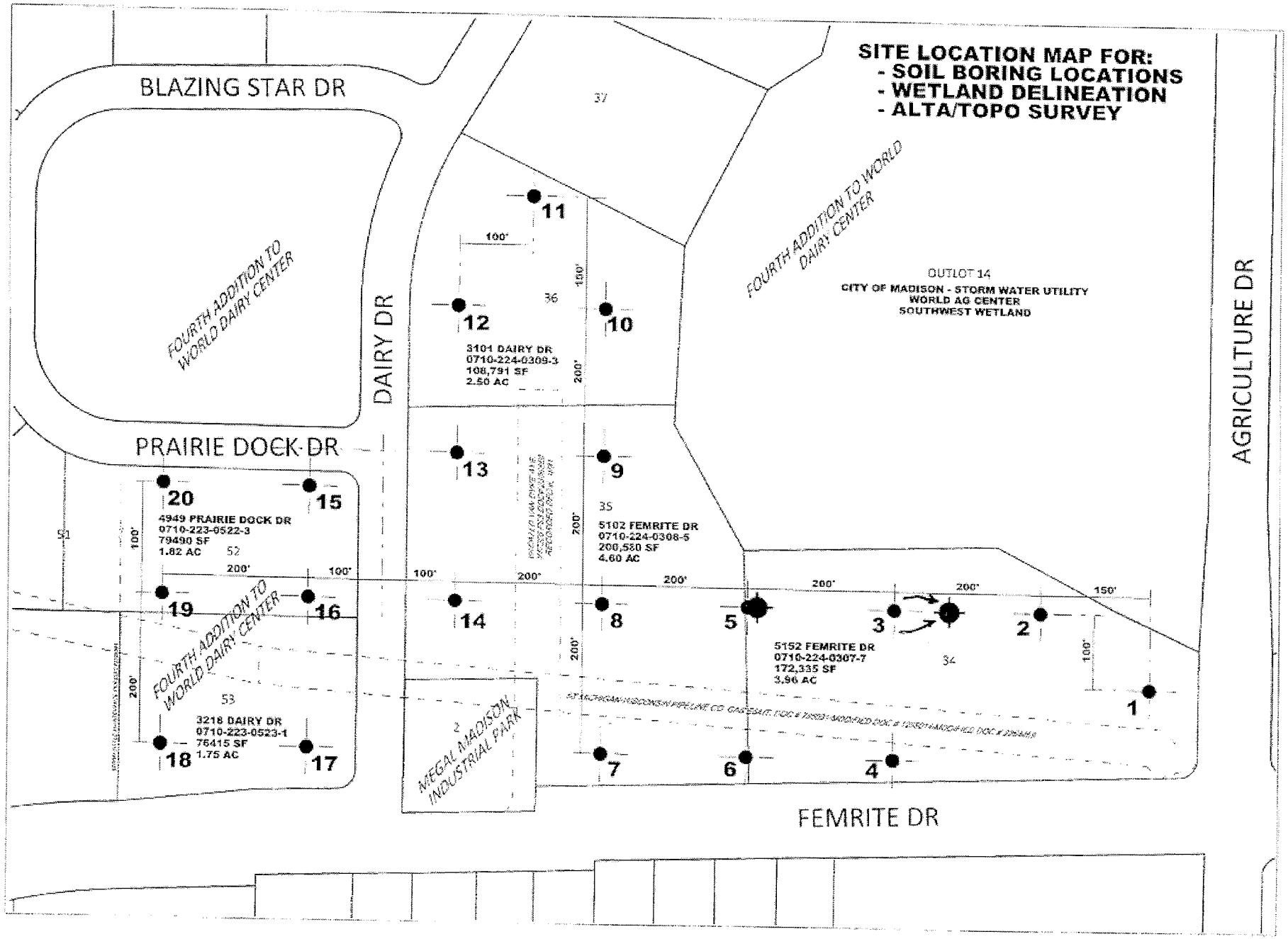
2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the soil samples for possible environmental contaminants was not conducted by the drillers as environmental site assessment activities were not part of CGC's work scope.* Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled with bentonite (where required) to satisfy WDNR regulations and the soil samples were delivered to our laboratory for visual elassification and laboratory testing. The soil samples were visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

SOIL BORING LOCATION MAP
LOGS OF TEST BORINGS (20)
LOG OF TEST BORING - GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM



Legend

Denotes Boring Location and Number

Scale: Unknown.

Notes

1. Borings drilled by Badger State Drilling on July 22 through 25, 2013.
2. Base map prepared by City of Madison.
3. Boring locations are approximate.

Job No. C13064-7		**SOIL BORING LOCATION MAP** Proposed Fire Station No. 14 & Fire Training Center Femrite Drive and Dairy Drive Madison, WI
Date: 08/2013	CGC, Inc.	

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **1**
Surface Elevation (ft) **859.8**
Job No. **C13064-7**
Sheet **1** of **1**

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SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						13 in.± Clayey TOPSOIL (OL)					
1		6	M	4		Medium Stiff to Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL) USDA: 10YR 5/1 Silty Clay Loam (Redox: C2F 10YR 6/6)	(1.0)	26.3			
2		8	W	4	5	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3		10	W	4							
4		7	W	5	10	Loose, Gray Fine SAND, Some Silt, Little to Some Gravel (SM) USDA: 10YR 5/2 Sandy Loam					
5		10	W	6	15	Loose to Medium Dense, Gray Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/2 Sand					
6		12	W	12	20						
7		10	W	10	25	Scattered Silt (Silt Loam) Seams Near 25 ft					
8		18	W	21	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

	While Drilling	Upon Completion of Drilling
Time After Drilling		
Depth to Water	▽ 3.5'	▼
Depth to Cave in		

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/23/13** End **7/23/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 10'-30' 0-10';**
3-7/8" RB/DM; Autohammer

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **2**
Surface Elevation (ft) **859.9**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						15 in.± Clayey TOPSOIL (OL)					
1		9	M	5		Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
2		10	W	6	5						
3		18	W	4							
4		18	W	5	10						
5		9	W	7	15	Loose, Gray Sandy SILT, Scattered Sand Seams (ML) USDA: 10YR 5/2 Loam					
6		18	W	11	20	Soft, Gray Silty CLAY, Trace Sand, Scattered Sand Seams (CL-ML) USDA: 10YR 5/2 Silty Clay	(0.25-0.5)	24.2			
						Medium Dense, Gray Fine to Coarse SAND, Trace to Little Silt, Little to Some Gravel (SP/SP-SM) USDA: 10YR 5/2 Sand					
7		3	W	27	25	Medium Dense, Gray-Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/2 Sand					
8		6	W	18	30	End of Boring at 30 ft					
						Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **3.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/23/13** End **7/23/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0'-6' 3-7/8" RB/DM 6'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **3**
Surface Elevation (ft) **861.0**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						15 in.± Clayey TOPSOIL (OL)					
1		5	M	5		Stiff to Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Little to Some Sand (CL) USDA: 10YR 5/1 Silty Clay Loam (Redox: C2F 10YR 6/6)	(2.0)				
2		10	W	8	5						
3		14	W	9		Very Loose to Loose, Light Brown Fine to Medium SAND, Trace to Little Silt, Little Gravel (SP/SP-SM) USDA: 10YR 6/3 Sand Scattered Silt (Silt Loam) Seams near 10 ft					
4		6	W	4	10						
5		12	W	4	15	Very Loose to Loose, Brown/Gray Fine SAND, Little to Some Silt (SP-SM/SM) USDA: 10YR 4/2 Sandy Loam					
6		14	W	7	20	Loose, Gray Silty Fine SAND, Trace Gravel, Scattered Silt Seams (SM) USDA: 10YR 5/2 Sandy Loam, Scattered Silt Loam Seams					
7		14	W	7	25	Loose, Brown/Gray Fine SAND, Little to Some Silt (SP-SM/SM) USDA: 10YR 4/2 Sandy Loam					
8		18	W	4	30	Stiff, Brown/Gray Lean CLAY, Trace Sand, Scattered Sand Seams (CL) USDA: 10YR 5/3 Silty Clay Loam	(1.75)				
9		14	W	11	35	Very Loose to Loose, Gray Fine SAND, Some Silt, Little to Some Gravel, Scattered Silt Seams (SM) USDA: 10YR 5/2 Sandy Loam, Scattered Silt Loam Seams					
						Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
					40	End of Boring at 35 ft Borehole Backfilled with bentonite chips and slurry					
					45	Boring offset 75 ft to the east of staked location (downed tree blocking path).					
					50						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **3.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/23/13** End **7/23/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 10'-30' 0-10';**
3-7/8" RB/DM; Autohammer

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **4**
Surface Elevation (ft) **862.0**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						13 in.± Clayey TOPSOIL (OL)					
1		18	M	7		Very Stiff, Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL)	(2.25-2.5)				
						USDA: 10YR 5/1 Silty Clay Loam (Redox: C2D 10YR 6/6)					
2		18	M	6	5	Loose, Light Brown to Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM)					
						USDA: 10YR 5/3, 6/3 Sand					
3		18	W	4							
4		18	W	4							
					10	End of Boring at 10 ft					
						Borehole Backfilled with bentonite chips					
					15						
					20						
					25						
					30						
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0' Upon Completion of Drilling ____
Time After Drilling ____ ____ ____ 15 min.
Depth to Water ____ ____ ____ 5.5' ▼
Depth to Cave in ____ ____ ____ 6.0'

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/25/13** End **7/25/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **5**
Surface Elevation (ft) **860.2**
Job No. **C13064-7**
Sheet **1** of **2**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						13 in.± Clayey TOPSOIL (OL)					
1		4	M	4		Soft to Medium Stiff, Gray-Brown Lean CLAY, Some Sand, Scattered Sand Seams (CL) USDA: 10YR 4/2 Silty Clay Loam	(0.5)	17.0			
2		10	W	8	5	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel, Scattered Silt Seams (SP/SP-SM) USDA: 10YR 5/3 Sand, Scattered Silt Loam Seams					
3		12	W	2							
4		8	W	6	10	Color Change to Dark Brown (10YR 3/3) near 7.5 ft					
5		10	W	5	15						
6		7	W	8	20	Color Change to Gray (10YR 5/2) near 20 ft)					
7		7	W	31	25	Dense, Gray Silty Fine SAND, Trace Gravel (SM) USDA: 10YR 5/2 Sandy Loam					
8		10	W	15	30	Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
					35	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry Boring offset 10 ft east from staked location					

WATER LEVEL OBSERVATIONS

While Drilling ▽ 3.5'	Upon Completion of Drilling			
Time After Drilling				
Depth to Water				▼
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/23/13** End **7/23/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **6**
Surface Elevation (ft) **861.5**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						13 in.± Clayey TOPSOIL (OL)					
1		8	M	5		Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL) USDA: 10YR 5/1 Silty Clay Loam (Redox: C2D 10YR 6/6)	(1.5-1.75)	27.4			
2		18	M	5				15.3			2.1
3		12	W	6	5	Loose, Dark Gray Clayey Fine SAND, Trace Organics (SC) USDA: 10YR 3/1 Sandy Clay Loam					
4		18	W	4		Loose, Gray/Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/2 Sand					
					10	End of Boring at 10 ft					
						Borehole Backfilled with bentonite chips					
					15						
					20						
					25						
					30						
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ **15 min.**
Depth to Water _____ _____ _____ **5.8'** ▼
Depth to Cave in _____ _____ _____ **6.0'**

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/25/13** End **7/25/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **7**
Surface Elevation (ft) **862.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						12 in.± Clayey TOPSOIL (OL)					
1		8	M	8		Very Stiff, Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL)	(2.0-2.75)				
						USDA: 10YR 5/2 Silty Clay Loam (Redox: C2D 10YR 6/6)					
2		3	M	8							
					5	Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel, Scattered Silt Seams in Upper Part of Layer (SP/SP-SM)					
3		12	W	6		USDA: 10YR 5/3 Sand, Scattered Silt Loam Seams					
4		18	W	6							
					10	End of Boring at 10 ft					
						Borehole Backfilled with bentonite chips					
					15						
					20						
					25						
					30						
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0'	Upon Completion of Drilling			
Time After Drilling				15 min.
Depth to Water				6.0' ▼
Depth to Cave in				7.0'

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/25/13** End **7/25/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **8**
Surface Elevation (ft) **863.8**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
1		18	M	15		FILL: Medium Dense, Tan Fine to Medium Sand, Some Silt and Gravel USDA: FILL - 2.5Y 5/3 Sandy Loam					
2		10	M	5	5	FILL: Soft to Medium Stiff, Dark Gray/Gray Lean Clay, Little to Some Sand, Trace Organics USDA: FILL - 10YR 3/1, 5/2 Silty Clay Loam	(0.5)	15.4			
3		8	M	5		Medium Stiff, Dark Gray/Black Organic CLAY (OL - Probable Buried Topsoil) USDA: 10YR 2/1 Silty Clay Loam	(1.0)	26.6			9.1
4		18	W	10	10	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		5	W	2	15						
6		3	W	4	20						
7		12	W	14	25	Medium Dense, Brown Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/3 Fine Sand					
8		8	W	21	30	Medium Dense, Gray-Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/2 Sand					
					35	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8"**
RB/DM; Autohammer

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **9**
Surface Elevation (ft) **863.5**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						FILL: Medium Dense, Tan Fine to Medium Sand, Some Silt and Gravel USDA: FILL - 2.5Y 5/3 Sandy Loam					
1	■	18	M	17							
						Loose, Dark Gray/Black Organic Clayey SILT (OL - Probable Buried Topsoil) USDA: 10YR 2/1 Silt Loam					
2	■	15	M	5	5			19.3			6.5
						Very Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3	■	10	W	10							
4	■	12	W	8	10						
5	■	18	W	3	15	Grades to Fine Sand near 15 ft					
6	■	3	W	10	20						
7	■	4	W	27	25						
8	■	12	W	9	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/23/13** End **7/23/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-15'; 3-7/8" RB/DM 15'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **10**
Surface Elevation (ft) **860.4**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						14 in.± Clayey TOPSOIL (OL)					
1		6	M	7		Loose, Gray Fine to Medium SAND, Some Silt, Trace Clay and Gravel (SM - Possible Fill) USDA: 10YR 5/1 Sandy Loam					
2		6	W	5	5	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3		12	W	3							
4		8	W	4	10	Color Change to Dark Brown (10YR 3/3) with Scattered Silt Seams near 7.5 ft					
5		10	W	4	15	Very Loose to Loose, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
6		9	W	9	20	Loose, Gray Fine SAND, Some Silt, Trace Gravel (SM) USDA: 10YR 5/2 Sandy Loam					
7		14	W	10	25	Loose, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
8		12	W	8	30	Scattered Silt Seams near 30 ft					
						End of Boring at 30 ft					
					35	Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **11**
Surface Elevation (ft) **861.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						15 in.± Clayey TOPSOIL (OL)					
1		12	M	7		Medium Stiff to Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand and Organics (CL)	(2.5)				
2		8	M	3	5	USDA: 10YR 5/1 Silty Clay Loam (Redox: C2D 10YR 6/6)	(0.5-1.0)	20.4			
3		11	W	7		Scattered Sand Seams near 5 ft					
4		10	W	3	10	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		6	W	9	15	Loose, Brown/Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/3 Fine Sand					
6		5	W	3	20	Very Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
7		9	W	14	25						
8		15	W	16	30	Medium Dense, Gray Sandy SILT, Scattered Sand Seams (ML) USDA: 10YR 5/2 Loam					
					35	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

	While Drilling	Upon Completion of Drilling		
Time After Drilling				
Depth to Water	▽ 6.0'			▼
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8"**
RB/DM 10'30'; Autohammer

LOG OF TEST BORING

CGC Inc.

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **12**
Surface Elevation (ft) **863.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						12 in.± Clayey TOPSOIL (OL)					
1		10	M	9		Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL) USDA: 10YR 5/1 Silty Clay Loam (Redox: C2F 10YR 6/6)	(3.0)				
2		16	M	5	5	Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3		12	W	5							
4		14	W	8	10						
5		12	W	5	15	3 in. Stiff, Gray/Brown Lean Clay Seam near 15 ft	(1.0-1.5)				
6		12	W	15	20	Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
7		16	W	15	25						
8		14	W	23	30						
					35	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

LOG OF TEST BORING

CGC Inc.

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **13**
Surface Elevation (ft) **862.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						12 in.± Sand and Gravel FILL					
1		5	M	8		Stiff to Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL - Possible Fill in Upper Few Feet of Layer)	(3.5)				
2		18	M	8	5	USDA: 10YR 5/1 Silty Clay Loam (Redox: C2D 10YR 6/6)	(1.0-1.5)	29.5			
3		18	W	4		Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM)					
4		18	W	4	10	USDA: 10YR 5/3 Sand					
5		3	W	4	15						
6		12	W	17	20	Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
7		12	W	27	25	Medium Dense, Brown Fine to Coarse SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
8		4	W	14	30	End of Boring at 30 ft Borehole backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0' Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **14**
Surface Elevation (ft) **865.0**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						8 in.± Sandy TOPSOIL FILL (OL)					
1		12	M	12		FILL: Very Stiff, Brown/Gray Lean Clay, Trace to Little Sand USDA: FILL-10YR 4/3 Silty Clay Loam	(3.75-4.0)				
2		12	M	8	5	Stiff to Very Stiff, Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL) USDA: 10YR 5/2 Silty Clay Loam (Redox: C2D 10YR 6/6)	(2.0-2.5)				
3		18	M	8			(1.0-1.5)	24.7			
4		6	W	4	10	Very Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		18	W	4	15	Grades to Fine Sand near 15 ft					
6		6	W	2	20						
7		8	W	12	25						
8		18	W	20	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **15**
Surface Elevation (ft) **863.6**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						18 in.± Clayey TOPSOIL FILL(OL)					
1		13	M	16		FILL: Stiff, Dark Gray-Brown Silty Clay, Intermixed with Topsoil, Scattered Wood/Roots	(1.5-2.0)				
2		14	M	6	5	USDA: FILL-10YR 3/2 Silty Clay Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL)	(2.0-2.5)				
3		12	M/W	8		USDA: 10YR 5/1 Silty Clay Loam (Redox: C2F 10YR 6/6)					
4		17	W	15	10	Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		8	W	11	15						
6		6	W	16	20	Loose to Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
7		12	W	7	25						
8		9	W	32	30						
						End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **16**
Surface Elevation (ft) **863.3**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						9 in.± Clayey TOPSOIL FILL (OL)					
1		18	M	14		FILL: Medium Dense, Orange-Brown Fine Sand, Little to Some Silt USDA: FILL - 10YR 5/6 Sandy Loam					
2		18	M	7	5	Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Little to Some Sand (CL) USDA: 10YR 5/1 Silty Clay Loam (Redox: C2F 10YR 6/6)	(2.25-2.5)				
3		16	M/W	7							
4		15	W	7	10	Loose, Gray/Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/2, 5/3 Sand					
5		18	W	10	15						
6		7	W	9	20	Loose, Gray Sandy SILT, Scattered Sand Seams (ML) USDA: 10YR 5/2 Loam					
7		5	W	19	25	Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
8		12	W	30	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **KD** Rig **D-120**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **17**
Surface Elevation (ft) **864.3**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						4 in.± Clayey TOPSOIL FILL (OL)					
1		6	M	12		FILL: Medium Dense, Gray/Brown Clayey Fine to Medium Sand					
						USDA: FILL - 10YR 5/2, 4/3 Sandy Clay Loam					
2		12	M	7		Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Some Sand (CL)	(2.0-2.5)				
					5	USDA: 10YR 5/1 Silty Clay Loam (Redox: C2F 10YR 6/6)					
3		16	W	8		Loose, Gray Fine to Medium SAND, Some Silt, Trace Clay (SM)					
						USDA: 10YR 5/2 Sandy Loam					
4		18	W	11		Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM)					
					10	USDA: 10YR 5/3 Sand					
5		7	W	13							
					15						
6		8	W	12							
					20						
7		10	W	15		Grades to Fine Sand near 25 ft					
					25						
8		13	W	25							
					30	End of Boring at 30 ft					
						Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0'	Upon Completion of Drilling			
Time After Drilling				
Depth to Water				▼
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **18**
Surface Elevation (ft) **863.8**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						4 in.± Clayey TOPSOIL FILL (OL)					
1		10	M	13		FILL: Very Stiff, Brown/Gray Lean Clay, Little to Some Gravel, Trace to Little Sand	(2.5)				
						USDA: FILL-10YR 4/3 Silty Clay Loam					
2		12	M	8		Medium Stiff to Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL)	(1.5)				
					5						
3		16	M/W	3		USDA: 10YR 5/1 Silty Clay Loam (Redox: C2D 10YR 6/6)	(0.5)	28.3			
4		13	W	15		Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM)					
					10	USDA: 10YR 5/3 Sand					
5		7	W	8							
					15						
6		14	W	15							
					20						
7		9	W	10		Grades to Fine Sand near 25 ft					
					25						
8		11	W	22		Scattered Silty Sand Seams near 30 ft					
					30	End of Boring at 30 ft					
						Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8"**
RB/DM 10'-30'; Autohammer

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **19**
Surface Elevation (ft) **863.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						5 in.± Clayey TOPSOIL (OL)					
1		10	M	11		Very Stiff, Brown (Mottled) Lean CLAY, Trace Sand USDA: 10YR 4/4 Silty Clay Loam	(3.5)				
2		10	M	5	5	(Redox: C2D 10YR 6/6)					
3		15	W	13		Loose, Gray Fine to Medium SAND, Some Silt, Little Clay, Scattered Soft Clay Seams (SM) USDA: 10YR 4/3 Sandy Loam, Silty Clay Loam Seams					
4		12	W	8	10	Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		3	W	18	15						
6		5	W	10	20	Color Changes to Gray near 20 ft					
7		10	W	14	25						
8		4	W	16	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8"**
RB/DM 10'-30'; Autohammer

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **20**
Surface Elevation (ft) **864.4**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						8 in.± Clayey TOPSOIL FILL (OL)					
1		16	M	17		FILL: Medium Dense, Brown Fine to Medium Sand, Some Silt and Gravel, Intermixed with Clay					
						USDA: 10YR 4/3 Sandy Loam with Silty Clay Loam					
2		9	M	11			(4.5+)				
					5	Hard, Brown (Mottled) Lean CLAY, Trace Sand					
3		10	M	6		USDA: 10 YR 4/4 Silty Clay Loam (C2D 10YR 6/6)					
						Loose to Medium Dense, Brown Fine to Medium					
4		15	W	17		SAND, Trace Silt, Clay and Gravel, Scattered Silt Seams (SP/SP-SM)					
					10	USDA: 10YR 5/3 Sand to Loamy Sand, Silt Loam Seams					
						Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM)					
5		18	W	11		USDA: 10YR 5/3 Sand					
					15						
6		5	W	11		Medium Dense, Gray Fine SAND, Some Silt, Trace Gravel (SM)					
					20	USDA: 10YR 5/2 Sandy Loam					
7		16	W	18							
					25						
8		12	W	26		Scattered Silty Sand Seams near 30 ft					
					30	End of Boring at 30 ft					
						Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **KD** Rig **D-120**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in complianee with the design concepts, specifieations and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until eonstruction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, , *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not Informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where surface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgement and opinion, geotechnical engineers can finalize their recommendations only by observing actual subsurface eonditions revealed during construction. *CGC cannot assume responsibility or liability for the report's recommendations if we do not perform construction observation.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors ean also misinterpret a geotechnical engineering report. Reduce that risk by having CGC participate in prebid and preconstruction conferences, and by providing construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

GEOENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of ASFE, for more information.

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ASFE/The Best People on Earth
881 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

Table 1
Gradation of Special Fill Materials

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55	75 (2)		
No. 40			5-20	8-28	10-35	15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

Table 2
Compaction Guidelines

Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 3 ft below subgrade	92	95
- Greater than 3 ft below subgrade	90	90
Landscaping	85	90

Notes:

1. Based on Modified Proctor Dry Density (ASTM D 1557)

APPENDIX E

TYPICAL PERIMETER DRAIN DETAILS

General Notes

1. This system's primary function is to intercept infiltrating surface water. These Alternates are not appropriate for use in situations of high groundwater (i.e., cases where the water table approaches floor slab elevation).

2. Grade surface cap to slope away from structure.

3. Exterior surface of walls below grade should be damp-proofed.

4. A plastic vapor barrier should be installed below the slab.

5. Recommended types of drain pipes:

Specification	Description
ASTM D2729	Polyvinyl Chloride (PVC) Drain Pipe
ASTM F405	Corrugated Polyethylene Drain Pipe
ASTM D2852	Styrene-Rubber Plastic Drain Pipe
AASHTO M136	Corrugated Metal Underdrain Pipe

6. Minimum slope of drain pipes should be 2 in. per 100 lin ft.

7. Place drain pipe below basement floor level and orient the perforations toward the bottom.

8. Clean-outs should be provided to service the pipe.

9. Collected field water should be discharged to a sump, storm sewer or drainage field.

10. The geotextile for Alternative Nos. 2 and 3 may be eliminated if filter requirements are satisfied between the wall and pipe backfill, as well as between backfill materials and natural soils.

11. Pipe backfill materials should satisfy filter requirements for the slot width or hole diameter of the perforated pipe.

12. Care should be taken during backfilling not to damage the integrity of the system. For compaction requirements, refer to geotechnical report.

13. Pipe, geotextile, and geocomposite should be installed according to manufacturer specifications.

General Notes

1. This system's primary function is to intercept infiltrating surface water. These Alternates are not appropriate for use in situations of high groundwater (i.e., cases where the water table approaches floor slab elevation).

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12. Care should be taken during backfilling not to damage the integrity of the system. For compaction requirements, refer to geotechnical report.

13. Pipe, geotextile, and geocomposite should be installed according to manufacturer specifications.

APPENDIX F

WISCONSIN DEPARTMENT OF SAFETY & PROFESSIONAL SERVICES
SOIL EVALUATION FORMS (20 Borings)

Wisconsin Department of Safety & Professional Development

SOIL EVALUATION - STORM

in accordance with Comm 82.365 & 85, Wis. Adm. Code

Attach complete site plan on paper not less than 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

Please print all information.

Personal information you provide may be used for secondary purposes (Privacy Law, s.15.04 (1) (m)).

County	
Dane	
Parcel I.D.	071022403077
Review by	Date

Property Owner	Property Location
FHB Investments, LLC	Govt. Lot 1/4 SE 1/4 S 22 T 07 N R 10 E
Property Owner's Mailing Address	Lot # 34 / Block # / Subd. Name or CSM# 4th Addition of World Dairy Center
1830 Meadow Lane, Suite A	
City: Pewaukee / State: WI / Zip Code: 53072 / Phone Number:	[X] City [ ] Village [ ] Town / Nearest Road: 5152 Femrite Dr.
	Madison

Drainage area _____ [ ] sq. ft. [ ] acres

Optional:

Test Site Suitable for (check all that apply)

[ ] Irrigation [ ] Bioretention trench [ ] Trench(es)

[ ] Rain Garden [ ] Grassed Swale [ ] Reuse

[ ] Infiltration trench [ ] SDS (>15' wide) [ ] Other _____

Hydraulic Application Test Method

[X] Morphological Evaluation

[ ] Double-Ring Infiltrometer

[ ] Other (Specify)_____

1 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 859.8 ft Depth to limiting factor 13, 42 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 13	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	13 - 42	10 YR 5/1	C2F 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
3	42 - 102	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
4	102 - 162	10 YR 5/2	None	SL	1msbk	mvfr	gs	10 - 15	0.5
5	162 - 360	10 YR 5/2	None	S	0sg	ml		<5	3.6
		Groundwater was encountered in boring at 42 in. below existing grade.							

2 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 859.9 ft Depth to limiting factor 42 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 15	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	15 - 162	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
3	162 - 216	10 YR 5/2	None	L	0m	mvfr	gs	<5	0.24
4	216 - 228	10 YR 5/2	None	SiC	1msbk	mvfr	gs	<5	0.07
5	228 - 282	10 YR 5/2	None	S	0sg	ml	gs	10-15	3.6
6	282 - 360	10 YR 5/2	None	S	0sg	ml		<5	3.6
		Groundwater was encountered in boring at 42 in. below existing grade.							

CST/PSS Name (Please Print)	Signature	CST/PSS Number
David Staab	David Staab	1042602
Address	**Date Evaluation Conducted**	**Telephone Number**
3911 Mineral Point Road	7/25/2013	608/288-4100

3 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 861.0 ft Depth to limiting factor 15, 42 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 15	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	15 - 42	10 YR 5/1	C2F 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
3	42 - 162	10 YR 6/3	None	S, SiL	0sg	ml	gs	10 - 15	0.13
4	162 - 222	10 YR 4/2	None	SL	1msbk	mvfr	gs	<5	0.5
5	222 - 282	10 YR 5/2	None	SL, SiL	1msbk	mvfr	gs	<5	0.13
6	282 - 342	10 YR 4/2	None	SL	1msbk	mvfr	gs	<5	0.5
7	342 - 354	10 YR 5/3	None	SiCL	1msbk	mvfr	gs	<5	0.04
8	354 - 402	10 YR 5/2	None	SL, SiL	1msbk	mvfr	gs	10 - 15	0.13
9	402 - 420	10 YR 5/2	None	FS	0sg	ml		<5	0.5
	Groundwater was encountered in boring at 42 in. below existing grade.								

4 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 862.0 ft Depth to limiting factor 13, 66 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 13	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	13 - 36	10 YR 5/1	None	SiCL	1msbk	mvfr	gs	<5	0.04
3	36 - 120	10 YR 5/3, 6/3	None	S	0sg	ml		<5	3.6
		Groundwater was encountered in boring at 66 in. below existing grade.							

5 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 860.2 ft Depth to limiting factor 42 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 13	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	13 - 42	10 YR 4/2	None	SiCL	1msbk	mvfr	gs	<5	0.04
3	42 - 282	10 YR 5/3, 3/3, 5/2	None	S, SiL	0sg	ml	gs	<5	0.13
4	282 - 342	10 YR 5/2	None	SL	1msbk	mvfr	gs	<5	0.5
5	342 - 360	10 YR 5/2	None	FS	0sg	ml		<5	0.5
		Groundwater was encountered in boring at 42 in. below existing grade.							

Property Owner FMB Investments, LLC Parcel ID# 71022403077 Page 3 of 3

6 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 861.5 ft Depth to limiting factor 70 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 13	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	13 - 42	10 YR 5/1	C2D 10 YR 6/6	SiCL	1msbk	mvfr	gs	<5	0.04
3	42 - 54	10 YR 3/1	None	SCL	0m	mvfr	gs	<5	0.11
4	54 - 120	10 YR 5/2	None	S	0sg	ml		<5	3.6
		Groundwater was encountered in boring at 70 in. below existing grade.							

Obs. # [ ] Boring [ ] Pit Ground Surface Elev. _____ ft Depth to limiting factor _____ in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr

Obs. # [ ] Boring [ ] Pit Ground Surface Elev. _____ ft Depth to limiting factor _____ in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr

Wisconsin Department of Safety & Professional Development

SOIL EVALUATION - STORM

in accordance with Comm 82.365 & 85, Wis. Adm. Code

Attach complete site plan on paper not less than 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

Please print all information.

Personal information you provide may be used for secondary purposes (Privacy Law, s.15.04 (1) (m)).

County	
Dane	
Parcel I.D.	071022403093, 071022403085
Review by	Date

Property Owner	Property Location
FHB Investments, LLC	Govt. Lot 1/4 SE 1/4 S 22 T 07 N R 10 E
Property Owner's Mailing Address	**Lot #** / **Block #** / **Subd. Name or CSM#**
1830 Meadow Lane, Suite A	35,36 — 4th Addition of World Dairy Center
City / **State** / **Zip Code** / **Phone Number**	[X] City [ ] Village [ ] Town — **Nearest Road**
Pewaukee / WI / 53072	Madison — 3101 and 3201 Dairy Drive

Drainage area _____ [ ] sq. ft. [ ] acres

Optional:

Test Site Suitable for (check all that apply)

[ ] Irrigation [ ] Bioretention trench [ ] Trench(es)

[ ] Rain Garden [ ] Grassed Swale [ ] Reuse

[ ] Infiltration trench [ ] SDS (>15' wide) [ ] Other _____

Hydraulic Application Test Method

[X] Morphological Evaluation

[ ] Double-Ring Infiltrometer

[ ] Other (Specify)_____

7 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 862.2 ft Depth to limiting factor 12, 72 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 12	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	12 - 36	10 YR 5/2	C2D 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
3	36 - 120	10 YR 5/3	None	S, SiL	0sg	ml		<5	0.13
		Groundwater was encountered in boring at 72 in. below existing grade.							

8 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 863.8 ft Depth to limiting factor 96 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 36	2.5 Y 5/3	None	Fill - SL	Variable	Variable	as	20 - 30	0.5
2	36 - 66	10 YR 3/1, 5/2	None	Fill - SiCL	Variable	Variable	as	<5	0.04
3	66 - 108	10 YR 2/1	None	SiCL	1msbk	mvfr	gs	<5	0.04
4	108 - 282	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
5	282 - 342	10 YR 5/3	None	FS	0sg	ml	gs	<5	0.5
6	342 - 360	10 YR 5/2	None	S	0sg	ml		<5	3.6
		Groundwater was encountered in boring at 96 in. below existing grade.							

CST/PSS Name (Please Print)	Signature	CST/PSS Number
David Staab	David Staab	1042602
Address	**Date Evaluation Conducted**	**Telephone Number**
3911 Mineral Point Road	7/25/2013	608/288-4100

9 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 863.5 ft Depth to limiting factor 72 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 30	2.5 Y 5/3	None	Fill - SL	Variable	Variable	as	20 - 30	0.5
2	30 - 72	10YR 2/1	None	SiL	1msbk	mvfr	as	<5	0.13
3	72 - 360	10 YR 5/3	None	S	0sg	ml		<5	3.6
	Groundwater was encountered in boring at 72 in. below existing grade.								

10 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 860.4 ft Depth to limiting factor 72 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 14	10 YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	14 - 42	10 YR 5/1	None	SL	1msbk	mvfr	gs	<5	0.5
3	42 - 162	10 YR 5/3, 3/3	None	S, SiL	0sg	ml	gs	<5	0.13
4	162 - 222	10 YR 5/2	None	FS	0sg	ml	gs	<5	0.5
5	222 - 282	10 YR 5/2	None	SL	1msbk	mvfr	gs	<5	0.5
6	282 - 360	10 YR 5/2	None	FS	0sg	ml		<5	0.5
		Groundwater was encountered in boring at 72 in. below existing grade.							

11 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 861.2 ft Depth to limiting factor 72 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 15	10 YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	15 - 72	10 YR 5/1	C2D 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
3	72 - 162	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
4	162 - 222	10 YR 5/3	None	FS	0sg	ml	gs	<5	0.5
5	222 - 342	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
6	342 - 360	10 YR 5/2	None	L	1msbk	mvfr		<5	0.24
		Groundwater was encountered in boring at 72 in. below existing grade.							

12 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 863.2 ft Depth to limiting factor 12, 72 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 12	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	12 - 42	10 YR 5/1	C2F 10 YR 6/6	SiCL	1msbk	mvfr	gs	<5	0.04
3	42 - 222	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
4	222 - 360	10 YR 5/2	None	FS	0sg	ml		<5	0.5
		Groundwater was encountered in boring at 72 in. below existing grade.							

13 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 862.2 ft Depth to limiting factor 12, 72 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 12	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	12 - 66	10 YR 5/1	C2D 10 YR 6/6	SiCL	1msbk	mvfr	gs	<5	0.04
3	66 - 216	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
4	216 - 270	10 YR 5/2	None	FS	0sg	ml	gs	<5	0.5
5	270 - 360	10 YR 5/3	None	S	0sg	ml			3.6
		Groundwater was encountered in boring at 72 in. below existing grade.							

14 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 865.0 ft Depth to limiting factor 42, 102 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 8	10YR 2/1	None	SCL - Fill	Variable	Variable	as	<5	0.11
2	8 - 42	10 YR 4/3	None	SiCL- Fill	Variable	Variable	gs	<5	0.04
3	42 - 84	10 YR 5/2	C2D 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
4	84 - 360	10 YR 5/3	None	S	0sg	ml		<5	3.6
		Groundwater was encountered in boring at 102 in. below existing grade.							

Wisconsin Department of Safety & Professional Development

SOIL EVALUATION - STORM

in accordance with Comm 82.365 & 85, Wis. Adm. Code

Attach complete site plan on paper not less than 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

Please print all information.

Personal information you provide may be used for secondary purposes (Privacy Law, s.15.04 (1) (m)).

County: Dane

Parcel I.D.: 071022305223, 071022305231

Review by: Date:

Property Owner

FHB Investments, LLC

Property Location

Govt. Lot: 1/4 SE 1/4 S 22 T 07 N R 10 E

Property Owner's Mailing Address

1830 Meadow Lane, Suite A

Lot #: 51, 52 & 53 Block #: Subd. Name or CSM#: 4th Addition of World Dairy Center

City	State	Zip Code	Phone Number
Pewaukee	WI	53072	

[X] City [ ] Village [ ] Town Nearest Road: 3202 & 3218 Dairy Drive

Madison

Drainage area _____ [ ] sq. ft. [ ] acres

Optional:

Test Site Suitable for (check all that apply)

[ ] Irrigation [ ] Bioretention trench [ ] Trench(es)

[ ] Rain Garden [ ] Grassed Swale [ ] Reuse

[ ] Infiltration trench [ ] SDS (>15' wide) [ ] Other _____

Hydraulic Application Test Method

[X] Morphological Evaluation

[ ] Double-Ring Infiltrometer

[ ] Other (Specify)_____

15 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 863.6 ft Depth to limiting factor 36, 102 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 18	10YR 2/1	None	Fill - SiCL	Variable	Variable	as	<5	0.04
2	18 - 36	10 YR 3/2	None	Fill - SiC	Variable	Variable	gs	<5	0.07
3	36 - 72	10 YR 5/1	C2F 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
4	72 - 222	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
5	222 - 360	10 YR 5/2	None	FS	0sg	ml		<5	0.5
		Groundwater was encountered in boring at 102 in. below existing grade.							

16 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 863.3 ft Depth to limiting factor 42,102 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 9	10YR 2/1	None	Fill - SiCL	Variable	Variable	as	<5	0.04
2	9 - 42	10 YR 5/6	None	Fill - SL	Variable	Variable	gs	<5	0.5
3	42 - 72	10 YR 5/1	C2F 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
4	72 - 222	10 YR 5/2, 5/3	None	S	0sg	ml	gs	<5	3.6
5	222 - 282	10 YR 5/2	None	L	0m	mvfr	gs	<5	0.24
6	282 - 360	10 YR 5/2	None	FS	0sg	ml		<5	3.6
		Groundwater was encountered in boring at 102 in. below existing grade.							

CST/PSS Name (Please Print)	Signature	CST/PSS Number
David Staab	David Staab	1042602
Address	**Date Evaluation Conducted**	**Telephone Number**
3911 Mineral Point Road	7/25/2013	608/288-4100

17 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 864.3 ft Depth to limiting factor 42, 72 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 4	10YR 2/1	None	Fill - SiCL	Variable	Variable	as	<5	0.04
2	4 - 42	10 YR 5/2, 4/3	None	Fill - SCL	Variable	Variable	gs	<5	0.11
3	42 - 72	10 YR 5/1	C2F 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
4	72 - 102	10 YR 5/2	None	SL	1msbk	mvfr	gs	<5	0.5
5	102 - 360	10 YR 5/3	None	S	0m	mvfr	gs	<5	3.6
	Groundwater was encountered in boring at 72 in. below existing grade.								

18 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 863.8 ft Depth to limiting factor 36, 102 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 4	10YR 2/1	None	Fill - SiCL	Variable	Variable	as	<5	0.04
2	4 - 36	10 YR 4/3	None	Fill - SiCL	Variable	Variable	gs	10 - 15	0.04
3	36 - 102	10 YR 5/1	C2F 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
5	102 - 360	10 YR 5/3	None	S	0m	mvfr		<5	3.6
		Groundwater was encountered in boring at 102 in. below existing grade.							

19 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 863.2 ft Depth to limiting factor 5, 72 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 5	10YR 2/1	None	SiCL	1msbk	mvfr	as	<5	0.04
2	5 - 42	10 YR 4/4	C2D 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
3	42 - 72	10 YR 4/3	None	SL, SiCL	1msbk	mvfr	gs	<5	0.04
4	72 - 360	10 YR 5/3	None	S	0sg	ml		<5	3.6
		Groundwater was encountered in boring at 72 in. below existing grade.							

Property Owner FMB Investments, LLC Parcel ID# 071022305223, 071022305231 Page 3 of 3

20 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 864.4 ft Depth to limiting factor 36, 102 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 8	10YR 2/1	None	Fill - SiCL	Variable	Variable	as	<5	0.04
2	8 - 36	10 YR 4/3	None	Fill - SL/SiCL	Variable	Variable	gs	20 - 25	0.04
3	36 - 54	10 YR 4/4	C2D 10YR6/6	SiCL	1msbk	mvfr	gs	<5	0.04
4	54 - 102	10 YR 5/3	None	S/LS/SiL	0sg	ml	gs	<5	0.13
5	102 - 222	10 YR 5/3	None	S	0sg	ml	gs	<5	3.6
6	222 - 240	10 YR 5/2	None	SL	1msbk	mvfr		<5	0.5
		Groundwater was encountered in boring at 102 in. below existing grade.							

Obs. # [ ] Boring [ ] Pit Ground Surface Elev. _____ ft Depth to limiting factor _____ in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr

Obs. # [ ] Boring [ ] Pit Ground Surface Elev. _____ ft Depth to limiting factor _____ in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr

CGC, Inc.

Construction • Geotechnical
Consulting Engineering/Testing

July 13, 2017
C17051-15

Mr. Jon Evans, P.E., LEED AP-BD&C
Building Design Project Manager
Department of Public Works
Engineering Division
City-County Building, Room 115
210 Martin Luther King Jr. Blvd
Madison, WI 53703

Re: Geotechnical Exploration Report
Proposed Fire Station No. 14
3201 Dairy Drive
City of Madison, Dane County, Wisconsin

Dear Mr. Evans:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the geotechnical exploration program for the proposed Fire Station No. 14 on Dairy Drive. The purpose of this exploration program was to evaluate the subsurface conditions within the planned construction area and to provide geotechnical recommendations regarding site preparation, foundation, floor slab and pavement design/construction. We are sending you one paper copy of this report and can provide a paper copy upon request.

PROJECT DESCRIPTION AND SITE CONDITIONS

We understand that Fire Station No. 14 is proposed for a vacant parcel on the east side of Dairy Drive, across from the intersection with Prairie Dock Drive. Most of the site is moderately to heavily-wooded, and site topography generally slopes down gently to the east. Based on a topographic site plan showing 1-ft contour lines, which was provided to us by OPN Architects, current site grades within the planned construction area range between approximately EL 862 and 865 ft.

Based on aerial photos dating back to the years 1995, 2000 and 2005, the site has been previously developed. A building can be identified in north portion of the site, with a greenhouse or similar structure extending into the center of the site. Apparent drives existed to the west and south of the previous structures. There is also evidence that some grading (cutting and filling) has occurred on the property. A 50-ft wide easement for a large high-pressure gas line traverses the south end of parcel.

The new fire station is proposed to be a one-story, slab-on-grade building with partial mezzanine. Finish first floor elevation is (tentatively) planned at EL 866.25 ft. Paved drives and parking areas are planned surrounding the new building. Structural loads have not been provided to us, be we expect loads resulting from the masonry and structural steel construction to be moderate to heavy. Previous fire

2921 Perry Street, Madison WI 53713
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stations of similar size have had maximum wall loads of 6 to 10 kips/ft and maximum column loads of 150 to 200 kips. Maximum floor slab live loads are anticipated to be 125 psf. Pavement areas are anticipated to be subjected to both light-duty and heavy-duty traffic loading.

SUBSURFACE CONDITIONS

Subsurface conditions within the proposed building footprint were explored by drilling five Standard Penetration Test (SPT) soil borings (labeled B-1A through B-5A) to planned depths of 30 ft below existing site grades. The boring locations were selected and field-staked by City of Madison personnel. The borings were drilled on June 27 and 28, 2017 by Badger State Drilling (under subcontract to CGC) using an ATV-mounted D-50 rotary drill rig equipped with hollow-stem augers, mud rotary equipment and an automatic SPT hammer. Ground surface elevations at the boring locations were interpolated by CGC using a topographic site plan (showing 1-ft contour lines), which was provided to us by OPN Architect, and should therefore be considered approximate.

In addition to the five borings recently performed within the building footprint, we have also included six previous SPT soil borings in our evaluation of the site. The six previous borings (labeled B-8 through B-10 and B-12 through B-14) are located in the vicinity of the proposed building, and were performed from July 22 to 24, 2013 by Badger State Drilling (under subcontract to CGC) to planned depths of 30 ft below site grades for a preliminary study of the site.

Specific procedures used for drilling and sampling are described in Appendix A, and the recent and previous boring locations are shown in plan on the Soil Boring Location Exhibit attached in Appendix B.

The subsurface profiles at the boring locations varied somewhat at shallow depths due to previous site development and grading, but the profiles were fairly similar with depth. The following strata were typically encountered (in descending order):

- About 8 to 14 in. of ***topsoil/topsoil fill*** in about half of the borings; over
- About 2.3 to 6 ft of ***fill*** or ***possible fill*** in most borings, consisting primarily of soft to very stiff clay with variable sand and gravel contents as well as occasional organic inclusions (roots and other organic matter), and secondarily of medium dense sand with considerable silt and gravel contents; followed by
- About 1.5 to 3.5 ft of natural, soft to very stiff ***lean to silty clay*** with varying sand content and very loose to loose ***clayey sand*** in most borings; and/or
- Very loose to medium dense ***sand*** with variable silt and gravel contents to the maximum depths explored in all borings.

Instead of *topsoil*, about 4 and 12 in. of ***sand/gravel surface*** was encountered in Borings 3A and 13, respectively, while borings 4A, 5A, 8 and 9 did not contain either. The *fill/possible fill* layer was not present in Boring 12, which featured a profile of topsoil over apparent natural clay that was underlain by natural sand strata. Conversely, *natural clays* were apparently missing in Borings 1A and 8 through 10. However, approximately 3.5-ft thick ***probable buried topsoil layers*** were encountered below the fill in Borings 8 and 9. The organic content (as measured by loss-on-ignition) on the buried topsoil layer ranged from 6.5% to 9.1%, where soils with loss on ignition exceeding 4% are considered organic. The shallow clays (fill and natural) were soft to very stiff, with moisture contents ranging from 14.9% to 29.5% in representative samples. Some of the on-site cohesive soils should therefore be considered slightly to moderately compressible. Possible clay fill samples obtained from Borings 1A and 4A containing apparent organic pockets had overall organic contents between 2.6% and 3.4%.

Groundwater was encountered in the borings during drilling at about 6 to 8.5 ft below site grades (corresponding to approximately EL 854.4 to 857.5 ft). Groundwater levels can be expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration, the level of nearby streams and lakes, the pumping rate of nearby wells and other factors. A more detailed description of the site soil and groundwater conditions is presented on the Soil Boring Logs attached in Appendix B, which also contain the laboratory test results.

DISCUSSION AND RECOMMENDATIONS

Subject to the limitations discussed below and based on the subsurface exploration, it is our opinion that the site is generally suitable for construction. *However, based on the presence of fairly deep, very loose sands within large portions of proposed building footprint, a conventional spread footing foundation system at a typical design bearing pressure is likely not feasible for most of the planned building, as adequate undercutting/replacement of marginal soils will likely be impractical due to shallow groundwater.* In our opinion, suitable foundation support will require ground improvement with rammed aggregate piers (RAPs) or supporting the building on deep foundations such as helical piers. Alternatively, conventional spread footings could potentially be designed for a low bearing pressure, provided that a partial undercut will be included below footings and the structure can tolerate settlement that may slightly exceed typical levels.

Accordingly, our recommendations for site preparation, foundation, floor slab and pavement design/construction along with our assessment of the site class for seismic design are presented in the following subsections. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

1. Site Preparation

We recommend that the topsoil be stripped at least 10 ft beyond the proposed construction areas, including areas required for fill beyond the building footprint or pavement limits. The topsoil can be

stockpiled on-site and re-used as fill in landscaped areas. As noted above, topsoil ranged from 8 to 14 in. thick in the borings, but variable topsoil thicknesses may be encountered between boring locations due to previous development and grading activities. Brush, trees and tree roots should be removed from the construction areas in conjunction with topsoil stripping, and we recommend that remnants of the previous development (including utilities that are no longer in use) be removed in their entirety within the proposed building footprint. Where structures are removed, the soils at the base of the excavation should be checked for suitability prior to backfilling with engineered granular backfill. Remnants of previous structures can potentially remain in-place below new pavement areas assuming the former structures are at least 2 ft below proposed base course grades, and the former structures do not interfere with new utility construction. Old floor slabs should be broken up to allow drainage.

After topsoil stripping and where existing structures have been removed (if any), we recommend that the exposed soils in areas to remain at-grade or requiring fill be proof-rolled with a heavy piece of rubber-tire construction equipment, such as a loaded tri-axle dump truck, to check for soft/yielding areas. Granular soils exposed should be proof-compacted using a vibratory smooth-drum roller. If loose or soft/yielding areas are encountered or zones remain loose after recompaction, these areas should be undercut and replaced with granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) in accordance with the Recommended Compacted Fill Specifications contained in Appendix D. Alternatively, 3-in. dense graded base (DGB) that is placed in loose lifts of 10 in. (or less) and compacted until deflection ceases can be used to restore grades in undercut areas. *Note that the shallow soils below the topsoil generally consist of marginal cohesive soils (natural and fill) that contain variable organic content, unstable soils or soils with elevated organic content. Therefore, partial undercutting/replacement of these layers may be required within pavement areas, with partial to complete undercutting/replacement required within the building footprint, which is discussed in more detail in the Foundation Design and Floor Slab sections of this report. We recommend that the budget include a generous contingency for soil correction.*

Fill placement to establish building and pavement grades can then proceed. We recommend using granular soils (i.e., sands/gravels) as structural fill within the building envelope and upper 2 to 3 ft in pavement areas because these soils are relatively easy to place and compact in most weather conditions, compared to fine-grained and cohesive soils. Clay/silt soils excavated on-site are not recommended as structural fill because moisture conditioning will generally be required to achieve desired compaction levels, which is highly weather dependent (i.e., warm, windy and dry conditions) and could potentially delay construction progress. Clay/silt soils are best used as fill in landscaping or potentially as lower lifts in pavement areas provided the moisture contents can be sufficiently lowered from the natural states to facilitate compaction efforts. We recommend that structural fill/backfill be compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) following Appendix D guidelines. Periodic field density tests should be taken by CGC staff within the fill/backfill to document the adequacy of compactive effort.

We understand that fill heights may be on the order of 1 to 4 ft to establish floor slab subgrades within the building footprint, and site grades within surrounding pavement areas are anticipated to be adjusted accordingly. *Given the presence of slightly to moderately compressible cohesive soils within most of the site, we recommend a minimum time delay of approximately 2 to 4 weeks between fill placement and beginning footing construction to allow the compressive soils to largely consolidate and settle under the weight of the new fill and reduce post-construction settlement to typically tolerable levels.* The required time delay can potentially be reduced or eliminated if cohesive soils are partially or completely undercut and replaced within the building footprint. Settlement platforms (see detail in Appendix E) or monitoring points should be established in the areas of the building where settlement due to the weight of the new fill is a concern. The settlement monitoring points should be surveyed immediately after the full height of the fill reaches the floor slab subgrade elevation, and twice per week until three consecutive sets or survey readings indicate that settlement has ceased. The normal construction sequence can begin after the settlement data indicates that settlement has largely ceased. We can provide additional details upon request.

2. Foundation Design

A. Undercutting and Replacement of Soils Unsuitable for Foundation Support

Assuming finish first floor elevation of the proposed building at EL 866.25 ft and footing grades on the order of 2 to 5 ft below finish first floor elevation, we anticipate footings to bear within newly-placed engineered granular fill/backfill after undercutting (removal) of the existing fill and soft cohesive soils, which are considered unacceptable for foundation support. Undercut depths are expected to extend about 3.5 to 6 ft below grade, and potentially 8.5 ft below existing grade near Boring 4A. Very loose to loose sands extend to depths between about 8 and 22 ft below current site grades, which will limit the allowable bearing pressure. Fairly deep marginal soils (especially in southern portions of the proposed building) in conjunction with the relatively shallow groundwater table are expected to render extensive undercutting and replacement operations impractical, but a conventional spread footing foundation system could potentially be utilized by implementing a low bearing pressure and the following additional parameters for foundation design:

- Maximum net allowable bearing pressure
  (assuming undercutting of existing fill and soft clays): 1,000 psf

- Minimum foundation widths:
  - Continuous wall footings: 18 in.
  - Column pad footings: 30 in.

- Minimum footing depths:
  - Exterior/perimeter footings: 4 ft
  - Interior footings: no minimum requirement

Note that undercut depths may potentially increase if marginal soils are encountered at the bottom of undercut excavations. A CGC field representative should be present on-site during footing and undercut excavations to carefully check the subgrade soils for footing support suitability, and advise on corrective measures, if necessary. We recommend using a smooth-edged backhoe bucket for footing excavations. Additionally, granular soils exposed at footing grade and at the bottom of undercut excavations (that are at least 2 ft above the water table) should be thoroughly recompacted with a large vibratory plate compactor or an excavator-mounted hoe-pack prior to formwork/concrete placement or backfilling to densify soils loosened during the excavation process. Soils potentially susceptible to disturbance from compaction (e.g. silty or clayey soils or soils with elevated water content) should be hand-trimmed.

Where the bottom of undercut excavations extend near the water table, appropriate dewatering measures should be implemented, as determined by the contractor, to lower the water table at least 2 ft below the bottom of the excavation. Very moist to wet soils should be stabilized with a 6 to 12 in. thick layer of crushed clear stone that is compacted into the subgrade. If the stone layer exceeds 12 in., non-woven geotextile fabric (e.g., Mirafi 160N, or equivalent) should be utilized to envelop the stone layer in order to prevent migration of fines into the void spaces of the stone layer. Where undercutting is required, the base of the undercut excavation should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. In order to re-establish footing grade, we recommend using granular soils (i.e., sands/gravels) as backfill, that are compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) following Appendix D guidelines. Alternatively, well-compacted 3-in. DGB can be used to restore grades in undercut areas. OSHA slope guidelines should be followed if workers need to enter excavations.

Provided the foundation design/construction recommendations discussed above are followed (including undercutting/replacement of unsuitable soils and early fill placement), we estimate that total and differential settlements should be on the order of 1.0 to 1.3 and 0.5 to 0.7 in., respectively.

B. Rammed Aggregate Pier Supported Spread Footing Foundation

In our opinion, a proprietary system known as rammed aggregate piers (RAPs or Geopiers™) designed and installed by Ground Improvement Engineering (GIE; formerly Geopier™ Foundation Company) would be a possible system to support the proposed structure. This system is not a pile foundation, but instead essentially stiffens the softer clays and loose sands to a sufficient depth below foundation grade such that a conventional foundation and slab system at a typical bearing pressure is feasible while limiting settlements to typically tolerable levels. Structure loads will generally be concentrated on the perimeter wall footings and exterior/interior column pads, with lower loads anticipated to be distributed more uniformly across the floor slab. Based on the expected, fairly concentrated load distribution, we anticipate that ground improvement elements (RAPs) would be installed in a fairly dense grid pattern below the structure footings in order to limit total settlement to about 1 inch. We do not anticipate RAPs to be required below floor slabs unless high floor slab loads exist, although undercutting/replacement of

unsuitable fill and cohesive soils will be required, as discussed previously and in the Floor Slab section of this report. The use of RAPs in floor slab areas would likely reduce the need for undercutting/ replacement in floor slab areas.

Due to collapsible soils, we expect that a displacement system will be required to construct the piers. This system involves inserting a hollow mandrel to a specified depth (depending on soil conditions and building loads) at which point stone is introduced through the mandrel, which is compacted through a combination of down pressure and oscillations as the mandrel is systematically raised and lowered. The installation process not only creates a relatively strong and rigid aggregate pier but also improves the strength and compressibility properties of the soil around the pier. Based on preliminary discussions with GIE, we expect that RAPs will be installed after fill placement to establish floor slab subgrades. As discussed earlier, a time delay of a few weeks will be required after fill placement to allow the soils to partially consolidate under the weight of the new fill. During this time, settlement will be monitored to determine when settlement due to the new fill has largely ceased and foundation construction can begin. Full-time inspection is recommended during RAP installation to document their construction according to design requirements.

In our opinion and based on preliminary review by GIE, RAP-supported footings could be designed for a maximum net allowable soil bearing pressure of about 4,000 psf. The maximum allowable bearing pressure for footings bearing on RAPs will need to be confirmed by Ground Improvement Engineering once additional project information becomes available. RAPs have been used successfully on many projects in Wisconsin with similar soil conditions. Rammed aggregate piers can be bid as an alternative to undercutting the fill and soft clays (and use a low bearing pressure) or using helical piers for building support, with foundation design included in the package.

C. Helical Pier Supported Spread Footing Foundation

As an alternative to undercutting/replacement and RAPs, it is our opinion that the building foundations can be supported on helical piers that extend through the very loose sands, and bear within the underlying medium dense sands. Helical pier capacity will vary depending on the number and size of helices, depth of installation and bearing stratum. Floor slabs would likely be supported in a conventional fashion, as previously described.

Note that in order to gather more subsurface information for helical pier design, we recommend performing at least one more boring within the building footprint. The additional boring should extend at least 50 to 75 ft below current site grades in order to reach denser soil more suitable to develop higher helical pier capacities. If desired, we can provide additional details and develop a supplemental geotechnical scope at the appropriate time.

3. Seismic Site Class

In our opinion, the average soil properties in the upper 100 ft of the site (based on SPT blow counts "N-values" of less than 15 blows/ft, on average) can be characterized as a soft soil profile. This characterization would place the site in Class E for seismic design according to International Building Code (see Table 1613.5.2).

4. Floor Slab

The floor slab subgrade soils are expected to consist mainly of newly-placed engineered granular fill/backfill over soft to very stiff cohesive soils (natural or existing fill). (Note that due to anticipated light floor loads, we do not expect that the floor slabs will require support by RAPs or helical piers, although partial undercutting of existing fill/possible fill soils and lower strength natural soils will likely be required.) Prior to slab construction, the subgrade soils should be thoroughly proof-rolled/recompacted to densify soils that may become disturbed or loosened during construction activities. Areas of disturbed soil or where soils remain loose after recompaction should be undercut and replaced with compacted 3-in. DGB or granular fill. *As mentioned previously, some of the shallow fill/possible fill cohesive soils are considered marginal to unsuitable for direct slab support, and some undercutting/stabilization will likely be required within slab areas during general site grading prior to new fill placement to establish finish floor elevation. Undercut depths could be on the order of 2 to 4 ft (potentially deeper) within floor slab areas.*

To act as a capillary break, we recommend including a minimum 4 to 6-in. thick layer of well-graded sand/gravel with less than 5% passing the No. 200 U.S. standard sieve below the floor slab. To further minimize the potential for moisture migration through the slab, a plastic vapor barrier can also be utilized below the slab. Fill and base layer material below the floor slab should be placed as described in the Site Preparation section of this report. A subgrade modulus of 100 pci may be used for slab design on the sand/gravel layer above a firm or stabilized subgrade. The design subgrade modulus is based on a recompacted subgrade such that non-yielding conditions are developed. Note that some structural engineers require a 4 to 6-in. layer of DGB, such as 1¼-in. DGB, below the slab to increase the subgrade modulus immediately below the slab. If 6 in. of DGB is included below the floor slab, the subgrade modulus can be increased to 150 pci. The slab should be structurally separated from the foundations with a compressible filler and have construction joints and reinforcement for crack control.

5. Pavement Design

Pavement within at-grade parking areas and drives is anticipated to be constructed on a variety of soils, including newly-placed engineered granular fill, natural and/or existing fill granular soils and natural and/or existing fill cohesive/fine-grained soils. Subgrades should be prepared, as described in the Site Preparation section of this report, with undercutting/stabilization completed to develop suitable subgrades, where needed. *Due to the variable fill expected at pavement subgrades in some portions of*

the site, we recommend that the budget include a generous contingency for subgrade undercutting/ stabilization. For budgeting purposes, we recommend including an allowance for 12 in. of additional coarse aggregate (e.g., 3-in. DGB) over biaxial geogrid within about 50% of the pavement area. The need for undercutting below the pavement section will likely be reduced when site grades are raised at least 2 ft above existing grade with high quality granular fill.

We anticipate that some asphalt pavement within parking lots will be exposed to primarily automobile traffic with less than one 18-kip equivalent single axle load (ESAL) per day. In view of this, we have assumed Traffic Class I following Wisconsin Asphalt Pavement Association (WAPA) recommendations for parking areas and driveways that are mainly used by light passenger vehicles. However, main sections of driveways are likely to experience heavier traffic loads due to truck traffic. For pavement areas where trucks will routinely travel, we have assumed a traffic load of less than 20 ESALs per day and Traffic Class II according to WAPA. We have also included a heavy duty pavement section where higher truck traffic loads including heavy fire truck traffic (up to 50 ESALs per day) are expected. The pavement sections summarized in Table 1 below were selected assuming a Soil Support Value "SSV" of 4.0 for a firm or adequately stabilized subgrade and a design life of 20 years.

TABLE 1 – Recommended Pavement Sections

Material	Thicknesses (in.)			WDOT Specification[1]
	Traffic Class I (Light Duty)	Traffic Class II (Medium Duty)	Traffic Class III (Heavy Duty)	
Bituminous Upper Layer[2,3]	1.5	1.75	2.0	Section 460, Table 460-1, 9.5 mm (light duty), 12.5 mm (medium and heavy duty)
Bituminous Lower Layer[2,3]	2.0	2.25	3.0	Section 460, Table 460-1, 12.5 mm (light duty), 19 mm (medium and heavy duty)
Dense Graded Base Course[2,4]	8.0	10.0	12.0	Sections 301 and 305, 3 in. and 1¼ in.
Total Thickness	**11.5**	**14.0**	**17.0**	

Notes:

1. Wisconsin DOT *Standard Specifications for Highway and Structure Construction*, latest edition, including supplemental specifications, and Wisconsin Asphalt Pavement Association *2016 Asphalt Pavement Design Guide*.

2. Compaction requirements:
   - Bituminous concrete: Refer to Section 460-3.
   - Base course: Refer to Section 301.3.4.2, Standard Compaction

3. Mixture Type LT bituminous; refer to Section 460, Table 460-2 of the *Standard Specifications*. Mixture type MT is recommended in heavy duty traffic areas. Note that an "H Grade" asphalt surface layer is recommended where there will be slow moving heavy truck traffic making turning movements.

4. The upper 4 in. should consist of 1¼-in. DGB; the bottom part of the layer can consist of 3-in. DGB.

Note that if traffic volumes are greater than those assumed, CGC should be allowed to review the recommended pavement sections and adjust them accordingly. The pavement design assumes a stable/non-yielding subgrade which will be evaluated using proof-rolling techniques. *As mentioned above, where pavement construction occurs fairly close to existing site grades, a stabilization layer that is underlain by a biaxial geogrid may potentially be required below the pavement sections summarized in Table 1 in order to develop suitable pavement subgrades on the existing fill soils.* Alternative pavement designs may prove acceptable and should be reviewed by CGC. If there is a delay between subgrade preparation and placing the base course, the subgrade should be recompacted.

Where concrete pavement may be used, such as in pavement areas subjected to concentrated wheel loads (e.g., dumpster pads, aprons around the apparatus bay, etc.), we recommend that the concrete pavement should be at least 6-in. thick (thicker concrete may be required within areas of heavy traffic loads due to fire trucks), be underlain by at least 6 in. of DGB and contain mesh reinforcement for crack control. Concrete slabs underlain by a minimum 6-in. thick dense graded base layer over a firm or stabilized subgrade can be designed utilizing a subgrade modulus of 150 pci. Note that a thicker pavement section (more than 6 in. of concrete) may be required depending on pavement loads, which should be evaluated by a structural engineer.

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties that could be encountered on the site are discussed below:

- Due to the potentially sensitive nature of some of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.

- Contingencies in the project budget for subgrade stabilization with coarse aggregate in pavement and floor slab areas should be increased if the project schedule requires that work proceed during adverse weather conditions.

- Earthwork construction during the early spring or late fall could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.

- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards.

- Based on observations made during the field exploration, we generally do not anticipate groundwater to be encountered during footing excavations. However, groundwater could be encountered at the base of undercut excavations that requires dewatering measures to lower the water during construction activities. Additionally, water accumulating at the base of excavations as a result of precipitation or seepage should be quickly removed, with dewatering means and methods the contractor's responsibility.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation, floor slab and pavement subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

- Topsoil stripping/subgrade proof-rolling;
- Fill/backfill placement and compaction;
- RAP or helical pier installation;
- Foundation excavation/subgrade preparation; and
- Concrete placement.

* * * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

Tim F. Gassenheimer, E.I.T.
Staff Engineer

David A. Staab, P.E., LEED AP
Senior Consulting Professional

Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Exhibit
Logs of Recent Test Borings (5)
Logs of Previous Test Borings (6)
Particle Size Distribution Test Reports (2)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications
Appendix E - Settlement Platform

APPENDIX A

FIELD EXPLORATION REPORT

APPENDIX A

FIELD EXPLORATION

Subsurface conditions within the proposed building footprint were explored by drilling five Standard Penetration Test (SPT) soil borings (labeled B-1A through B-5A) to planned depths of 30 ft below existing site grades. The boring locations were selected and field-staked by City of Madison personnel. The borings were drilled on June 27 and 28, 2017 by Badger State Drilling (under subcontract to CGC) using an ATV-mounted D-50 rotary drill rig equipped with hollow-stem augers, mud rotary equipment and an automatic SPT hammer. Ground surface elevations at the boring locations were interpolated by CGC using a topographic site plan (showing 1-ft contour lines), which was provided to us by OPN Architect, and should therefore be considered approximate.

In addition to the five borings recently performed within the building footprint, we have also included six previous SPT soil borings in our evaluation of the site. The six previous borings (labeled B-8 through B-10 and B-12 through B-14) are located in the vicinity of the proposed building, and were performed from July 22 to 24, 2013 by Badger State Drilling (under subcontract to CGC) to planned depths of 30 ft below site grades for a preliminary study of the site.

In the previous borings, soil samples were obtained at 2.5 foot intervals to a depth of 10 ft and at 5 ft intervals thereafter. To better explore the extent of very loose sands, the recent borings were samples at 2.5 foot intervals to a depth of 20 ft and at 5 ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

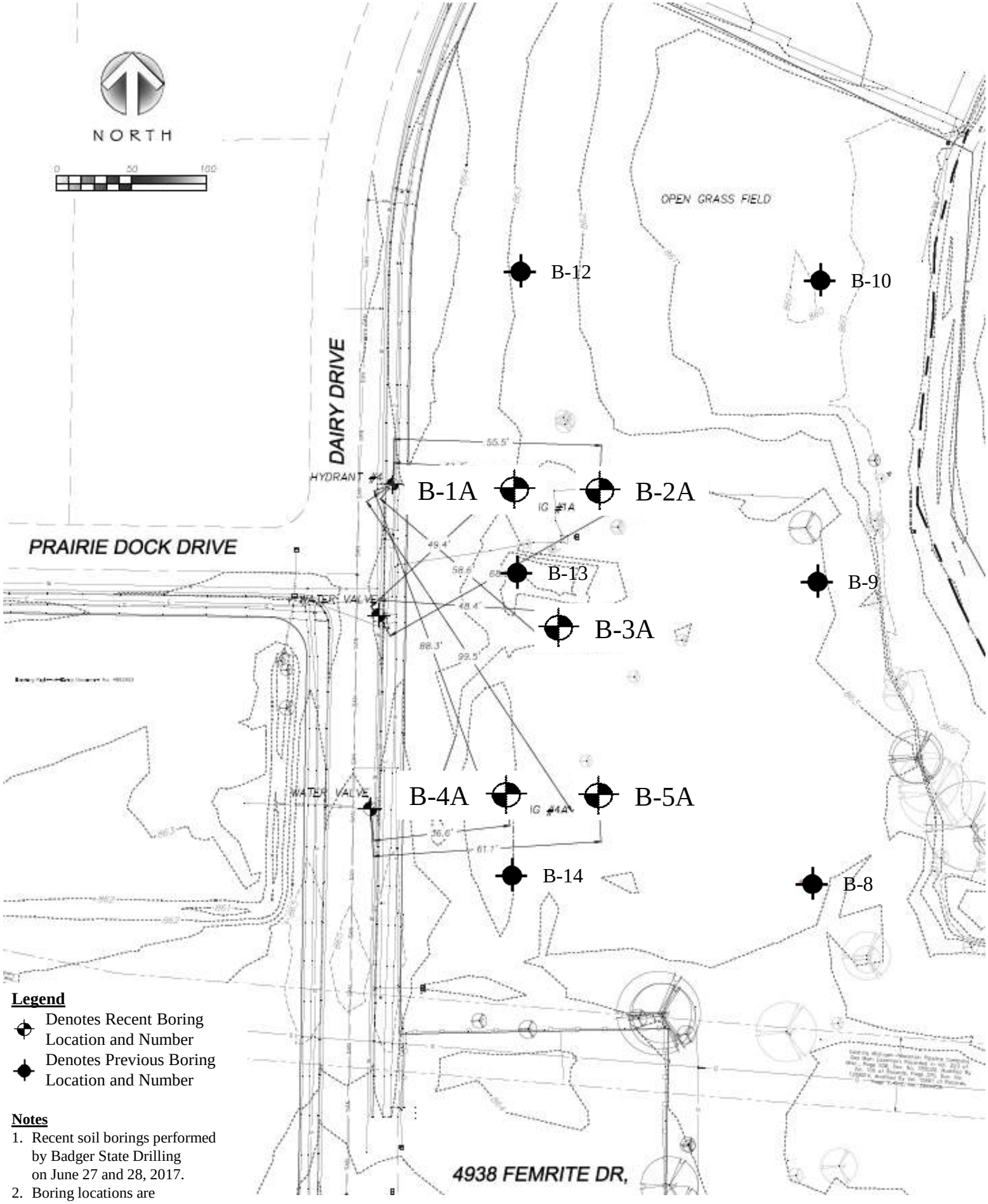
2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the soil samples for possible environmental contaminants was not conducted by the drillers as environmental site assessment activities were not part of CGC's work scope.* Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled with bentonite to satisfy WDNR regulations, and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The soil samples were visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer, including laboratory test results, a boring location map, and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

SOIL BORING LOCATION EXHIBIT
LOGS OF RECENT TEST BORINGS (5)
LOGS OF PREVIOUS TEST BORINGS (6)
PARTICLE SIZE DISTRIBUTION TEST REPORTS (2)
LOG OF TEST BORING – GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM



Legend

- Denotes Recent Boring Location and Number
- Denotes Previous Boring Location and Number

Notes

1. Recent soil borings performed by Badger State Drilling on June 27 and 28, 2017.
2. Boring locations are approximate.
3. Base map was provided by OPN Architects.

Job No.: C17051-15 **Date:** 7/2017	CGC, Inc.	**SOIL BORING LOCATION EXHIBIT** **Proposed Fire Station No. 14** **3201 Dairy Drive** **City of Madison, Dane Co., WI**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **1A**
Surface Elevation (ft) **± 863.0**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						± 8 in. TOPSOIL (OL)					
1		12	M	5		Soft to Medium Stiff, Gray/Brown (Lightly Mottled) Lean CLAY, Little to Some Sand, Trace Gravel, Scattered Dark Gray Organic Pockets (CL - Possible Fill)	(0.75-1.0)	23.3			2.6
2		18	M	4			(0.25)	28.5			
					5	Sand and Gravel Contents Slightly Decreasing With Depth					
3		16	W	4	▽	Loose, Tan Fine to Coarse SAND, Little Gravel, Trace to Little Silt, Scattered Cobbles/Boulders (SP)					
4		18	W	9		Silt Content Slightly Increasing with Depth					
					10						
5		8	W	16		Medium Dense, Gray Fine to Medium SAND, Little Silt, Trace Gravel, Scattered Cobbles/Boulders (SP-SM)					
6		10	W	20							
					15						
7		10	W	21		Medium Dense, Gray Fine to Medium SAND, Some Silt, Trace Gravel, Scattered Cobbles/Boulders (SM)					
8		12	W	19							
					20						
9		8	W	29		Scattered Silt Seams near 23.5 ft					
					25						
10		10	W	24							
					30	End of Boring at 30 ft Borehole Backfilled with Bentonite Chips					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/28/17** End **6/28/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **2A**
Surface Elevation (ft) **± 863.0**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						± 8 in. TOPSOIL (OL)					
1		14	M	8		Stiff, Gray/Brown (Lightly Mottled) Lean CLAY, Little Sand, Trace Gravel, Scattered Dark Gray Organic Pockets and Roots (CL - Possible Fill)	(1.75-2.0)	25.0			
2		18	M	6	5	Soft to Medium Stiff, Gray Lean to Silty CLAY, Some Sand (CL/CL-ML)	(0.25-0.75)	14.9	20	13	
3		14	W	4		Very Loose, Tan Fine to Coarse SAND, Little Gravel, Trace Silt, Scattered Cobbles/Boulders (SP)					
4		6	W	2	10	Scattered Clay Seams near 8.5 ft					
5		16	W	15		Medium Dense, Gray Fine to Medium SAND, Some Silt, Trace Gravel, Scattered Cobbles/Boulders (SM)					
6		8	W	11	15	P200 (Sample 6): 15.0%		24.2			
7		12	W	20							
8		10	W	11	20						
9		8	W	12	25	Medium Dense, Gray Fine to Coarse SAND, Some Gravel, Little Silt, Scattered Cobbles/Boulders (SP-SM)					
10		10	W	17	30	Medium Dense, Grayish Brown Fine to Medium SAND, Some Silt, Trace Gravel, Scattered Cobbles/Boulders (SM)					
						End of Boring at 30 ft					
					35	Borehole Backfilled with Bentonite Chips					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/28/17** End **6/28/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **3A**
Surface Elevation (ft) **± 862.0**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						± 4 in. GRAVEL SURFACE					
1		14	M	8		Very Stiff, Gray/Brown (Lightly Mottled) Lean CLAY, Little Sand, Trace Gravel, Scattered Dark Gray Organic Pockets and Roots (CL - Possible Fill)	(2.0-2.25)	25.5			
2		12	M	7	5	Soft to Medium Stiff, Gray/Brown (Lightly Mottled) Sandy Lean CLAY, Trace Gravel (CL)	(0.25-0.75)	17.7			
3		18	W	2		Very Loose, Gray Silty Fine SAND, Layered with Tan Fine to Medium SAND, Little to Some Silt, Trace to Little Gravel (SM)					
4		16	W	2	10	Very Loose to Loose, Gray Fine to Medium SAND, Little Silt and Gravel, Scattered Cobbles/Boulders (SP-SM)					
5		16	W	7							
6		10	W	6	15						
7		18	W	22		Medium Dense, Gray Silty Fine SAND, Trace Gravel, Scattered Less Silty Fine to Medium Sand Seams (SM)					
8		12	W	9	20	Loose to Medium Dense, Gray Fine to Medium SAND, Little Silt, Trace Gravel, Scattered Cobbles/Boulders (SP-SM)					
9		14	W	23	25						
10		12	W	30	30	End of Boring at 30 ft Borehole Backfilled with Bentonite Chips					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/27/17** End **6/28/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **4A**
Surface Elevation (ft) **± 864.0**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						FILL: Dark Gray Silty Clay, Some Sand, Little Gravel, Trace Organics, Scattered Roots (Possible Tospoil Fill)					
1	■	12	M	10			(-)	16.8			3.4
2	■	8	M	7		FILL: Medium Stiff to Stiff, Gray/Tan/Reddish Brown Lean to Silty Clay, Some Sand, Trace Gravel, Numerous Roots	(0.5-1.25)	17.5			
3	■	10	M	4	5	Very Loose to Loose, Gray Clayey Fine to Medium SAND, Scattered Lean Clay Seams (SC)		16.7			
4	■	12	W	6		Loose, Tan Fine to Coarse SAND, Little Gravel, Trace Silt, Scattered Cobbles/Boulders (SP)					
5	■	8	W	3	10	Very Loose, Tan Fine to Medium SAND, Trace to Little Silt and Gravel, Scattered Cobbles/Boulders (SP/SP-SM)					
6	■	10	W	2		P200 (Sample 6): 2.5%		22.3			
7	■	14	W	4	15	Grading Gray/Gravel Content Slightly Increasing with Depth					
8	■	10	W	2							
9	■	12	W	13	20	Medium Dense, Tan Fine to Medium SAND, Some Silt, Trace Gravel, Scattered Cobbles/Boulders (SM)					
10	■	12	W	18	25						
					30	End of Boring at 30 ft Borehole Backfilled with Bentonite Chips					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/27/17** End **6/27/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **5A**
Surface Elevation (ft) **± 863.5**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						FILL: Stiff, Gray/Dark Gray/Brown Lean Clay, Some Sand, Scattered Roots					
1	■	10	M	6			(1.25-1.75)	22.0			
2	■	12	M	9	5	Stiff, Gray/Brown (Lightly Mottled) Sandy Lean CLAY, Trace Gravel (CL)	(1.5-1.75)	16.4			
3	■	12	W	5		Loose, Tan Fine to Medium SAND, Trace Silt and Gravel, Scattered Cobbles/Boulders (SP)					
4	■	10	W	2	10	Very Loose, Tan Fine to Medium SAND, Little Silt and Gravel, Scattered Cobbles/Boulders (SP-SM)					
5	■	12	W	3		Very Loose, Gray Fine to Medium SAND, Some Silt, Trace Gravel and Organics, Scattered Tan Less Silty Seams and Cobbles/Boulders (SM)					
6	■	10	W	2	15						
7	■	10	W	5		Very Loose to Loose, Gray Fine to Medium SAND, Little Silt and Gravel, Scattered Cobbles/Boulders (SP-SM)					
8	■	8	W	2	20						
9	■	12	W	19	25	Medium Dense, Gray Fine to Medium SAND, Some Gravel, Little Silt, Scattered Silt Seams and Cobbles/Boulders (SP-SM)					
10	■	12	W	21	30	Medium Dense, Gray Fine to Medium SAND, Some Silt, Little Gravel, Scattered Cobbles/Boulders (SM)					
						End of Boring at 30 ft Borehole Backfilled with Bentonite Chips					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/27/17** End **6/27/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **8**
Surface Elevation (ft) **863.8**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
1		18	M	15		FILL: Medium Dense, Tan Fine to Medium Sand, Some Silt and Gravel USDA: FILL - 2.5Y 5/3 Sandy Loam					
2		10	M	5	5	FILL: Soft to Medium Stiff, Dark Gray/Gray Lean Clay, Little to Some Sand, Trace Organics USDA: FILL - 10YR 3/1, 5/2 Silty Clay Loam	(0.5)	15.4			
3		8	M	5		Medium Stiff, Dark Gray/Black Organic CLAY (OL - Probable Buried Topsoil) USDA: 10YR 2/1 Silty Clay Loam	(1.0)	26.6			9.1
4		18	W	10	10	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		5	W	2	15						
6		3	W	4	20						
7		12	W	14	25	Medium Dense, Brown Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/3 Fine Sand					
8		8	W	21	30	Medium Dense, Gray-Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/2 Sand					
					35	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8"**
RB/DM; Autohammer

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **9**
Surface Elevation (ft) **863.5**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						FILL: Medium Dense, Tan Fine to Medium Sand, Some Silt and Gravel USDA: FILL - 2.5Y 5/3 Sandy Loam					
1	■	18	M	17							
						Loose, Dark Gray/Black Organic Clayey SILT (OL - Probable Buried Topsoil) USDA: 10YR 2/1 Silt Loam					
2	■	15	M	5	5			19.3			6.5
						Very Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3	■	10	W	10							
4	■	12	W	8	10						
5	■	18	W	3	15	Grades to Fine Sand near 15 ft					
6	■	3	W	10	20						
7	■	4	W	27	25						
8	■	12	W	9	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/23/13** End **7/23/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-15'; 3-7/8" RB/DM 15'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **10**
Surface Elevation (ft) **860.4**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						14 in.± Clayey TOPSOIL (OL)					
1		6	M	7		Loose, Gray Fine to Medium SAND, Some Silt, Trace Clay and Gravel (SM - Possible Fill) USDA: 10YR 5/1 Sandy Loam					
2		6	W	5	5	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3		12	W	3							
4		8	W	4	10	Color Change to Dark Brown (10YR 3/3) with Scattered Silt Seams near 7.5 ft					
5		10	W	4	15	Very Loose to Loose, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
6		9	W	9	20	Loose, Gray Fine SAND, Some Silt, Trace Gravel (SM) USDA: 10YR 5/2 Sandy Loam					
7		14	W	10	25	Loose, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
8		12	W	8	30	Scattered Silt Seams near 30 ft					
						End of Boring at 30 ft					
					35	Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM; Autohammer**

LOG OF TEST BORING

CGC Inc.

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **12**
Surface Elevation (ft) **863.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						12 in.± Clayey TOPSOIL (OL)					
1		10	M	9		Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL) USDA: 10YR 5/1 Silty Clay Loam (Redox: C2F 10YR 6/6)	(3.0)				
2		16	M	5	5	Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3		12	W	5							
4		14	W	8	10						
5		12	W	5	15	3 in. Stiff, Gray/Brown Lean Clay Seam near 15 ft	(1.0-1.5)				
6		12	W	15	20	Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
7		16	W	15	25						
8		14	W	23	30						
					35	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

LOG OF TEST BORING

CGC Inc.

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **13**
Surface Elevation (ft) **862.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						12 in.± Sand and Gravel FILL					
1		5	M	8		Stiff to Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL - Possible Fill in Upper Few Feet of Layer)	(3.5)				
2		18	M	8	5	USDA: 10YR 5/1 Silty Clay Loam (Redox: C2D 10YR 6/6)	(1.0-1.5)	29.5			
3		18	W	4		Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM)					
4		18	W	4	10	USDA: 10YR 5/3 Sand					
5		3	W	4	15						
6		12	W	17	20	Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
7		12	W	27	25	Medium Dense, Brown Fine to Coarse SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
8		4	W	14	30	End of Boring at 30 ft Borehole backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0' Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **14**
Surface Elevation (ft) **865.0**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						8 in.± Sandy TOPSOIL FILL (OL)					
1		12	M	12		FILL: Very Stiff, Brown/Gray Lean Clay, Trace to Little Sand USDA: FILL-10YR 4/3 Silty Clay Loam	(3.75-4.0)				
2		12	M	8	5	Stiff to Very Stiff, Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL) USDA: 10YR 5/2 Silty Clay Loam (Redox: C2D 10YR 6/6)	(2.0-2.5)				
3		18	M	8			(1.0-1.5)	24.7			
4		6	W	4	10	Very Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		18	W	4	15	Grades to Fine Sand near 15 ft					
6		6	W	2	20						
7		8	W	12	25						
8		18	W	20	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

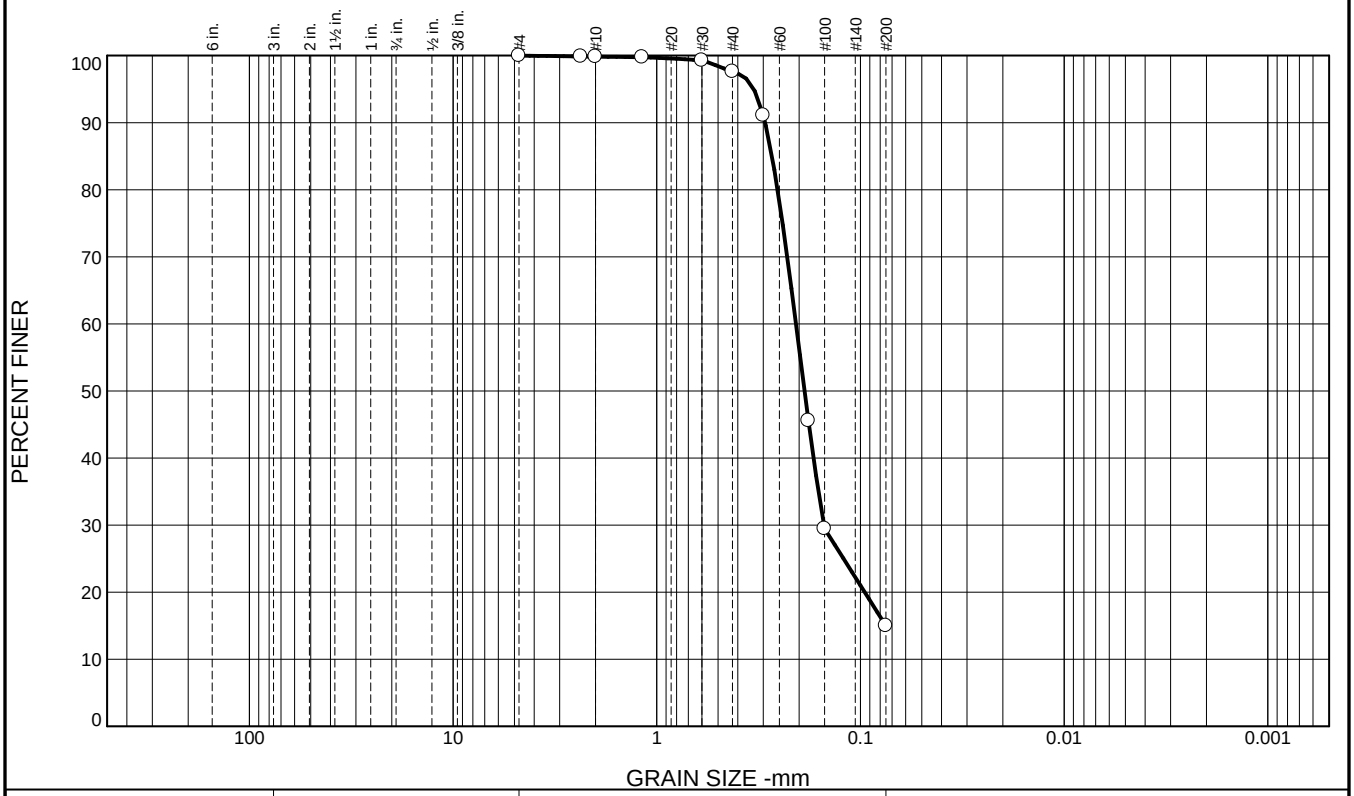
While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	2.2	82.6	15.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.9		
#10	99.8		
#16	99.8		
#30	99.3		
#40	97.6		
#50	91.1		
#80	45.5		
#100	29.5		
#200	15.0		

* (no specification provided)

Material Description

Brown Fine Sand, Some Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2938 D_{85}= 0.2718 D_{60}= 0.2073
D_{50}= 0.1881 D_{30}= 0.1511 D_{15}= 0.0751
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample Number: B-2A, S-6

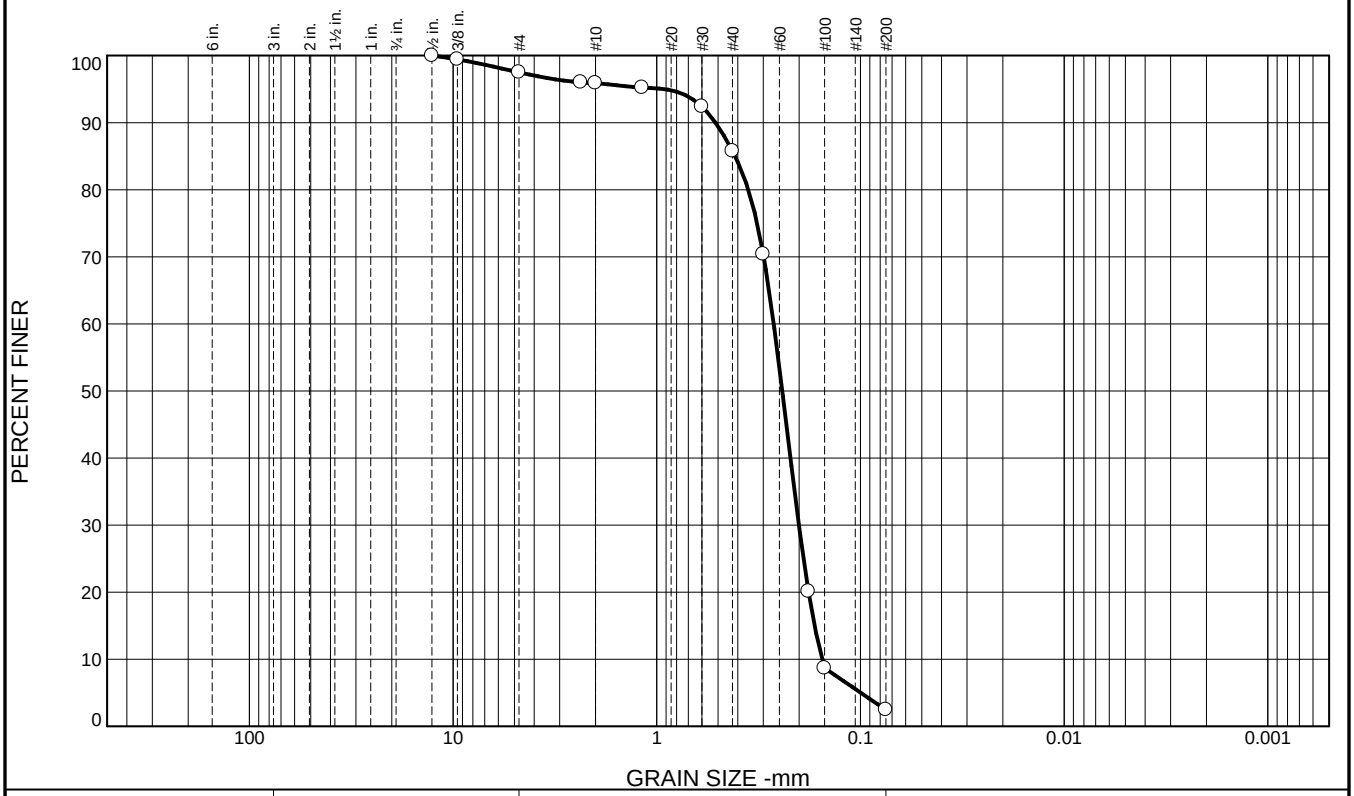
Date: 7/5/17

CGC,Inc.

Client: City of Madison - Public Works
Project: Fire Station No. 14
Dairy Drive, Madison
Project No: C17051-15 **Figure**

Tested By: DRW **Checked By:** TFG

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.5	1.6	10.1	83.3	2.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2	100.0		
3/8	99.4		
#4	97.5		
#8	96.0		
#10	95.9		
#16	95.2		
#30	92.4		
#40	85.8		
#50	70.4		
#80	20.1		
#100	8.7		
#200	2.5		

* (no specification provided)

Material Description

Brown Fine to Medium Sand, Trace Silt and Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5150 D_{85}= 0.4128 D_{60}= 0.2665
D_{50}= 0.2420 D_{30}= 0.2005 D_{15}= 0.1680
D_{10}= 0.1542 C_u= 1.73 C_c= 0.98

Classification

USCS= SP AASHTO=

Remarks

Sample Number: B-4A, S-6

Date: 7/5/17

CGC,Inc.

Client: City of Madison - Public Works
Project: Fire Station No. 14
Dairy Drive, Madison
Project No: C17051-15 **Figure**

Tested By: DRW **Checked By:** TFG

CGC, Inc.

LOG OF TEST BORING
General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Fine	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse	2.00 mm to 4.76 mm	#10 to #4
Medium	0.42 to mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

Relative Density

Term	"N" Value
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

Consistency

Term	q_u-tons/sq. ft
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4 – 12%
Sedimentary Peat	12% - 50%
Fibrous and Woody Peat	More than 50%

Plasticity

Term	Plastic Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

CS – Continuous Sampling
RC – Rock Coring: Size AW, BW, NW, 2"W
RQD – Rock Quality Designation
RB – Rock Bit/Roller Bit
FT – Fish Tail
DC – Drove Casing
C – Casing: Size 2 ½", NW, 4", HW
CW – Clear Water
DM – Drilling Mud
HSA – Hollow Stem Auger
FA – Flight Auger
HA – Hand Auger
COA – Clean-Out Auger
SS - 2" Dia. Split-Barrel Sample
2ST – 2" Dia. Thin-Walled Tube Sample
3ST – 3" Dia. Thin-Walled Tube Sample
PT – 3" Dia. Piston Tube Sample
AS – Auger Sample
WS – Wash Sample
PTS – Peat Sample
PS – Pitcher Sample
NR – No Recovery
S – Sounding
PMT – Borehole Pressuremeter Test
VS – Vane Shear Test
WPT – Water Pressure Test

Laboratory Tests

q_a – Penetrometer Reading, tons/sq ft
q_a – Unconfined Strength, tons/sq ft
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
SL – Shrinkage Limit, %
LI – Loss on Ignition
D – Dry Unit Weight, lbs/cu ft
pH – Measure of Soil Alkalinity or Acidity
FS – Free Swell, %

Water Level Measurement

▽ - Water Level at Time Shown
NW – No Water Encountered
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
CW – Cave and Wet
CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

CGC, Inc.

Madison - Milwaukee

Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)		
		GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)		
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)		
		SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)		
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

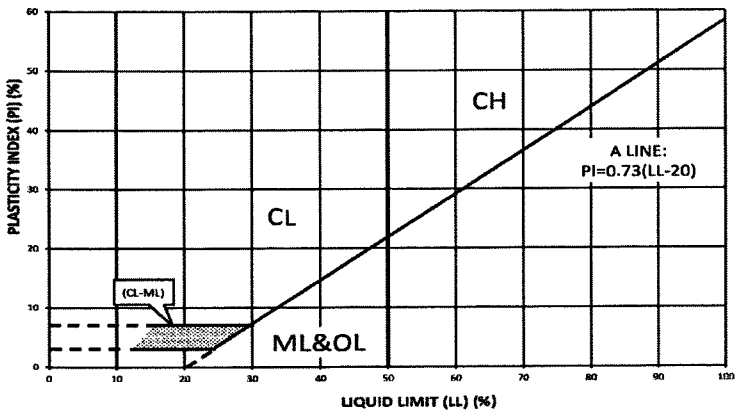
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limts below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limts above "A" line or P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engincering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

READ THE FULL REPORT

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most

effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the confirmation-dependent recommendations included in your report. *Those confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's confirmation-dependent recommendations if we do not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical engineering report. Confront that risk by having CGC participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONSTRUCTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and constructors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

ENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in the Geotechnical Business Council (GBC) of Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of GBC, for more information.

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Geotechnical Business Council
of the Geoprofessional Business Association
8811 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

Table 1
Gradation of Special Fill Materials

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55			
No. 40			5-20	8-28	10-35	75 (2)		
No. 100						15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

Table 2
Compaction Guidelines

Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 2 ft below subgrade	92	95
- Greater than 2 ft below subgrade	90	90
Landscaping	85	90

Notes:

1. Based on Modified Proctor Dry Density (ASTM D 1557)

APPENDIX E

SETTLEMENT PLATFORM

Settlement Platform Instructions

Settlement platforms will be placed as close to the bottom of the fill as is practical. The surface upon which the settlement platform should rest must be cleaned off to a flat compacted surface. The settlement platform should then be placed in this surface and backfill should be placed over the top of the settlement platform to a depth of at least two feet.

Initial elevations should be taken on the top of the first section of the pipe riser. These should be referenced to the elevation at the platform so that all future additional lengths of riser pipe can be referenced to the elevation of the platform.

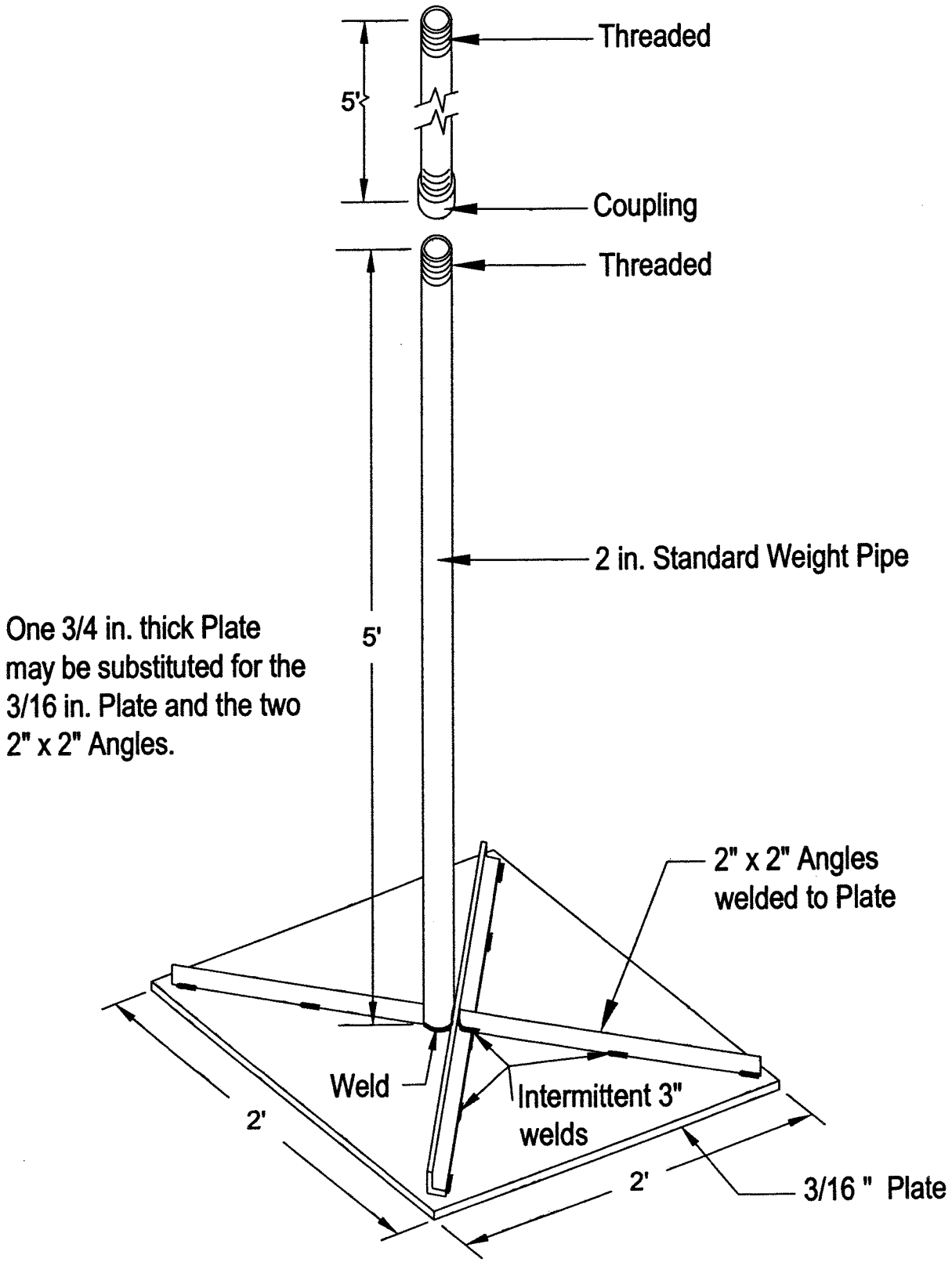
The settlement platform locations should be guarded with tall stakes driven into the fill marked with red flags. No equipment should be permitted to operate closer than three feet from the riser pipes. As each layer of fill is being added to the area, fill should be carefully placed around the riser pipe to an elevation slightly above the surrounding area. The vibrating compactor then should be moved to within a foot or so of the riser pipe with care being taken so as to avoid disturbance of the riser pipe. If necessary, hand compacting equipment should be used to avoid damage to the riser pipe.

When settlement platform readings are taken, the elevation of nearby fill should also be taken.

The elevation at the settlement platform and the nearby fill should be observed at least once each week, and during the period that fill is being placed in the vicinity of the platform, these elevations should be obtained daily. All elevation data should be plotted according to time, with one graph prepared per settlement platform. The plotting should contain the time scale along the abscissa and the vertical scale should be height of fill shown going upward from the middle of the paper, and the settlement of the settlement platforms should be plotted downward from the middle of the paper. The time sale should include both the actual calendar date and also the number of days since the platform was installed.

The benchmark to be used in reading the various settlement platforms should be well away from the proposed excavation or filling areas.

If damage occurs to any settlement platform riser pipe, it is suggested that the pipe be repaired as quickly as possible and the readings continued. The adjustment of these readings can be made, considering that settlement rate during the period of damage was uniform.



CGC, Inc.	Typical Detail Settlement Platform

CGC, Inc.

Construction • Geotechnical
Consulting Engineering/Testing

August 7, 2017
C17051-18

Mr. Jon Evans, P.E., LEED AP-BD&C
Building Design Project Manager
Department of Public Works
Engineering Division
City-County Building, Room 115
210 Martin Luther King Jr. Blvd
Madison, WI 53703

Re: Addendum to Geotechnical Exploration Report
Proposed Fire Station No. 14
3201 Dairy Drive
City of Madison, Dane County, Wisconsin

Dear Mr. Evans:

As requested, Construction • Geotechnical Consultants, Inc. (CGC) arranged for geophysical testing to further evaluate the subsurface conditions as it relates to seismic site class. The recommendations in other sections of our report (Report C17051-15, dated July 14, 2017) completed for this project are still current. We are sending you an electronic copy of this report and can provide a paper copy upon request.

GEI Consultants, Inc. (GEI) (under subcontract to CGC) completed a Refraction Micro-Tremor (ReMi) survey on July 28, 2017 in order to estimate the shear wave velocity profile within the upper 100 ft of the site. The findings of their geophysical survey indicated that the shear wave velocity profile was fairly low in the upper approximately 20 ft of the site, which is consistent with the findings of the previously-completed soil borings on this site that encountered loose sands to approximately 20 ft below existing grade. The ReMi survey indicates that the density of the soil increases with depth (based on increased shear wave velocity), with a noticeable increase in shear wave velocity near 85 ft, which is generally consistent with very dense soil. Based on the ReMi survey, the average shear wave velocity in the upper 100 ft of the site was determined to be 1,076 feet per second. GEI's report is attached for additional information on the test methods, results and conclusions.

In our opinion, based on the average shear wave velocity of 1,076 feet per second in the upper 100 ft of the site, the average soil properties in the upper 100 ft of the site can be characterized as a stiff soil profile. This characterization would classify the site as **Site Class D** for seismic design according to International Building Code (see Table 1613.5.2).

2921 Perry Street, Madison WI 53713
Telephone: 608/288-4100
FAX: 608/288-7887

* * * * *

We trust that this report satisfies the current needs of this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

David A. Staab, P.E., LEED AP
Senior Consulting Professional

Encl: Appendix A - GEI Report, Date August 3, 2017

APPENDIX A

GEI REPORT (Project No. 1703284), DATED AUGUST 3, 2017

GEI Consultants

Consulting Engineers and Scientists

August 3, 2017
GEI Project No. 1703284

VIA EMAIL: *dstaab@cgcinc.net*

David A. Staab, P.E., LEED AP
CGC, Inc.
2921 Perry Street
Madison, WI 53713

RE: Seismic Site Classification at the Proposed Madison Fire Station, Madison, Wisconsin

Dear Mr. Staab:

We are pleased to present the following report on the seismic testing that we performed in accordance with our agreement.

Introduction

GEI Consultants, Inc. (GEI) was instructed by CGC, Inc. to perform a Refraction Micro-tremor (ReMi) survey for seismic site classification at the site for the proposed Madison Fire Station at 3201 Dairy Drive in Madison, Wisconsin. GEI performed the ReMi measurements at the above-referenced site on Friday, July 28, 2017.

Test Results

To characterize the shear wave velocity characteristics of the subsurface profile, GEI conducted a ReMi survey within the development area in the locations shown on Figure No. 1. The ReMi method is described in Louie, 2001 ((Louie, J, N., 2001, Faster, Better: Shear-wave Velocity to 100 Meters Depth from Refraction Microtremor Arrays: Bulletin of the Seismological Society of America, v. 91, p. 347-364). The method uses standard seismic P-wave recording equipment and ambient noise to produce average one-dimensional shear-wave profiles.

The survey line laid out for this work employed a total of 24 geophones spaced at 10 foot centers. Data was recorded in 20 second samples, with a 2-millisecond sampling rate per channel, utilizing a Geometrics 24 channel "Geode" seismograph and 4.5 Hz. geophones.

GEI Consultants, Inc.
400 N. Lakeview Parkway, Suite 140, Vernon Hills, IL 60061
847.984.3401 fax: 847.984.3532

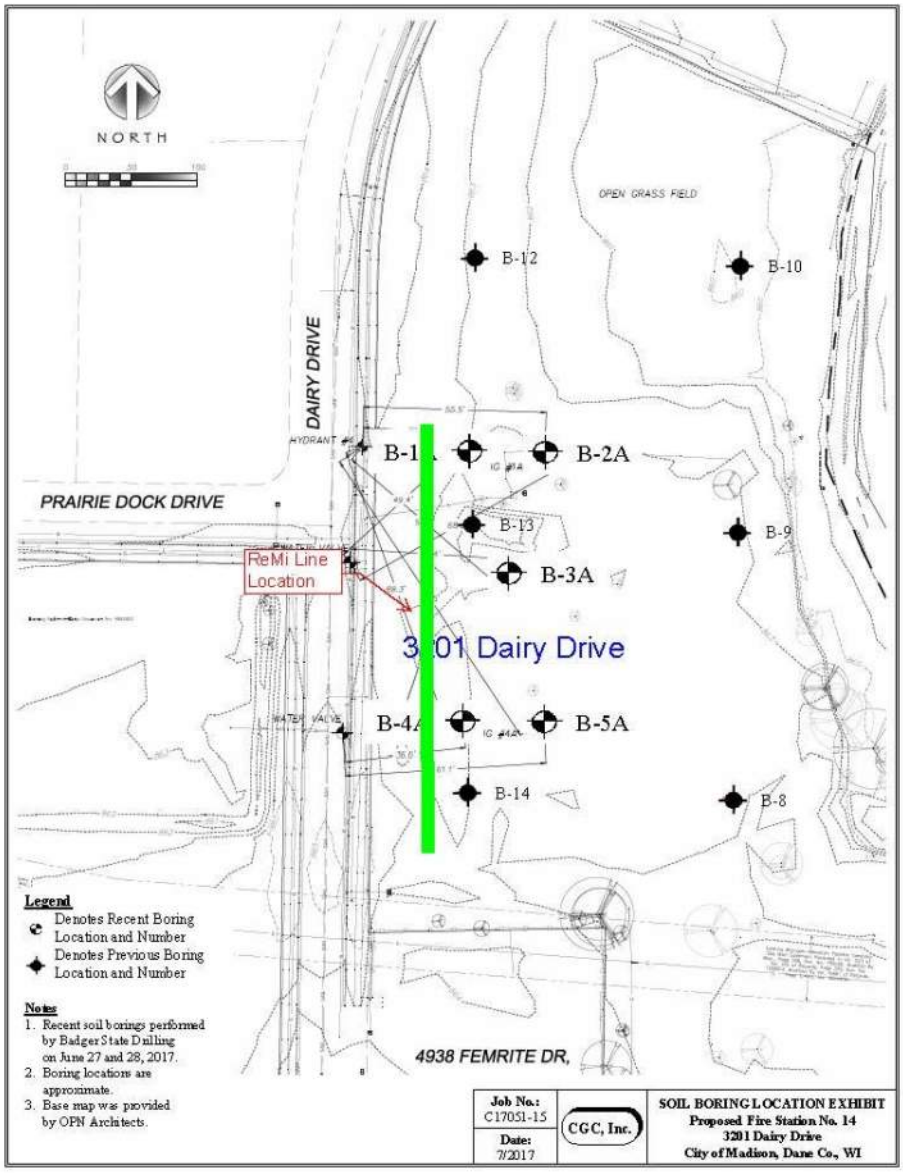


Figure No. 1

Background vibrations from vehicle traffic on the adjacent road were measured and employed in a wave-field transformation data processing technique to permit interpretation of the shear wave velocity profile using the ReMi "V-Spect" Computer program, developed by Optim Software. The resulting profile, presented in Figure No. 2, represents the average shear wave velocity profile over the length of the array. However, it should be noted that the actual profile varies from point to point over the extent of the array.

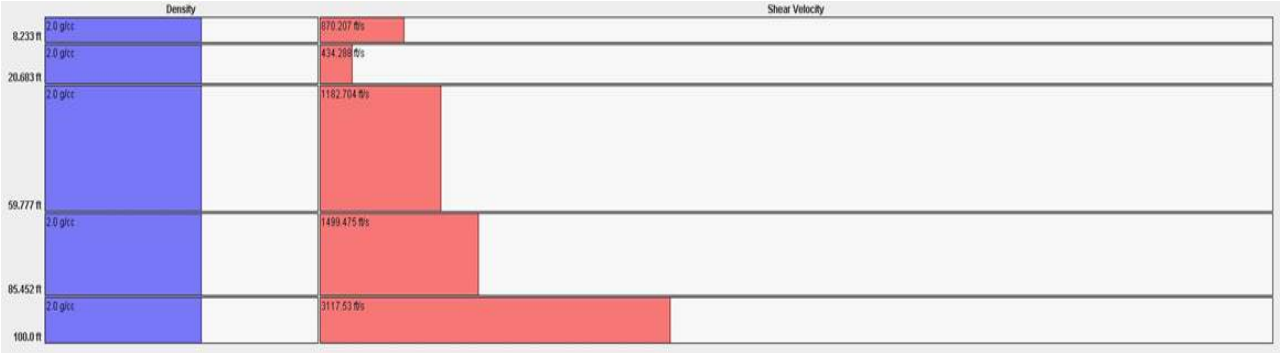


Figure No. 2

In general, the shear wave velocity was found to be relatively low within the upper 20 feet of the subsurface profile, with a gradual increase to a depth of about 85 feet. Below 85 feet a relatively high shear wave velocity, consistent with very dense soil, was interpreted from the results. This is consistent with the results of soil test borings drilled on the site, which were provided for our review.

Conclusion

The average shear wave velocity to a depth of 100 feet determined from this test was 1076 feet per second. This value is consistent with the characteristics of Seismic Site Class D as defined by the International Building Code.

We thank you for this opportunity to provide our services to CGC, Inc. If you have any questions regarding the contents of this report, please do not hesitate to contact us at 847-984-3401.

Respectfully,

GEI CONSULTANTS, INC.

Sean B. Brady
Senior Instrumentation Specialist

Bernard H. Hertlein, FACI, M. ASCE, M.GI
Senior Consultant

SBB:nls

CGC, Inc.

Construction • Geotechnical
Consulting Engineering/Testing

September 26, 2017
C17051-15

Mr. Jon Evans, P.E., LEED AP-BD&C
Building Design Project Manager
Department of Public Works
Engineering Division
City-County Building, Room 115
210 Martin Luther King Jr. Blvd
Madison, WI 53703

Re: Supplemental Geotechnical Exploration Report
Proposed Fire Station No. 14 – Helical Pier Alternative
3201 Dairy Drive
City of Madison, Dane County, Wisconsin

Dear Mr. Evans:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the supplemental geotechnical exploration program for the proposed Fire Station No. 14 on Dairy Drive. The purpose of this exploration program was to evaluate the deeper subsurface conditions within the planned construction area and to provide geotechnical recommendations regarding helical pier design/construction. We are sending you an electronic copy of this report and we can provide a paper copy upon request.

PROJECT DESCRIPTION AND SITE CONDITIONS

We understand that Fire Station No. 14 is proposed for a vacant parcel on the east side of Dairy Drive, across from the intersection with Prairie Dock Drive. A geotechnical report including recommendations regarding site preparation, foundation, floor slab and pavement design/construction along with our assessment of the site class for seismic design was issued by us on July 13, 2017. A geophysical investigation of the site was conducted thereafter to more accurately determine (and improve) the site class for seismic design of the planned building, which was included in a report dated August 7, 2017.

Since our initial foundation recommendations included intermediate to deep foundations due to very loose sands extending fairly deep below the ground surface on this site, but previous borings were only performed to depths of 30 ft below current site grades, one additional boring (Boring 6A) was performed within the planned building footprint to gather more information for helical pier design.

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SUBSURFACE CONDITIONS

Subsurface conditions were explored for this study by drilling one Standard Penetration Test (SPT) soil boring (labeled B-6A) to a planned depth of 90 ft below the ground surface. However, the boring was stopped at 70 ft after encountering about 13 ft of very dense soil. The boring location was selected and field-staked by CGC. The boring was drilled on September 21, 2017 by Badger State Drilling (under subcontract to CGC) using an ATV-mounted D-50 rotary drill rig equipped with hollow-stem augers, mud rotary equipment and an automatic SPT hammer. The ground surface elevations at the boring location was interpolated by CGC using a topographic site plan (showing 1-ft contour lines), which was provided to us by OPN Architect, and should therefore be considered approximate.

In addition to the deep boring recently performed within the building footprint, we have also included five SPT soil borings that were performed earlier this summer within the building footprint (labeled B-1A through B-5A) and six previous soil borings located in the vicinity of the proposed building in our evaluation of the site. Specific procedures used for drilling and sampling are described in Appendix A, and the recent and previous boring locations are shown in plan on the Soil Boring Location Exhibit attached in Appendix B.

The subsurface profiles at the boring locations varied somewhat at shallow depths due to previous site development and grading, but the profiles were fairly similar with depth. The following strata were typically encountered (in descending order):

- About 8 to 14 in. of ***topsoil/topsoil fill*** in about half of the borings; over
- About 2.3 to 6 ft of ***fill*** or ***possible fill*** in most borings, consisting primarily of soft to very stiff clay with variable sand and gravel contents as well as occasional organic inclusions (roots and other organic matter), and secondarily of medium dense sand with considerable silt and gravel contents; followed by
- About 1.5 to 3.5 ft of natural, soft to very stiff ***lean to silty clay*** with varying sand content and very loose to loose ***clayey sand*** in most borings; and/or
- Very loose to medium dense (with isolated dense zones) ***sand*** with variable silt and gravel contents to the maximum depths explored in most borings/to about 37 ft below the ground surface in B-6A; underlain by
- About 15 ft of cohesive/fine-grained strata, consisting of loose to medium dense ***sandy silt*** and stiff to very stiff ***lean to fat clay*** that extended to a depth of approximately 52 ft in Boring 6A; over

- Medium dense to very dense ***sand*** with typically considerable silt and gravel contents and scattered cobbles/boulders to the termination depth of 70 ft in Boring 6A. Note that the sand became very dense about 57 ft below existing grade.

Exceptions to the above profile include the following: Instead of *topsoil*, about 4 and 12 in. of ***sand/gravel surface*** was encountered in Borings 3A and 13, respectively, while borings 4A, 5A, 8 and 9 did not contain either. The *fill/possible fill* layer was not present in Boring 12, which featured a profile of topsoil over apparent natural clay that was underlain by natural sand strata. Conversely, *natural clays* were apparently missing in Borings 1A and 8 through 10. However, approximately 3.5-ft thick ***probable buried topsoil layers*** were encountered below the fill in Borings 8 and 9. The organic content (as measured by loss-on-ignition) of the buried topsoil layer ranged from 6.5% to 9.1%, with soils with loss on ignition exceeding 4% being considered organic. The shallow clays (fill and natural) were soft to very stiff, with moisture contents ranging from 14.9% to 29.5% in representative samples. Some of the on-site cohesive soils should therefore be considered slightly to moderately compressible. Possible clay fill samples obtained from Borings 1A and 4A containing apparent organic pockets had overall organic contents between 2.6% and 3.4%.

Groundwater was encountered in the borings during drilling at about 6 to 8.5 ft below site grades (corresponding to approximately EL 854.4 to 857.5 ft). Groundwater levels can be expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration, the level of nearby streams and lakes, the pumping rate of nearby wells and other factors. A more detailed description of the site soil and groundwater conditions is presented on the Soil Boring Logs attached in Appendix B, which also contain the laboratory test results.

DISCUSSION AND RECOMMENDATIONS

Subject to the limitations discussed below and based on the subsurface exploration, it is our opinion that the site is generally suitable for construction. *However, based on the presence of fairly deep, very loose sands within large portions of the proposed building footprint, a conventional spread footing foundation system at a typical design bearing pressure is likely not feasible for most of the planned building, as adequate undercutting/replacement of marginal soils will likely be impractical due to shallow groundwater.* In our opinion, suitable foundation support will require ground improvement with rammed aggregate piers (RAPs), which was discussed in detail in or previous report. Alternatively, the building could be supported on deep foundations such as helical piers, which was only briefly discussed previously because subsurface information was not sufficient for helical pier design recommendations at that point. More detailed recommendations for helical pier design/construction are included in the following paragraphs. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

Helical Piers

In our opinion, the proposed building can be supported on helical piers that extend through the existing fill, marginal shallow clay/clayey sand, very loose sand and underlying silt/clay strata, and bear within the medium dense to very dense sand layers that were encountered below a depth of approximately 52 ft in Boring 6A. The soil parameters included in Table I should be used for helical pier design.

Helical pier capacity will vary depending on the number and size of helices, depth of installation and bearing stratum. Utilizing the parameters summarized in Table I, we used the commercially available software HeliCap®, produced by Hubbell Power Systems, to develop *preliminary* helical pier capacity estimates for a three-helix configuration (10 in., 12 in. and 14 in.) on a larger diameter circular shaft. In general, we estimate that *ultimate* helical pier capacities (in compression) ranging from about 100 to 180 kips can be developed for 50 to 60-ft long helical piers (below the bottom of foundation grade). Note that the helical pier capacity at these higher loads appears to be limited by the structural capacity of the helices and not from the geotechnical capacity of the soils. We anticipate that helical piers will encounter refusal shortly after reaching the very dense sand strata (below about 57 ft in Boring 6A). *The helical pier depths and capacities should be considered approximate and, since helical piers are proprietary, the helical pier installer should determine the helix configuration and depth necessary to satisfy project requirements.*

The installation torque is correlated with capacity, although static load tests can also be completed to confirm the ultimate and allowable capacities. A minimum factor of safety of 2.0 to 3.0 is generally used for helical pier design. If a factor of safety of 2.0 is used to determine the allowable helical pier capacity, we recommend that at least one static load test be performed to confirm the helical pier design satisfies the project requirements. Static load tests should be performed on piers installed to similar installation depths and torques as production piers. Additionally, the torque of each pier should be monitored during installation to document that each pier is torqued to the minimum torque established by the static load tests or empirical correlations to ultimate capacity. If static load tests are not performed, we recommend using a minimum factor of safety of 2.5 to 3.0 in determining the allowable capacity, and the installation torque of each pier should be monitored, which is empirically correlated to the ultimate capacity. *Since there are multiple proprietary helical pier systems, it is the responsibility of the contractor to determine that their selected helical pier configuration, installation procedures and termination criteria satisfy the project requirements.*

TABLE 1

Recommended Soil Parameters for Helical Pier Foundations

Proposed Fire Station No. 14, 3201 Dairy Drive, Madison, WI

Soil Layer	Cohesive FILL / Possible Fill and Natural CLAY to Clayey SAND		Very Loose to Medium Dense SAND		Medium Dense SAND with variable Silt and Gravel Contents		Medium Dense Sandy SILT		Stiff to Very Stiff Lean to Fat CLAY		Loose Sandy SILT		Medium Dense SAND		Very Dense SAND, Some Silt and Gravel	
Approximate Depth	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**
Boring 1A	0 ft	6 ft	6 ft	11 ft	11 ft	30 ft (1)										
Boring 2A	0 ft	6 ft	6 ft	11 ft	11 ft	30 ft (1)										
Boring 3A	0 ft	6 ft	6 ft	16 ft	16 ft	30 ft (1)										
Boring 4A	0 ft	8.5 ft	8.5 ft	22 ft	22 ft	30 ft (1)										
Boring 5A	0 ft	6 ft	6 ft	22 ft	22 ft	30 ft (1)										
Boring 6A	0 ft	5.5 ft	5.5 ft	17 ft	17 ft	37 ft	37 ft	42 ft	42 ft	47 ft	47 ft	52 ft	52 ft	57 ft	57 ft	70 ft (1)
Boring 13	0 ft	5.5 ft	5.5 ft	18 ft	18 ft	30 ft (1)										
Boring 14	0 ft	7 ft	7 ft	22 ft	22 ft	30 ft (1)										
Estimated Soil Parameters (2)																
Short-term Loading Conditions																
Angle of internal friction, ϕ	**0** degrees		**26** degrees		**32** degrees		**30** degrees		**0** degrees		**28** degrees		**32** degrees		**38** degrees	
Cohesion	**750** lb/sq ft		**0** lb/sq ft		**0** lb/sq ft		**0** lb/sq ft		**1500** lb/sq ft		**0** lb/sq ft		**0** lb/sq ft		**0** lb/sq ft	
Long-term Loading Conditions																
Angle of internal friction, ϕ	**25** degrees		**26** degrees		**32** degrees		**30** degrees		**25** degrees		**28** degrees		**32** degrees		**36** degrees	
Cohesion	**30** lb/sq ft		**0** lb/sq ft		**0** lb/sq ft		**0** lb/sq ft		**30** lb/sq ft		**0** lb/sq ft		**0** lb/sq ft		**0** lb/sq ft	
Moist unit weight	**120** lb/cu ft		**110** lb/cu ft		**120** lb/cu ft		**120** lb/cu ft		**120** lb/cu ft		**115** lb/cu ft		**120** lb/cu ft		**125** lb/cu ft	
Submerged unit weight	**125** lb/cu ft		**120** lb/cu ft		**130** lb/cu ft		**130** lb/cu ft		**125** lb/cu ft		**125** lb/cu ft		**130** lb/cu ft		**135** lb/cu ft	
Buoyant unit weight	**63** lb/cu ft		**58** lb/cu ft		**68** lb/cu ft		**68** lb/cu ft		**63** lb/cu ft		**63** lb/cu ft		**68** lb/cu ft		**73** lb/cu ft	
Earth pressure coefficients																
Active, Ka	**1.00**		**0.39**		**0.31**		**0.33**		**1.00**		**0.36**		**0.31**		**0.24**	
Passive, Kp	**1.00**		**2.56**		**3.25**		**3.00**		**1.00**		**2.77**		**3.25**		**4.20**	

Notes:

(1) End of boring.

(2) Does not include factor of safety.

Other helical pier considerations include the following:

- *Prospective helical pier contractors should be aware of the presence of possible buried concrete within the surficial fill soils (or other remnants of the former development) and very dense zones or possible cobbles and boulders within the predominantly very loose to medium dense natural sand strata, that may impact helical pier installation.* The helical pier installer should have provisions to deal with the presence of potential obstructions. If obstructions are encountered, removing obstructions with an excavator would be one method to deal with the obstructions. Using smaller diameter helix configuration may also assist in the installation process but may require deeper piers to develop capacity.

- The existing fill, marginal shallow clay/clayey sand and very loose sand layers have relatively low lateral capacity. As such, round helical pier shafts, which have higher resistance to buckling, are recommended over square shafts. A buckling analysis should be completed to check that the pier shaft has adequate buckling resistance.

- Portions of the existing fill soils could potentially contain contaminants that may represent an increase in corrosion potential for the steel helical pier shafts. We therefore recommend that measures be taken to protect the helical pier shafts from corrosion, such as with a corrosion-resistant coating, or by increasing the thickness of the steel shafts to account for section loss due to corrosive soils. The final helical pier design should take into account the potentially corrosive nature of some of the soils at this site.

- Pile caps along the perimeter of the building should be located a minimum of 4 ft below finish grade for frost protection.

- We recommend helical pier installation, pile cap subgrade preparation and concrete placement be monitored by CGC.

As discussed in the initial geotechnical report, since floor slab loads are expected to be fairly light, we anticipate that the floor slab will be a conventional concrete slab-on-grade. Note, however, that undercutting/replacement of some of the shallow fill and natural soils will likely be required to develop a suitable subgrade for slab support. Although structural slab support on helical piers could be considered, we anticipate a conventional slab-on-grade with undercutting/replacement will be economically favorable to a structural slab. We can provide additional information, if needed.

* * * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

Tim F. Gassenheimer, E.I.T.
Staff Engineer

David A. Staab, P.E., LEED AP
Senior Consulting Professional

Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Exhibit
Log of Recent Test Boring (1)
Logs of Previous Test Borings – June 2017 (5)
Logs of Previous Test Borings – July 2013 (6)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications

APPENDIX A

FIELD EXPLORATION REPORT

APPENDIX A

FIELD EXPLORATION

Subsurface conditions were explored for this study by drilling one Standard Penetration Test (SPT) soil boring (labeled B-6A) to a planned depth of 90 ft below the ground surface. However, the boring was stopped at 70 ft after encountering about 13 ft of very dense soil. The boring location was selected and field-staked by CGC. The boring was drilled on September 21, 2017 by Badger State Drilling (under subcontract to CGC) using an ATV-mounted D-50 rotary drill rig equipped with hollow-stem augers, mud rotary equipment and an automatic SPT hammer. The ground surface elevations at the boring location was interpolated by CGC using a topographic site plan (showing 1-ft contour lines), which was provided to us by OPN Architect, and should therefore be considered approximate.

In addition to the deep boring recently performed within the building footprint, we have also included five SPT soil borings that were performed earlier this summer within the building footprint (labeled B-1A through B-5A) and six previous soil borings located in the vicinity of the proposed building in our evaluation of the site.

In the previous borings, soil samples were obtained at 2.5-foot intervals to a depth of 10 ft and at 5 ft intervals thereafter. To better explore the extent of very loose sands, most of the the recent borings were samples at 2.5-foot intervals to a depth of 20 ft and at 5 ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

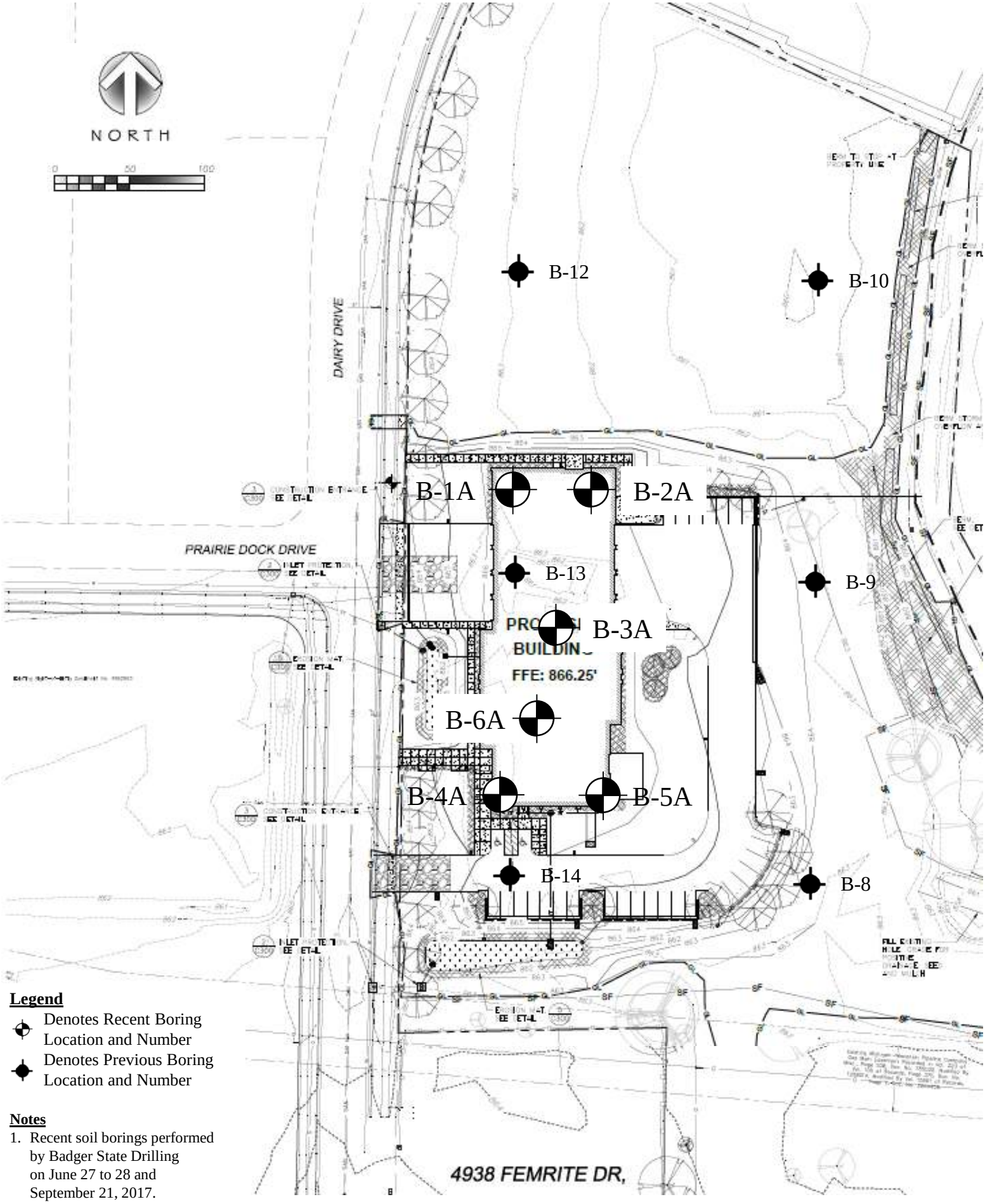
2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the soil samples for possible environmental contaminants was not conducted by the drillers as environmental site assessment activities were not part of CGC's work scope.* Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled with bentonite to satisfy WDNR regulations, and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The soil samples were visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer, including laboratory test results, a boring location map, and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

SOIL BORING LOCATION EXHIBIT
LOGS OF TEST BORINGS (1)
LOG OF PREVIOUS TEST BORINGS – JUNE 2017 (5)
LOG OF PREVIOS TEST BORINGS – JULY 2013 (6)
LOG OF TEST BORING – GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM



Legend

- Denotes Recent Boring Location and Number
- Denotes Previous Boring Location and Number

Notes

1. Recent soil borings performed by Badger State Drilling on June 27 to 28 and September 21, 2017.
2. Boring locations are approximate.
3. Base map was provided by OPN Architects.

Job No.: C17051-15	**CGC, Inc.**	**SOIL BORING LOCATION EXHIBIT**
Date: 09/2017		**Proposed Fire Station No. 14**
		3201 Dairy Drive
		City of Madison, Dane Co., WI

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **6A**
Surface Elevation (ft) **± 864.0**
Job No. **C17051-15**
Sheet **1** of **2**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						± 6 in. TOPSOIL FILL with Gravel (OL - Fill)					
1	■	18	M	8		Very Stiff, Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL)	(3.0-3.5)				
2	■	18	M	8		Loose, Gray Clayey Fine to Medium SAND, Scattered Less Clayey Seams (SC)					
3	■	12	M/W	7	5	Very Loose to Loose, Tan Fine to Medium SAND, Trace Silt and Gravel (SP)					
4	■	12	W	2	▽						
5	■	10	W	6	10	*Grading Gray near 13.5 ft*					
6	■	12	W	32	15	Medium Dense to Dense, Gray Fine SAND, Some Silt, Trace Gravel (SM)					
7	■	12	W	16	20						
8	■	10	W	6	25	Loose, Grayish Brown Fine to Medium SAND, Little Silt, Trace Gravel (SP-SM)					
9	■	12	W	16	30	Medium Dense, Gray Fine to Medium SAND, Some Silt, Trace Gravel (SM)					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **9/21/17** End **9/21/17**
Driller **BSD** Chief **KD** Rig **D-50**
Logger **DB** Editor **TFG**
Drill Method **2.25" HSA (0-10') / MR (10-70'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **6A**
Surface Elevation **± 864.0**
Job No. **C17051-15**
Sheet **2** of **2**

2921 PERRY STREET, MADISON, WIS. 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						Medium Dense, Gray Sandy SILT, Scattered Lean to Fat Clay Seams (ML)					
10		12	W	17	40						
						Stiff to Very Stiff, Gray Lean to Fat CLAY, Trace Sand (CL/CH)					
11		18	W	17	45		(1.5-3.5)				
						Loose, Gray Sandy SILT, Scattered Lean to Fat Clay Seams (ML)					
12		18	W	6	50						
						Medium Dense, Grayish Brown Fine to Medium SAND, Little Silt, Trace Gravel (SP-SM)					
13		18	W	24	55						
						Very Dense, Gray Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
14		12	W	54	60						
15		12	W	92	65						
16		10	W	50/2"	70	*Drove Stone, Possible Top of Bedrock near 68.5 ft* *Split-Spoon Refusal at 69.2 ft*					
						End of Boring at 70 ft Borehole Backfilled with Bentonite Chips					

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **1A**
Surface Elevation (ft) **± 863.0**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						± 8 in. TOPSOIL (OL)					
1		12	M	5		Soft to Medium Stiff, Gray/Brown (Lightly Mottled) Lean CLAY, Little to Some Sand, Trace Gravel, Scattered Dark Gray Organic Pockets (CL - Possible Fill)	(0.75-1.0)	23.3			2.6
2		18	M	4			(0.25)	28.5			
					5	Sand and Gravel Contents Slightly Decreasing With Depth					
3		16	W	4	▽	Loose, Tan Fine to Coarse SAND, Little Gravel, Trace to Little Silt, Scattered Cobbles/Boulders (SP)					
4		18	W	9		Silt Content Slightly Increasing with Depth					
					10						
5		8	W	16		Medium Dense, Gray Fine to Medium SAND, Little Silt, Trace Gravel, Scattered Cobbles/Boulders (SP-SM)					
6		10	W	20							
					15						
7		10	W	21		Medium Dense, Gray Fine to Medium SAND, Some Silt, Trace Gravel, Scattered Cobbles/Boulders (SM)					
8		12	W	19							
					20						
9		8	W	29		Scattered Silt Seams near 23.5 ft					
					25						
10		10	W	24							
					30	End of Boring at 30 ft Borehole Backfilled with Bentonite Chips					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/28/17** End **6/28/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **2A**
Surface Elevation (ft) **± 863.0**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						± 8 in. TOPSOIL (OL)					
1		14	M	8		Stiff, Gray/Brown (Lightly Mottled) Lean CLAY, Little Sand, Trace Gravel, Scattered Dark Gray Organic Pockets and Roots (CL - Possible Fill)	(1.75-2.0)	25.0			
2		18	M	6	5	Soft to Medium Stiff, Gray Lean to Silty CLAY, Some Sand (CL/CL-ML)	(0.25-0.75)	14.9	20	13	
3		14	W	4		Very Loose, Tan Fine to Coarse SAND, Little Gravel, Trace Silt, Scattered Cobbles/Boulders (SP)					
4		6	W	2	10	Scattered Clay Seams near 8.5 ft					
5		16	W	15		Medium Dense, Gray Fine to Medium SAND, Some Silt, Trace Gravel, Scattered Cobbles/Boulders (SM)					
6		8	W	11	15	P200 (Sample 6): 15.0%		24.2			
7		12	W	20							
8		10	W	11	20						
9		8	W	12	25	Medium Dense, Gray Fine to Coarse SAND, Some Gravel, Little Silt, Scattered Cobbles/Boulders (SP-SM)					
10		10	W	17	30	Medium Dense, Grayish Brown Fine to Medium SAND, Some Silt, Trace Gravel, Scattered Cobbles/Boulders (SM)					
						End of Boring at 30 ft					
					35	Borehole Backfilled with Bentonite Chips					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/28/17** End **6/28/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **3A**
Surface Elevation (ft) **± 862.0**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						± 4 in. GRAVEL SURFACE					
1		14	M	8		Very Stiff, Gray/Brown (Lightly Mottled) Lean CLAY, Little Sand, Trace Gravel, Scattered Dark Gray Organic Pockets and Roots (CL - Possible Fill)	(2.0-2.25)	25.5			
2		12	M	7	5	Soft to Medium Stiff, Gray/Brown (Lightly Mottled) Sandy Lean CLAY, Trace Gravel (CL)	(0.25-0.75)	17.7			
3		18	W	2		Very Loose, Gray Silty Fine SAND, Layered with Tan Fine to Medium SAND, Little to Some Silt, Trace to Little Gravel (SM)					
4		16	W	2	10	Very Loose to Loose, Gray Fine to Medium SAND, Little Silt and Gravel, Scattered Cobbles/Boulders (SP-SM)					
5		16	W	7							
6		10	W	6	15						
7		18	W	22		Medium Dense, Gray Silty Fine SAND, Trace Gravel, Scattered Less Silty Fine to Medium Sand Seams (SM)					
8		12	W	9	20	Loose to Medium Dense, Gray Fine to Medium SAND, Little Silt, Trace Gravel, Scattered Cobbles/Boulders (SP-SM)					
9		14	W	23	25						
10		12	W	30	30	End of Boring at 30 ft Borehole Backfilled with Bentonite Chips					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/27/17** End **6/28/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **4A**
Surface Elevation (ft) **± 864.0**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						FILL: Dark Gray Silty Clay, Some Sand, Little Gravel, Trace Organics, Scattered Roots (Possible Tospoil Fill)					
1	■	12	M	10			(-)	16.8			3.4
2	■	8	M	7		FILL: Medium Stiff to Stiff, Gray/Tan/Reddish Brown Lean to Silty Clay, Some Sand, Trace Gravel, Numerous Roots	(0.5-1.25)	17.5			
3	■	10	M	4	5	Very Loose to Loose, Gray Clayey Fine to Medium SAND, Scattered Lean Clay Seams (SC)		16.7			
4	■	12	W	6		Loose, Tan Fine to Coarse SAND, Little Gravel, Trace Silt, Scattered Cobbles/Boulders (SP)					
5	■	8	W	3	10	Very Loose, Tan Fine to Medium SAND, Trace to Little Silt and Gravel, Scattered Cobbles/Boulders (SP/SP-SM)					
6	■	10	W	2		P200 (Sample 6): 2.5%		22.3			
7	■	14	W	4	15	Grading Gray/Gravel Content Slightly Increasing with Depth					
8	■	10	W	2							
9	■	12	W	13	20	Medium Dense, Tan Fine to Medium SAND, Some Silt, Trace Gravel, Scattered Cobbles/Boulders (SM)					
10	■	12	W	18	25						
					30	End of Boring at 30 ft Borehole Backfilled with Bentonite Chips					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/27/17** End **6/27/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station No. 14**
3201 Dairy Drive
Location **City of Madison, Dane Co., WI**

Boring No. **5A**
Surface Elevation (ft) **± 863.5**
Job No. **C17051-15**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						FILL: Stiff, Gray/Dark Gray/Brown Lean Clay, Some Sand, Scattered Roots					
1	■	10	M	6			(1.25-1.75)	22.0			
2	■	12	M	9	5	Stiff, Gray/Brown (Lightly Mottled) Sandy Lean CLAY, Trace Gravel (CL)	(1.5-1.75)	16.4			
3	■	12	W	5		Loose, Tan Fine to Medium SAND, Trace Silt and Gravel, Scattered Cobbles/Boulders (SP)					
4	■	10	W	2	10	Very Loose, Tan Fine to Medium SAND, Little Silt and Gravel, Scattered Cobbles/Boulders (SP-SM)					
5	■	12	W	3		Very Loose, Gray Fine to Medium SAND, Some Silt, Trace Gravel and Organics, Scattered Tan Less Silty Seams and Cobbles/Boulders (SM)					
6	■	10	W	2	15						
7	■	10	W	5		Very Loose to Loose, Gray Fine to Medium SAND, Little Silt and Gravel, Scattered Cobbles/Boulders (SP-SM)					
8	■	8	W	2	20						
9	■	12	W	19	25	Medium Dense, Gray Fine to Medium SAND, Some Gravel, Little Silt, Scattered Silt Seams and Cobbles/Boulders (SP-SM)					
10	■	12	W	21	30	Medium Dense, Gray Fine to Medium SAND, Some Silt, Little Gravel, Scattered Cobbles/Boulders (SM)					
						End of Boring at 30 ft Borehole Backfilled with Bentonite Chips					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **6/27/17** End **6/27/17**
Driller **BSD** Chief **MC** Rig **D-50**
Logger **MG/CD** Editor **TFG**
Drill Method **4.25" HSA (0-10') / MR (10-30'); Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **8**
Surface Elevation (ft) **863.8**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
1		18	M	15		FILL: Medium Dense, Tan Fine to Medium Sand, Some Silt and Gravel USDA: FILL - 2.5Y 5/3 Sandy Loam					
2		10	M	5	5	FILL: Soft to Medium Stiff, Dark Gray/Gray Lean Clay, Little to Some Sand, Trace Organics USDA: FILL - 10YR 3/1, 5/2 Silty Clay Loam	(0.5)	15.4			
3		8	M	5		Medium Stiff, Dark Gray/Black Organic CLAY (OL - Probable Buried Topsoil) USDA: 10YR 2/1 Silty Clay Loam	(1.0)	26.6			9.1
4		18	W	10	10	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		5	W	2	15						
6		3	W	4	20						
7		12	W	14	25	Medium Dense, Brown Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/3 Fine Sand					
8		8	W	21	30	Medium Dense, Gray-Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/2 Sand					
					35	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8"**
RB/DM; Autohammer

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **9**
Surface Elevation (ft) **863.5**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						FILL: Medium Dense, Tan Fine to Medium Sand, Some Silt and Gravel USDA: FILL - 2.5Y 5/3 Sandy Loam					
1	■	18	M	17							
						Loose, Dark Gray/Black Organic Clayey SILT (OL - Probable Buried Topsoil) USDA: 10YR 2/1 Silt Loam					
2	■	15	M	5	5			19.3			6.5
						Very Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3	■	10	W	10							
4	■	12	W	8	10						
5	■	18	W	3	15	Grades to Fine Sand near 15 ft					
6	■	3	W	10	20						
7	■	4	W	27	25						
8	■	12	W	9	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/23/13** End **7/23/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-15'; 3-7/8" RB/DM 15'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **10**
Surface Elevation (ft) **860.4**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						14 in.± Clayey TOPSOIL (OL)					
1		6	M	7		Loose, Gray Fine to Medium SAND, Some Silt, Trace Clay and Gravel (SM - Possible Fill) USDA: 10YR 5/1 Sandy Loam					
2		6	W	5	5	Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3		12	W	3							
4		8	W	4	10	Color Change to Dark Brown (10YR 3/3) with Scattered Silt Seams near 7.5 ft					
5		10	W	4	15	Very Loose to Loose, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
6		9	W	9	20	Loose, Gray Fine SAND, Some Silt, Trace Gravel (SM) USDA: 10YR 5/2 Sandy Loam					
7		14	W	10	25	Loose, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
8		12	W	8	30	Scattered Silt Seams near 30 ft					
						End of Boring at 30 ft					
					35	Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM; Autohammer**

LOG OF TEST BORING

CGC Inc.

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **12**
Surface Elevation (ft) **863.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						12 in.± Clayey TOPSOIL (OL)					
1		10	M	9		Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL) USDA: 10YR 5/1 Silty Clay Loam (Redox: C2F 10YR 6/6)	(3.0)				
2		16	M	5	5	Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
3		12	W	5							
4		14	W	8	10						
5		12	W	5	15	3 in. Stiff, Gray/Brown Lean Clay Seam near 15 ft	(1.0-1.5)				
6		12	W	15	20	Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
7		16	W	15	25						
8		14	W	23	30						
					35	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **6.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/24/13** End **7/24/13**
Driller **BSD** Chief **KD** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

LOG OF TEST BORING

CGC Inc.

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **13**
Surface Elevation (ft) **862.2**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						12 in.± Sand and Gravel FILL					
1		5	M	8		Stiff to Very Stiff, Light Green-Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL - Possible Fill in Upper Few Feet of Layer)	(3.5)				
2		18	M	8	5	USDA: 10YR 5/1 Silty Clay Loam (Redox: C2D 10YR 6/6)	(1.0-1.5)	29.5			
3		18	W	4		Very Loose to Loose, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM)					
4		18	W	4	10	USDA: 10YR 5/3 Sand					
5		3	W	4	15						
6		12	W	17	20	Medium Dense, Gray Fine SAND, Trace to Little Silt (SP/SP-SM) USDA: 10YR 5/2 Fine Sand					
7		12	W	27	25	Medium Dense, Brown Fine to Coarse SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
8		4	W	14	30	End of Boring at 30 ft Borehole backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0' Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project **Proposed Fire Station #14 & Fire Training Site**
Femrite Drive and Dairy Drive
Location **Madison, Wisconsin**

Boring No. **14**
Surface Elevation (ft) **865.0**
Job No. **C13064-7**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						8 in.± Sandy TOPSOIL FILL (OL)					
1		12	M	12		FILL: Very Stiff, Brown/Gray Lean Clay, Trace to Little Sand USDA: FILL-10YR 4/3 Silty Clay Loam	(3.75-4.0)				
2		12	M	8	5	Stiff to Very Stiff, Gray/Brown (Mottled) Lean CLAY, Trace Sand (CL) USDA: 10YR 5/2 Silty Clay Loam (Redox: C2D 10YR 6/6)	(2.0-2.5)				
3		18	M	8			(1.0-1.5)	24.7			
4		6	W	4	10	Very Loose to Medium Dense, Brown Fine to Medium SAND, Trace to Little Silt, Trace Gravel (SP/SP-SM) USDA: 10YR 5/3 Sand					
5		18	W	4	15	Grades to Fine Sand near 15 ft					
6		6	W	2	20						
7		8	W	12	25						
8		18	W	20	30	End of Boring at 30 ft Borehole Backfilled with bentonite chips and slurry					
					35						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **7/22/13** End **7/22/13**
Driller **BSD** Chief **DC** Rig **CME-750**
Logger **JM** Editor **DAS**
Drill Method **2.25" HSA; 0-10'; 3-7/8" RB/DM 10'-30'; Autohammer**

CGC, Inc.

LOG OF TEST BORING
General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Fine	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse	2.00 mm to 4.76 mm	#10 to #4
Medium	0.42 to mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

Relative Density

Term	"N" Value
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

Consistency

Term	q_u-tons/sq. ft
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4 – 12%
Sedimentary Peat	12% - 50%
Fibrous and Woody Peat	More than 50%

Plasticity

Term	Plastic Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

CS – Continuous Sampling
RC – Rock Coring: Size AW, BW, NW, 2"W
RQD – Rock Quality Designation
RB – Rock Bit/Roller Bit
FT – Fish Tail
DC – Drove Casing
C – Casing: Size 2 ½", NW, 4", HW
CW – Clear Water
DM – Drilling Mud
HSA – Hollow Stem Auger
FA – Flight Auger
HA – Hand Auger
COA – Clean-Out Auger
SS - 2" Dia. Split-Barrel Sample
2ST – 2" Dia. Thin-Walled Tube Sample
3ST – 3" Dia. Thin-Walled Tube Sample
PT – 3" Dia. Piston Tube Sample
AS – Auger Sample
WS – Wash Sample
PTS – Peat Sample
PS – Pitcher Sample
NR – No Recovery
S – Sounding
PMT – Borehole Pressuremeter Test
VS – Vane Shear Test
WPT – Water Pressure Test

Laboratory Tests

q_a – Penetrometer Reading, tons/sq ft
q_a – Unconfined Strength, tons/sq ft
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
SL – Shrinkage Limit, %
LI – Loss on Ignition
D – Dry Unit Weight, lbs/cu ft
pH – Measure of Soil Alkalinity or Acidity
FS – Free Swell, %

Water Level Measurement

▽ - Water Level at Time Shown
NW – No Water Encountered
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
CW – Cave and Wet
CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

CGC, Inc.

Madison - Milwaukee

Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

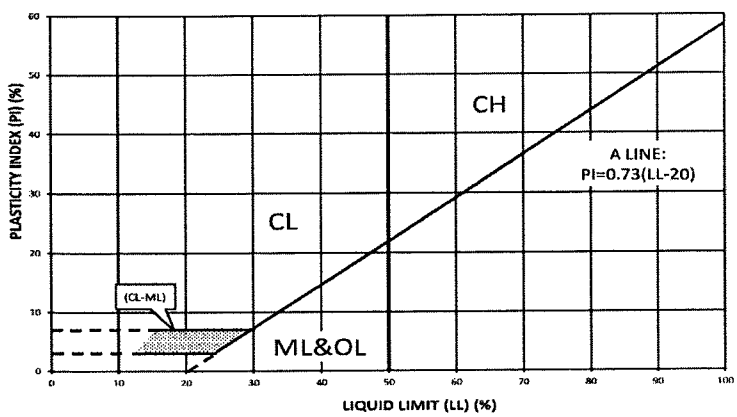
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limts below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limts above "A" line or P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

READ THE FULL REPORT

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most

effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the confirmation-dependent recommendations included in your report. *Those confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's confirmation-dependent recommendations if we do not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical engineering report. Confront that risk by having CGC participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONSTRUCTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and constructors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

ENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in the Geotechnical Business Council (GBC) of Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of GBC, for more information.

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Geotechnical Business Council
of the Geoprofessional Business Association
8811 Colesville Road, Suite G 106
Silver Spring, MD 20910

SECTION 00 31 46
PERMITS

PART 1 – GENERAL

1.1. SUMMARY

A. Each project has varying requirements for permits, inspections, and fees based on the scope, size, and location of the project.

B. The City of Madison (Owner) is subject to all permits, inspections and associated fees for construction, demolition, utility connection, storm water management, and other similar requirements that may be required to complete the scope of work associated with these contract documents.

C. The General Contractor (GC) shall be responsible for obtaining all permits, inspections and paying for all associated fees unless specifically identified within this specification.

1.2. REFERENCES

A. The following references are not intended to be all inclusive. It shall be the GC's responsibility to determine all requirements based on the scope of work in the contract documents.

B. City of Madison Ordinances: Review all ordinances that may require a permit or fee that may be connected with a required permit. Contact the following City Agencies to determine the exact requirements during bidding
   1. Building Inspection
   2. Zoning
   3. Engineering
   4. Water Utility
   5. Traffic Engineering
   6. Others as may be specified by the contract documents.

B. State Statutes

C. Other Regulatory Regulations

D. Other Agencies or companies that may have related requirements
   1. Madison Metropolitan Sewerage District
   2. Local gas and electric utility companies
   3. Other utility companies

1.3. GENERAL CONTRACTORS REQUIREMENTS

A. The GC shall be responsible for all of the following:
   1. Execute application for all required permits as may be required by the scope of work described within the contract documents.
   2. Paying all fees associated with the application of any required permits.
   3. Scheduling all required inspections that may be conditions of any required permits.

B. The GC shall provide high quality scanned images of all required permits and inspections and upload them to the Contract Documents-Regulatory Documents Library on the Project Management Web Site.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.1 PROJECT

A. Project Name: Madison Fire Department - Station 14.

B. The Project consists of the construction of a new fire station..

1.2 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Alternates.

1.2 ACCEPTANCE OF Alternates

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.3 SCHEDULE OF Alternates

A. Alternate No. 1 - (8) 4-Fold Apparatus Bay Doors in lieu of (8) Overhead Doors: see drawing sheet A801 and Division 08 36 14 for alternate items.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

A. The City of Madison uses a specific list of preferred products for various specification items to establish standards of quality, utility, and appearance required.

B. The City of Madison will not allow substitutions for specified Products except as follows:

1. The Product is no longer produced or the product manufacturer is no longer in business.
2. The manufacturer has significantly changed performance data, product dimensions, or other such design criteria for the specified Product(s).
3. Products specified by naming one or more Products or manufacturer's and "or approved equal" or "approved equivalent."

C. The City of Madison will not allow substitutions for specified Products as follows:

1. For Products specified by naming only one Product and manufacturer, no substitute product will be considered.
2. For Products specified by naming several Products or manufacturers select any one of the products or manufacturers named, which complies with the specifications. No substitute product will be considered.

D. Request for substitutions from any party other than the General Contractor (GC) will not be accepted.

1.2. RELATED SPECIFICATIONS

A. Section 01 26 13 Request for Information (RFI)
B. Section 01 31 23 Project Management Web Site
C. Section 01 33 23 Submittals

PART 2 – PRODUCTS

2.1. SUBSTITUTION REQUEST FORM

A. During bidding all contractors (General and Sub-contractors) and suppliers of materials or products shall provide hard copy of the Substitution Request form and all required attachments directly to the Project Architect. Submission shall use the form located at the end of this specification.

1. Contractors and suppliers shall use the screen shot of the form located at the end of this specification to print a hard copy for all pre-bid substitution requests.

B. After bidding only the GC shall submit a request and shall use the form located on the Project Management Web Site.

PART 3 - EXECUTION

3.1. REQUESTING A SUBSTITUTION DURING BIDDING

A. In the event that a substitution is requested during the bidding phase the Contractor or Supplier shall meet the substitution request deadline listed in the bidding documents. No substitution request will be considered during the bidding period after the stated substitution request deadline. In general this procedure shall be as follows:

1. Submit the Substitution Request Form including all required supporting documentation to the City Project Manager and Project Architect by the substitution request deadline specified in Section A of the Contract Documents. Utilize the Substitution Request Form found at the end of this Section.
2. Submit a Substitution Request Form for each product, supported with complete data, drawings and samples as appropriate, including:

i. Comparison of qualities of the proposed substitutions with that specified.
ii. Changes required in other elements of the Work because of the substitution.
iii. Effect on the construction schedule.
iv. Cost data comparing the proposed substitution with the Product specified.
v. Any required license fees or royalties.
vi. Availability of maintenance service and source of replacement materials.

3. The Owner and Architect will review the Substitution Request Form and if approved the City of Madison will publish a bidding addendum authorizing the replacement. The Owner and Architect may reject any substitution request without providing specific reasons.

B. Substitutions submitted and approved during the bidding phase shall be announced by the City of Madison by addenda prior to the bid due date.

3.2. REQUESTING A SUBSTITUTION AFTER AWARD OF CONTRACT

A. A substitution request will only be considered after award of contract if it meets the qualifying provisions as described in 1.1.B.1 and .2 above.

B. The GC shall submit a substitution request using the digital form on the Project Management Web Site located in the Construction Administration-Substitution Request library.

1. Click on *Add document* to open a new digital form, fill out form, provide required attachments, then click the Submit button.
2. Consulting Staff, Owner and Owners Representatives will review the request and provide the appropriate approvals and feed back to the GC.

3.3. UNAUTHORIZED SUBSTITUTIONS

A. Any Contractor who substitutes products without proper authorization by the Owner and Architect will be required to immediately remove and replace the product and all costs required to conform to the Contract Documents shall be borne by the General Prime Contractor.

END OF SECTION

Substitution Request

Today's Date: 1/27/2015

Project Title:

Project Number: Contract Number:

Description	Spec Section	Page	Paragraph

The undersigned requests consideration of the following:

Proposed Substitution:

Attachments

Click here to attach a file

Insert item

- Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.
- Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned General Contractor representative certifies that the following paragraphs are correct.

1. ***The function, appearance, and quality of the proposed substitution are equal or superior to the specified item.***
2. ***The proposed substitution does not affect dimensions shown on drawings.***
3. ***The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the request.***
4. ***The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.***
5. ***Maintenance and service parts will be locally available for the proposed substitution. Provide supporting documentation.***

Submitted By:

****By typing my name and entering the date I hereby give my electronic signature****

Name: Title: Date:

Firm: Address:

Phone:

SECTION 01 26 13
REQUEST FOR INFORMATION (RFI)

PART 1 – GENERAL

1.1. SUMMARY

A. Contractors shall use the RFI form/process to request additional information or clarification regarding the construction documents.

B. All RFI documentation will be processed through the through the Construction Administration-Request for Information Library on the Project Management Web Site (PMWS).

1.2. RELATED SPECIFICATIONS

A.	Section 01 26 46	Construction Bulletin (CB)
B.	Section 01 26 57	Change Order Request (COR)
C.	Section 01 26 63	Change Order (CO)
D.	Section 01 31 23	Project Management Web Site (PMWS)
E.	Section 01 91 00	Commissioning

1.3. PERFORMANCE REQUIREMENTS

A. RFI issues initiated by any contractor shall be done through the General Contractor (GC).
   1. RFIs submitted by any Sub-contractor under the GCs control shall be returned with no response.

B. Submit a new RFI for each issue. Only multiple questions that are of a similar nature may be combined into one RFI shall be allowed and responded to.

1.4. QUALITY ASSURANCE

A. The GC shall be responsible for all of the following:
   1. Ensure that any request for additional information is valid and the information being requested is not addressed in the construction documents.
   2. Ensure that all requests are clearly stated and the RFI form is completely filled out.
   3. Ensure that all Work associated an RFI response is carried out as intended.

B. The PA shall be responsible for the following:
   1. Ensure that all responses to contractor initiated RFIs are properly responded to in a timely fashion.
      a. The CPM, Owner, consulting staff, and other City staff shall be responsible for the initial review of the RFI. The PA shall be responsible for codifying all consultant and Owner/City staff comments into a unified RFI response.

PART 2 – PRODUCTS

2.1. REQUEST FOR INFORMATION FORM

A. The RFI form is located on the Project Management Web Site. The GC, PA, or CPM as appropriate shall click the link in the left margin of the project web site opening a new form. Project information is pre-loaded, provide additional information as indicated below in the execution to complete the form.

PART 3 - EXECUTION

3.1. CONTRACTOR INITIATED RFI

A. Immediately on discovery of the need for additional information or interpretation of the Contract Documents any contractor may initiate an RFI for additional information or clarification through the GC.

B. The GC shall select the "Submit an RFI" link on the Project Management Web Site and completely fill out the form as follows:

1. Contract related information will be automatically populated on the form.
2. Thoroughly explain the issue at hand, provide backup information (photographs, sketches, drawings, data, etc) as necessary, and clearly state the question or problem that requires a resolution. Combine like or related issues but do not include multiple issues on one form.
    a. Example. If a duct interferes with other critical piping and electrical work include all issues into one RFI.
    b. Example. If you have a question regarding the chiller and another regarding toilet partitions create separate RFIs.
3. Check all relevant boxes for trades affected. This will assist the design team in determining who should be reviewing the RFI.

C. Upon completing the RFI click the "Submit" button. The PMWS software will automatically route the RFI to the appropriate reviewers.

3.3. RFI RESPONSES

A. Responses to simple RFI issues shall use the response section of the RFI form and shall be completed within five (5) working days of the RFI form being submitted.

B. Responses to more complex issues may require additional time or may require a Construction Bulletin to be published. The initial RFI shall be responded to within five (5) working days stating that the RFI is being reviewed and provide an estimated date for the response.

C. The following GC generated RFIs will be returned without action:

1. Requests for approval of submittals
2. Requests for approval of substitutions
3. Requests for approval of Contractor's means and methods.
4. Requests for coordination information already indicated in the Contract Documents.
5. Requests for adjustments in the Contract Time or the Contract Sum.
6. Requests for interpretation of A/E's actions on submittals.
7. Incomplete RFI or inaccurately prepared RFI.

3.4. COMMENCEMENT OF WORK RELATED TO AN RFI

A. The GC shall only proceed with the Work of an RFI when additional information is not required.

B. The GC shall not proceed with any Work associated with an RFI while it is under review.

C. The GC shall not proceed with any Work associated with an RFI that clearly states a CB will be issued in response to the RFI.

D. The GC will be required to immediately remove and replace unauthorized Work and all costs required to conform to the Contract Documents shall be borne by the GC.

END OF SECTION

SECTION 01 26 46
CONSTRUCTION BULLETIN (CB)

PART 1 – GENERAL

1.1. SUMMARY

A. Construction Bulletins (CB) are formal published construction documents that modify the original contract bid documents after construction has commenced. CBs may be published for many reasons, including but not limited to the following:
   1. Clarification of existing construction documents including specifications, plans, and details
   2. Change in product or equipment
   3. A response to a Request for Information
   4. Change in scope of the contract as either an add or a deduct of work

B. CBs provide a higher degree of detail in response to a Request for Information (RFI) through directives, revised plans/details, and specifications as necessary.

C. The CB may change the original contract documents through additions or deletions to the Work.

D. Where the directives of a CB are significant enough to warrant a Change Order Request (COR) the GC shall use all information provided in the CB to assemble all required back-up documentation for additions and deletions of materials, labor and other related contract costs for the COR.

E. All CB documentation will be processed through the Construction Administration-Construction Bulletin Library on the Project Management Web Site (PMWS).

1.2. RELATED SPECIFICATIONS

A. Section 01 26 13 Request for Information (RFI)
B. Section 01 26 57 Change Order Request (COR)
C. Section 01 26 63 Change Order (CO)
D. Section 01 31 23 Project Management Web Site
E. Section 01 91 00 Commissioning

1.3. PERFORMANCE REQUIREMENTS

A. Project Architect (PA): The PA shall be the only person authorized to publish a CB as needed for any reason indicated in section 1.1.A above. The PA shall consult as necessary with any of the following while drafting the CB and shall confirm final direction with the CPM prior to issuing a CB:
   1. City Project manager (CPM)
   2. Owner
   3. Members of the consulting staff
   4. Members of city staff
   5. The General Contractor
   6. Sub-contractors
   7. Commissioning Agent (CxA)

B. General Contractor: The GC shall be responsible for the following as needed:
   1. Executing the directives of the CB when he/she believes that no changes in labor, materials, equipment, or contract duration will be required for additions or deletions.
   2. Submit a COR when he/she believes that a change in labor, materials, equipment or contract duration will be required for additions or deletions.

1.4. QUALITY ASSURANCE

A. The PA shall be responsible for ensuring the final CB sufficiently provides direction, details, specifications and other information as necessary for the GC to perform the intended Work.

B. The PA shall be responsible for ensuring the final CB is published as expeditiously as practical based on the complexity of the CB being written. CBs that may affect the GC critical path shall be given priority.

PART 2 – PRODUCTS

2.1. CONSTRUCTION BULLETIN FORM

A. The CB form is located on the Project Management Web Site. The PA shall click the link in the left margin of the project web site opening a new form. Project information is pre-loaded, the PA only needs to enter information and make attachments as needed to complete the form.

PART 3 - EXECUTION

3.1. WRITING THE CONSTRUCTION BULLETIN

A. The PA shall draft a CB as needed using the Construction Bulletin form on the Project Management Web Site.

1. The PA and/or consulting staff as necessary shall provide specifications, model numbers and performance data, details and other such information necessary to clearly state the intentions of the CB.
2. The consulting staff, CPM, Owner, CxA and other City Staff shall review the draft and recommend changes as needed.
3. The PA shall amend the draft as necessary into a final CB for review

B. Once the final CB has been approved the PA shall “Submit” the CB through the Project Management Web Site to the GC.

3.2. EXECUTING THE CONSTRUCTION BULLETIN

A. The GC shall acknowledge receipt of the CB on the Project Management Web Site as instructed in the Tutorial Manual provided to the awarded contractor.

B. The GC shall notify all Sub-contractors of the CB and publish the CB to all field sets of drawings and specifications as appropriate.

C. The GC shall execute the directives of the CB or submit COR documentation as necessary during the execution and implementation of the CB.

1. See Specification 01 26 57 Change Order Request (COR)

END OF SECTION

SECTION 01 26 57
CHANGE ORDER REQUESTS (COR)

PART 1 – GENERAL

1.1. SUMMARY

A. Except in cases of emergency, no changes in the Work required by the Contract Documents may be made by the General Contractor (GC) without having prior approval of the City Engineer or his representative.

B. The City may at any time, without invalidating the Contract and without Notice to Sureties, order changes in the Work by written Change Order (CO). Such changes may include additions and/or deletions.

C. Where the City desires to make changes in the Work through use of written Change Order Request (COR), the following procedures apply:

1. If requested by the City, the GC shall prepare and submit a detailed proposal, including all cost and time adjustments to which the GC believes it will be entitled if the change proposed is incorporated into the Contract. The City shall be under no legal obligation to issue a Change Order for such proposal.
2. The parties shall attempt in good faith to reach agreement on the adjustments needed to the Contract to properly incorporate the proposed change(s) into the Work. In the event that the parties agree on such adjustments, the City may issue a Change Order and incorporate such changes and agreed to adjustments, if any.
3. In some instances, it may be necessary for the City to authorize Work or direct changes in Work for which no final and binding agreement has been reached and for which unit prices are not applicable. In such cases the following shall apply.
    a. Upon written request by the City, the GC shall perform proposed Work
    b. The cost of such change may be determined in accordance with this specification.
    c. In the event agreement cannot be accomplished as contemplated herein, the City may authorize the Work to be performed by City forces or to hire others to complete the Work. Such action on the part of the City shall not be the basis of a claim by the GC for failure to allow it to perform the changed Work.

D. Where changes in the Work are made by the City through use of a force account basis, the GC shall as soon as practicable, and in no case later than ten (10) working days from the receipt of such order, unless another time period has been agreed to by both parties, give the City written Notice, stating:

1. The date, circumstances and source of the extra work; and,
2. The cost of performing extra work described by such Order, if any; and,
3. Effect of the order on the required completion date of the Project, if any.

E. The giving of each Notice by the GC as prescribed by this specification, shall be a requirement to liability of the City for payment of any additional costs incurred by the GC in implementing changes in the Work. Under this specification, no order or statement of the City shall be treated as a Change Order, or shall entitle the GC to an equitable adjustment of the terms of this Contract or damages for costs incurred by the GC on any activity for which the Notice was not given.

F. In the event Work is required due to an emergency as described in this specification the GC must request an equitable adjustment as soon as practicable, and in no case later than ten (10) working days of the commencement of such emergency.

G. All GC requests for equitable adjustment shall be submitted to the CPM per the specifications below. Such requests shall set forth with specificity the amount of and reason(s) for the proposed adjustment and shall be accompanied by supporting information and documents.

H. No adjustment of any kind shall be made to this Contract, if asserted by the GC for the first time, after the date of final payment.

I. This specification shall be used by the GC when preparing documentation for any COR to ensure each has been properly and completely filled out as required by the City of Madison.

J. All COR documentation will be processed through the Construction Administration-Change Order Request Library on the Project Management Web Site (PMWS).

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 26 13 Request for Information (RFI)
B. Section 01 26 46 Construction Bulletins (CB)
C. Section 01 26 63 Change Order (CO)
D. Section 01 31 23 Project Management Web Site
E. Section 01 91 00 Commissioning

F. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public Works Construction".

1. Use the following link to access the Standard Specifications web page:
   http://www.cityofmadison.com/business/pw/specs.cfm
   a. Click on the "Part" chapter identified in the specification text. For example if the specification says "Refer to City of Madison Standard Specification **2**10.2" click the link for Part II, the Part II PDF will open.
   b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.

1.3. DEFINITIONS AND STANDARDS

A. LABOR: The amount of time and cost associated with the performance of human effort for a defined scope of Work. Labor is further defined as follows:
   1. Labor rate is the total hourly rate which includes the basic rate of pay, fringe benefits plus each company's cost of required insurance, also referred to as a reimbursable labor rate.
   2. Unit labor is the labor hours anticipated to install the corresponding unit of material.
   3. Labor cost is the labor hours multiplied by the hourly labor rates.

B. MATERIAL: Actual material cost is the amount paid, or to be paid, by the GC for materials, supplies and equipment entering permanently into the Work, including cost of transportation and applicable taxes. The cost shall not exceed the usual and customary cost for such items available in the geographical area of the project

C. LARGE TOOLS AND MAJOR EQUIPMENT: Large tools and major equipment are those with an initial cost greater than $1,500, whether from the GC or other sources.
   1. Tool and equipment use and time allowed is only for extra work associated with change orders.
      a. Rental Rate is the machine cost associated with operating a piece of equipment for a defined length of time (hour, day, week, or month) and shall not exceed the usual and customary amount for such items available in the geographical area of the project.
      b. Rental cost is the rental rate multiplied by the anticipated duration the equipment shall be required.
   2. The GC shall provide a breakdown of all rental rates to indicate what items and costs are associated with the rate. Examples of items to include in the breakdown would be fuel consumption, lubrication, maintenance and other similar expenses but not including profit and overhead.
   3. When large tools and equipment needed for Change Order work are not already at the job site, the actual cost to get the item there is also reimbursable.

D. BOND COST: The cost shall be calculated at 1% of the total proposed change order.

E. SUB-CONTRACTOR COSTS: Sub-contractor costs are for those labor, material, and equipment costs required by subcontracted specialties to complete the Change Order work including allowable markups as outlined within this specification.

F. OVERHEAD AND PROFIT Markup: The allowable markup percentage to a COR by the GC and Sub-contractors for overhead and profit. All of the following are expenses associated with overhead and profit and shall not be reimbursable as individual items on any COR:
   1. CHANGE ORDER PREPARATION: All costs associated with the preparing and processing of the change order.

2. DESIGN, ESTIMATING, AND SUPERVISION: All such efforts, unless specifically requested by Owner as additional Work to be documented as a COR or portion thereof.
3. INSTALLATION LAYOUT: The layout required for the installation of material and equipment, and the installation design, is the responsibility of the GC.
4. SMALL TOOLS AND SUPPLIES: The cost of small hand tools with an initial cost of $1,500 or less, along with consumable supplies and expendable items such as drill bits, saw blades, gasoline, lubricating or cutting oil, and similar items.
5. GENERAL EXPENSE: The general expense, which is those items that are a specific job cost not associated with direct labor and material such as job trailers, foreman truck, and similar items.
6. RECORD DRAWINGS: The preparation of record or as-built drawings.
7. OTHER COSTS: Any miscellaneous cost not directly assessable to the execution of the Change Order including but not limited to the following:
    a. All association dues, assessments, and similar items.
    b. All education, training, and similar items.
    c. All drafting and/or engineering, unless specifically requested by Owner as additional Work to be documented as a Change Order proposal or portion thereof.
    d. All other items including but not limited to review, coordination, estimating and expediting, field and office supervision, administrative work, etc.

G. Contract Extension: The necessary amount of time to be added to the contract deadlines for the completion of a change order.

1.4. CONTRACT EXTENSION

A. The GC shall not assume that every COR will require a Contract Extension. If the GC feels a contract extension is warranted he/she shall provide sufficient scheduling information that shows how the COR being requested impacts the critical path of the project.

B. The City of Madison strongly encourages the GC to explore alternative methods and practices prior to submitting a COR with a request for contract extension.

1.5. OVERHEAD AND PROFIT MARKUP

A. Pursuant to the City of Madison Standard Specifications for Public Works Construction, Section 104.7, Extra Work, the following maximum allowable markups shall be strictly enforced on all change orders associated with the execution of this contract.
1. The total maximum overhead and profit shall not exceed fifteen percent (15%) of the total costs.
2. The total maximum overhead and profit shall be distributed as follows:
    a. For work performed and materials provided solely by the General Contractor, fifteen percent (15%) of the total costs.
    b. For work performed and materials provided solely by Sub-contractors and supervised by the General Contractor:
        i. Supervision of the GC, five percent (5%) of the total Sub-contractor cost.
        ii. Sub-contractors work and materials ten percent (10%) of the total Sub-contractor cost.

1.6. PERFORMANCE REQUIREMENTS

A. The GC shall become thoroughly familiar with this specification as it will identify procedures and expenses that are or are not allowed under the Change Order and Change Order Request process.

B. The GC shall be responsible for all of the following:
1. Carefully reviewing the CB that is associated with the COR.
2. Collecting required supporting documentation from all contractors that quantify the need for a COR.
    a. Labor hours and wage rates
    b. Material costs
    c. Equipment costs

C. The following shall apply to establishing prices for labor, materials, and equipment costs:
1. Where Work to be completed has previously been established by individual bid items in the contract bid proposal the GC shall use the unit bid prices previously established.
2. Where Work to be completed was bid as a Lump Sum without individual bid items the GC shall provide a breakdown of all labor, materials, equipment including unit rates and quantities required.

D. The completion date is determined by Owner. The schedule, however, is the responsibility of the GC. Time extensions for extra Work will be considered when a schedule analysis of the critical path shows that the Change Order Request places the Work beyond the completion date stated in the Contract.

1.7. QUALITY ASSURANCE

A. The GC shall be responsible for ensuring that all COR supporting documentation meets the following requirements prior to completing the COR form on the Project Management Web Site:
   1. Sufficiently indicates labor, material, and other expenses related to completing the intent of the CB.
   2. No costs exceed the usual and customary amount for such items available in the geographical area of the project, and no costs exceed those established under the contract.

B. The Project Architect (PA), Commissioning Agent (CxA), City Project Manager (CPM), other members of the consulting staff, and city staff shall review all COR requests to ensure that the intent of the CB will be met under the proposal of the COR or request additional information as necessary.

PART 2 – PRODUCTS

2.1. CHANGE ORDER REQUEST FORM

A. The COR form is located on the Project Management Web Site. The GC shall click the link in the left margin of the project web site opening a new form. Follow additional instructions below in the execution section for filling out the form.

PART 3 - EXECUTION

3.1. ESTABLISHING A CHANGE ORDER REQUEST

A. Upon receipt of a Construction Bulletin (CB) where the GC believes a significant change in contract scope warrants the submittal of a COR the GC shall do all of the following within ten (10) working days after receipt of the CB:
   1. Review the CB with all necessary trades and sub-contractors required by the change in scope.
      a. Additions or deletions to the contract scope shall be as directed within the CB.
      b. Additions or deletions of labor and materials shall be determined by the GC based on the directives of the CB.
   2. Assemble all required back-up documentation for additions and deletions of materials, labor and other related contract costs as previously outlined in this specification.
   3. Submit a COR request form on the Project Management Web Site.

B. Submitting a COR does not obligate the GC to complete the work associated with the COR nor does it obligate the Owner to approve the COR as a change to the contract.

3.2. SUBMIT A CHANGE ORDER REQUEST FORM

A. This specification shall provide a subject overview only. In depth instructions shall be provided to the awarded Contractor in a PDF Instructional Manual.

B. The GC shall select the “Submit a COR” link on the Project Management Web Site.

C. The software will open a new COR form and the GC shall provide all of the following information:
   1. DO NOT perform any calculations on this worksheet, only provide the raw data as requested below. All calculations, totals, and markups shall be computed as described within this specification.
   2. Provide a summary description of the COR request, and justification for any requested time extension to the contract, indicate the number of calendar days being requested for the extension and add any attachments to the form as needed.
   3. Provide all GC self performance data including all of the following:
      a. Materials description, quantities, and unit costs.
      b. Labor hours and rates for all Foremen, Journeymen, and Apprentices by trade.
      c. Equipment descriptions, quantities, unit costs and rates.
   4. Provide all Sub-contractor data including all of the following:
      a. Materials description, quantities, and unit costs.
      b. Labor hours and rates for all Foremen, Journeymen, and Apprentices by trade.
      c. Equipment descriptions, quantities, unit costs and rates.
   5. Ensure all calculations performed by the form have been completed correctly. Contact the CPM directly if you suspect an error before hitting the save button.

C. At any time after creating a COR you must at a minimum click “Save as Draft” to save your work.

D. When all data has been entered and verified click on the “Submit COR” button. This will kick off the COR Review and Approval process.

3.3. CHANGE ORDER REQUEST REVIEW, APPROVAL, AND PROCESSING

A. The PA and CPM shall review all CORs submitted by the GC.
   1. Additional consulting staff and city staff having knowledge of the components of the COR shall review and advise the PA and CPM as to the accuracy of the items, quantities, and associated costs of the COR as directed by the CB.
   2. The CPM shall review the COR with the Owner.

B. If required the PA and CPM, shall in good faith, further negotiate the COR with the GC as necessary. All amendments to any COR shall be documented within the Project Management Web Site software.

C. After final review of the COR the CPM and Owner may accept the COR.

D. The CPM shall prepare the COR in the form of an official Board of Public Works Change Order for final review and approval as outlined in Section 01 26 63 Change Order (CO).

E. The GC shall not act upon any accepted COR until it has received final approval through the Public Works process as an official CO to the Work unless instructed to do so by the CPM. Proceeding without the final approval of a fully authorized Change Order is at the GC's own risk.

3.4. EMERGENCY CHANGE ORDER REQUEST

A. In the event Work is required due to an emergency as described in the Contract Documents, the GC must request an equitable adjustment as soon as practicable, and in no case later than ten (10) working days of the commencement of such emergency.

B. The GC shall provide full documentation of all labor, materials and equipment used during the period of emergency as part of the COR submittal.

END OF SECTION

SECTION 01 26 63
CHANGE ORDER (CO)

PART 1 – GENERAL

1.1. SUMMARY

A. Except in cases of emergency, no changes in the Work required by the Contract Documents may be made by the General Contractor (GC) without having prior approval of the City Project Manager (CPM).

B. The City may at any time, without invalidating the Contract and without Notice to Sureties, order changes in the Work by written Change Order. Such changes may include additions and/or deletions.

C. The Change Order (CO) is a Board of Public Works (BPW) form that is reviewed and approved by a specific process.

D. The CO form is typically made up of multiple Change Order Requests (CORs) and/or Bid Items as appropriate depending on the type of project and how the contract was bid.

E. All CO documentation shall be processed through the Construction Administration-Change Order Library and digital workflow on the Project Management Web Site (PMWS).

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 26 13 Request for Information (RFI)
B. Section 01 26 46 Construction Bulletin (CB)
C. Section 01 26 63 Change Order Request (COR)
D. Section 01 31 23 Project Management Web Site
E. Section 01 91 00 Commissioning

1.3. BOARD OF PUBLIC WORKS PROCEDURE

A. The Board of Public Works has a very explicit procedure for the review and approval of all change orders associated with any Public Works Contract as follows:

1. The Supervisory Chain of the CPM shall review and approve any CO under $10,000 provided it does not include either of the following:
   a. The CO does not request a time extension to the contract.
   b. The CO does not cause the contract contingency sum to be exceeded.
2. The Board of Public Works shall review and approve any CO that requires any of the following:
   a. Any CO over $10,000.
   b. Any CO requesting a time extension to the contract regardless of the monetary value of the CO.
   c. Any CO that that causes the contract contingency sum to be exceeded.

B. The Board of Public Works generally meets every other week and only once in August and December. The GC is cautioned that, under normal scheduling, a CO requiring a BPW review will take a minimum of two (2) weeks to achieve final approval.

1. The City shall not be responsible for additional delays to the Work caused by the scheduling constraints of the Board of Public Works.

C. *SPECIAL NOTE:* The GC is cautioned to never proceed unless told to do so by the CPM. Only in rare instances may the CPM give a written notice to proceed on a COR without an approved CO. Proceeding without the written notice of the CPM or an approved CO is at the GC's own risk.

PART 2 – PRODUCTS

2.1. CHANGE ORDER FORM

A. The CO form is located on the Project Management Web Site. The CPM shall click the link in the left margin of the project web site opening a new form. Project information is pre-loaded, the CPM only needs to enter information and make attachments as needed to complete the form.

PART 3 - EXECUTION

3.1. PREPARATION OF THE CHANGE ORDER

A. The CPM shall prepare the required CO forms in the Construction Administration-Change Order Library on the Project Management Web Site as follows:
   1. Provide information for all contract information.
   2. Provide a general description of the items described within the change order.
   3. Provide detailed information for each Item on the CO form. At the option of the CPM he/she may include multiple Change Order Requests each as their own item.
   4. Provide required pricing and accounting information as needed for the item.
   5. Insert attachments of contractor/architect provided information that clarifies and quantifies the CO. Attachments may include but not be limited to material lists, estimated labor, revised details or specifications, and other documents that may be related to the requested change.
   6. Save the final version of the completed CO.

3.2. EXECUTION OF THE CHANGE ORDER

A. Upon saving the CO as described in section 3.1 above the software associated with the Project Management Web Site shall notify the GC that the CO has been drafted and is ready for review. The GC shall do the following:
   1. Open the appropriate CO form in the Construction Administration-Change Order Library and review all items on the form.
   2. The GC shall notify the CPM immediately of any errors or discrepancies on the form and shall not sign or save it.
      a. The CPM shall make any corrections as needed, re-save the form, and notify the GC.
   3. If/when the GC concurs with the CO form as drafted the GC shall digitally sign the form and click SAVE.

B. After the GC digitally signs/saves the CO it shall be routed through the Project Management Web Site for additional review and/or approvals. The CPM shall do the following:
   1. Monitor the review process to ensure the software is working properly at each review step.
   2. Ensure that proper BPW procedures are executed as needed by the CO approval process.
      a. Schedule the CO on the next available BPW agenda if required.
         i. Attend the BPW meeting to speak on the CO to board members and answer questions.
         ii. The GC and/or PA may be required to attend the BPW meeting to address specific information as it relates to the Work and/or materials associated with the CO.
   3. Monitor final approval and distribution of the CO.
   4. Notify the GC that the CO has been completed.
   5. Ensure that the CO is posted to the next Public Works payment schedule.
   6. Verify that the GC's next Progress Payment-Schedule of Values show the CO as part of the contract sum.

C. Upon final approval of the CO the GC may proceed with executing the Work associated with the CO.

END OF SECTION

SECTION 01 29 73
SCHEDULE OF VALUES

PART 1 – GENERAL

1.1. SUMMARY

A. The Schedule of Values (SOV) is a Contractor provided statement that allocates portions of the total contract sum to various portions of the contracted work and shall be the basis for reviewing the Contractors Progress Payment Requests.

B. AIA Document G702 – Application and Certificate for Payment and AIA Document G703 Continuation Sheet shall be filled out in sufficient detail to be used as a guideline in determining work completed and materials stored on site when verifying Progress Payment Requests.

C. The General Contractor shall be responsible for filling out, updating, and providing these work sheets with each Progress Payment Request.

1.2. RELATED SPECIFICATIONS

A. Section 01 26 63 Change Order (CO)
B. Section 01 29 76 Progress Payment Procedures
C. Section 01 31 23 Project Management Web Site
D. Section 01 32 26 Construction Progress Reporting
E. Section 01 33 23 Submittals

F. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public Works Construction".

1. Use the following link to access the Standard Specifications web page:
   http://www.cityofmadison.com/business/pw/specs.cfm
   a. Click on the "Part" chapter identified in the specification text. For example if the specification says "Refer to City of Madison Standard Specification **2**10.2" click the link for Part II, the Part II PDF will open.
   b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.

1.3. RELATED DOCUMENTS

A. The following documents shall be used as the basis for initiating and maintaining the SOV worksheets throughout the execution of this contract.

1. Drawing documents and specifications (including general provisions) as provided with the bid set documents and any published addendums.
2. Documents associated with revisions or clarifications to number 1 above after awarding of the contract, including but not limited to:
   a. Construction Bulletins
   b. Request for Information
   c. Approved Change Orders
3. The latest daily/weekly Construction Progress Report
4. Other specifications as identified in Section 1.2 above

1.4. BASIS OF VALUES

A. The Contractor shall provide a breakdown of the Contract Sum in sufficient detail to assist the Architect and City Project Manager in evaluating Progress Payment Requests. The breakdown detail may require a labor and material breakdown for each division of work or trade or as directed by the CPM.

B. The total sum of all items shall equal the Contract Sum.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. AIA DOCUMENT G702 – APPLICATION AND CERTIFICATE FOR PAYMENT

A. The Contractor shall use AIA Document G-702 Application and Certificate for Payment with each Progress Payment Request.

B. Completely fill out the Project Information section as follows:
   1. TO OWNER; provide all owner related information as provided in the contract documents.
   2. PROJECT; provide all contract information including contract number, title and address.
   3. FROM CONTRACTOR; provide all contractor related information.
   4. VIA ARCHITECT; provide all the architect's related information including the architect's project reference number if different from the owners.
   5. Indicate the current APPLICATION NO., PERIOD TO date, and CONTRACT DATE.

C. Completely fill out the Contractors Application for Payment section.
   1. Fill out lines 1 through 9 to reflect the current status of the contract through the payment date being requested.
   2. The City of Madison calculates retainage on Public Works Contracts as follows:
      a. In general, across the duration of the contract, 2.5% of the total contract sum, including change orders, is withheld for retainage as referenced from the City of Madison Standard Specification 110.2:
         i. Beginning with Progress Payment 1, 5% retainage will be withheld until such time that 50% of the total contract sum has been paid out.
         ii. No additional retainage will be withheld after 50% of the total contract sum has been paid, unless additional change orders have been approved after the 50% milestone has been reached. Per City of Madison Standard Specification 110.2, additional retainage up to 10%, may be held in the event there are holds placed by Affirmative Action or liquidated damages by BPW.
         iii. Retainage for additional change orders after the 50% milestone will be withheld at the rate of 2.5% of the total cost of the change order.
         iv. Retainage is based on the change orders posted to the City's contract worksheet at the time the progress payment is processed.

D. Completely fill out the Change Order Summary section. Only change orders that have been finalized and posted to the City of Madison's Application for Partial Payment worksheet may be itemized into the SOV documents.

E. The Contractor shall sign and date the application and it shall be properly notarized.

F. The Contractor shall not fill in any information in the Architects Certificate for Payment section.

3.2. AIA DOCUMENT G703 – CONTINUATION SHEET

A. The Contractor shall use AIA Document G-703 Continuation Sheet to itemize his/her SOV for this contract. Provide additional sheets as necessary.

B. Provide information in Column A (Item No.), Column B (Description of Work), and Column C (Scheduled Value) by any method that allocates portions of the total contract sum to various portions of the contracted work. Possible methods include combinations of the following:
   1. By division of work
   2. By contractor, sub-contractor, sub sub-contractor
   3. By specialty item or group
   4. Other methods of breakdown as may be requested by the City Project Manager or City Construction Manager at the pre-construction meeting.

C. Provide total cost of the item/description of work including proportionate shares of profit and overhead related to the item.

3.3. INITIAL SCHEDULE OF VALUES SUBMITTAL

A. The Contractor shall upload his/her initial SOV to the Project Management Web Site, Submittals Library, no later than five (5) working days after the Pre-construction Meeting.
   1. The initial SOV shall provide information in Column A (Item No.), Column B (Description of Work), and Column C (Scheduled Value) only.
   2. The level of detail shall be as described in section 3.2 above.

B. The Project Architect (PA) and the City Project Manager (CPM) shall review the SOV as any other submittal and may require modifications to reflect additional detail as necessary.

C. The Contractor shall resubmit the SOV as necessary until such time as the PPA and CPM have sufficient detail for assessing and approving future Progress Payment Applications.

D. Progress Payment Application 1 will not be processed until such time as the Contractor has met this requirement regardless of the amount of work completed per the application.

3.4. SOV FOR PROGRESS PAYMENT REQUESTS

A. The Contractor shall update the initial SOV with each Progress Payment Application as follows:
   1. Initial items and values as part of Section 3.3 above will not be adjusted once the original Schedule of Values submittal has been approved.
   2. Change orders shall be added as additional items and values at the bottom of the SOV as they become approved and posted to the City's contract worksheet. The value for each change order shall be the value indicated on the SOV and shall stand alone. Values shall not be split out or combined with other existing items with similar work descriptions on the original SOV.
   3. Fill out Columns D, E, F and G to properly reflect the work completed and materials received since the last Progress Payment Application.
   4. Only materials delivered and stored on the project site may be reflected on SOV progress updates.

B. Provide updated G702 and G703 sheets with each Progress Payment application.

C. See Specification 01 29 76 Progress Payment Procedures for additional information on submitting Progress Payment Applications.

END OF SECTION

SECTION 01 29 76
PROGRESS PAYMENT PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

A. The General Contractor (GC) shall review this and all related specifications prior to submitting progress payment requests.

B. Progress payment requests (Partial Payment-PP) for this contract shall be uploaded digitally by the GC to the Project Management Web Site

C. The Project Architect (PA) and City Project Manager (CPM) shall review and amend or approve the PP on the Project Management Web Site.

D. After approval of the PP by the CPM, he/she shall forward the PP to the appropriate agencies for BPW contractual review and payment processing.

1.2. RELATED SPECIFICATIONS

A.	Section 01 26 63	Change Order (CO)
B.	Section 01 29 73	Schedule of Values
C.	Section 01 31 19	Progress Meetings
D.	Section 01 31 23	Project Management Web Site
E.	Section 01 32 16	Construction Progress Schedules
F.	Section 01 32 26	Construction Progress Reporting
G.	Section 01 33 23	Submittals
H.	Section 01 45 16	Field Quality Control Procedures
I.	Section 01 77 00	Closeout Procedures
J.	Section 01 78 13	Completion and Correction List
K	Section 01 78 23	Operation and Maintenance Data
L.	Section 01 78 36	Warranties
M.	Section 01 78 39	As-Built Drawings
N.	Section 01 78 43	Spare Parts and Extra Materials
O.	Section 01 79 00	Demonstration and Training

1.3. RELATED DOCUMENTS

A. The following documents shall be used when evaluating PP requests.

1. Daily and weekly construction progress reports filed since the last payment request.
2. Contractors Schedule of Values as updated from the last payment request. See Specification 01 29 73.
3. Any document that may be required to be submitted for review and approval, as noted by the specifications listed in Section 1.2 above, or the Progress Payment Milestone Schedule in Section 1.4 below, to achieve a required bench mark of contract progression or contract requirement.

1.4. PROGRESS PAYMENT MILESTONES

A. City Engineering-Facility Management has developed the Project Payment Milestone Schedule (Section 1.4 below) to assist the GC in providing required construction specific documentation and general contractual documentation in a timely manner.

B. The Progress Payment Milestone Schedule is not an all inclusive list. Multiple agencies review progress payment requests and contract closeout requests. Missing, incomplete, or incorrect documentation for any agency may

be a cause for not processing progress payments. It shall be the sole responsibility of the Contractor for providing documentation as required or requested to the appropriate agencies.

C. The milestone schedule is based on the contract total sum and shall be valid for most contracts. Milestone submittals will be required with whatever progress payment hits the percentage of contract total indicated in the schedule.

D. The CPM shall review the milestone schedule with each progress payment request and at his/her option may elect to hold processing the progress payment until such time as the contractor has met the requirements for providing construction specific documentation.

E. It shall be the General Contractors responsibility to comply with all BPW Contract Administration requirements and related deadlines as outlined in the Award Letter, Award Checklist, and Start Work Letter.

Progress Payment (PP) Milestone Schedule		
Milestone Description	***Due Before***	***Remarks***
BPW Contract Administration Documentation • Workforce profiles • Best Value Contracting Documentation • Sub-contractors prequalification approval & Affirmative Action plans • Other as may be required	PP-1, or start work as applicable	• For GC and Sub-contractors before PP-1 regardless of scheduling • Sub-contractors (if applicable), due 10 days before they may start work • Sub-contractors (if applicable), due 10 days before they may start work
Required Construction Submittals/Administrative Documents • Contractors Project Directory • Schedule of Values • Submittals Schedule • Waste Management Plan • Closeout Requirement Checklist • Warranty Checklist	PP-1	References • Specification 01 31 23 • Specification 01 29 73 • Specification 01 32 19 • Specification 01 74 19 • Specification 01 77 00 • Specification 01 78 36
Construction Progress Milestones • Early submittals, per submittal schedule • Detailed Contract Schedules	PP-1	See specifications for specific requirements • Specification 01 32 19, Examples: concrete mix, structural steel, products with long lead times • See Specification 01 32 16
General Construction Progress Requirements are all up to date • Progress Schedules • Submittals/Re-submittals (ongoing) • Schedule of Values • Progress Reporting • LEED Documentation • Waste Management documentation • QMOs are being addressed and closed • Progress Cleaning • As-Built Drawings	Each future PP	Verified with each Progress Payment Request • Specification 01 32 16 • Specification 01 33 23 • Specification 01 29 73 • Specification 01 32 26 • All specifications with LEED documentation requirements • Specification 01 74 19 • Specification 01 45 16 • Specification 01 74 13 • Specification 01 78 39
*** All of the above are being updated on the Project Management Web Site as required**		
BPW Contract Administration Documentation • Weekly payroll reports • Best Value Contracting Reports	25% CT or PP 2	See 1.4.E above. *This progress payment will be with held by BPW for any missing contractual documentation.*

Progress Payment (PP) Milestone Schedule		
Milestone Description	***Due Before***	***Remarks***
• SBE Reports		
Construction Progress Milestones • Construction/Contract Closeout Meeting #1 • Submittals/Re-submittals complete	50% CT	• Specification 01 31 19 • Specification 01 33 23
Operation and Maintenance (O & M) drafts	60% CT	• Specification 01 78 23
Construction/Contract Closeout Meeting #2 • Construction closeout checklist	70% CT	• Specification 01 31 19 • Specification 01 77 00
BPW Contract Administration Documentation • Request Finalization Review from BPW	80% CT	This is a recommendation to the GC and is not a requirement of this PP. • Specification 01 77 00
Construction Progress Milestones • Operation and Maintenance (O & M) finals, accepted • All major QMO issues resolved • As-Built Drawings, Division Trades ready for GC review	80% CT	• Specification 01 78 23 • Specification 01 45 16; Items that could prevent occupancy • Specification 01 78 39
All of the following shall be completed for this PP: • Regulatory Inspections completed • All QMO reports closed • Demonstration and Training completed • Attic Stock completed • Final Cleaning	90% CT	Contractor to determine the proper order of completion: • Governing ordinances and statutes • Specification 01 45 16 • Specification 01 79 00 • Specification 01 78 43 • Specification 01 74 13
Construction Closeout Procedures: • Letter of Substantial Compliance sent to BI and DHS as needed • Certificate of Occupancy issued • As-Built Drawings, finals, accepted • City Letter of Substantial Completion • Warranty letters dated and issued	100% CT	• Specification 01 77 00 • Generated/Signed by the Architect • Building Inspection • Specification 01 78 39 • Signed by the City Engineer • Specification 01 78 36
*** Completion of this begins the one year warranty.**		
BPW Contract Administration Documentation Contract Closeout Procedures • Construction Closeout has been completed • Contractor requests final payment of retainage upon receiving City Letter of Substantial Completion • All BPW contractual requirements are verified	Final	• Specification 01 77 00 • Contractor must provide any missing BPW Contractual Documentation
*** Completion of this closes the contract but not the warranty period/bond.**		

Progress Payment (PP) Milestone Schedule		
Milestone Description	***Due Before***	***Remarks***
***NOTE:* CT = Contract Total less held retainage**		

1.5. PROGRESS PAYMENT SUBMITTAL

A. Each progress payment submittal shall be:
   1. Digital in PDF format
   2. PDF shall be in color
   3. Uploaded to the appropriate Project Management library and properly named per the tutorial instructions provided to the awarded contractor.

B. Submit all required construction progress documentation to the appropriate Project Management Web Site library.

C. In general the following shall apply to all PP requests:
   1. Materials or products:
      a. On order, being shipped, etc. may not be invoiced.
      b. Received and stored on the project site may be invoiced.
      c. Being manufactured off site at any location may not be invoiced (example: cabinetry, ductwork, etc.)
      d. Completed products stored off site locally waiting for delivery to the project site may be invoiced with prior approval by the CPM. All of the following conditions must be met to be allowed:
         i. Items must be visually inspected by CPM to verify product is complete.
         ii. Item must be stored inside a compatible structure and the structure and contents must be insured.
         iii. Contractor is responsible for condition until installation is completed.
   2. All labor and equipment, including rental time for the current progress period may be invoiced.
   3. Only completed installations may be invoiced to 100% based on the Schedule of Values.

D. DO NOT submit BPW Contract Administration Documentation for review with Progress Payment Requests, submit them directly to the correct agency and in the correct format as instructed from information in your BPW Contract Award Packet instructions.

PART 2 - PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL CONTRACTOR PROCEDURE

A. The GC shall provide an updated version of his/her schedule of values (AIA documents G702 & G 703) with each PP request.
   1. The AIA - Application and Certificate for Payment (G702) shall be properly filled out and prepared for the Architects review. See specification 01 29 73, Schedule of Values for more information.
   2. The AIA - Continuation sheets (G703) shall be properly filled out and indicate the dollar value of the completed work to date for each item on the form. See specification 01 29 73, Schedule of Values for more information.
      a. The GC shall subtotal the work completed to date for all of the original Schedule of Value items.
      b. Divide the sub total of work completed by the Original Contract Total to obtain a percentage complete of the original Lump Sum Bid. This percentage may be taken out to five (5) decimal places (round fifth place up or down as needed).
         i. Example: $5,192.55 of completed work divided by $10,000 original Contract Total = 0.519255, round this to 0.51926
      c. Write the percentage in Column 10 on the City Tabular Sheet for the original lump sum bid item in RED ink.
   3. Ensure that any newly posted change orders from the City of Madison provided tabulation sheet have been entered on the G703 continuation sheets. Repeat steps a thru c above for each change order on the schedule of values and the City Tabular Sheet.

B. The GC shall fill out the City of Madison Application and Certificate of Payment cover sheet as follows:
   1. The GC shall not change any pre-printed information and shall not write in the box that indicates previous progress payments.
   2. The GC shall sign and date the form where indicated.
   3. The GC shall provide the dates from and to for the PP being requested.

4. The GC shall provide the list of all contractors/sub-contractors that were actively working during the dates indicated above.
    a. All contractors/sub-contractors named must be in compliance with all City requirements (Pre-qualified, Affirmative Action Plan on file, etc). The PP will be held and not processed by the City of Madison until all contractors/sub-contractors are in compliance.
    b. Do not list the names of suppliers or manufacturers, doing so will slow down processing and require a re-submittal of the paperwork.

C. The General Contractor (GC) shall scan all of the documents listed below in the order shown, save the scan as a single PDF file for each PP request.
1. City cover sheet – Application and Certificate for Payment
2. City tabulation sheet(s)
3. AIA G702 - Application and Certificate for Payment
4. AIA G703 - Continuation Sheet(s)
5. Any miscellaneous documents that may be requested as backup documentation for the pay request.
    a. Lien waivers are not required and shall not be submitted.
    b. Do not provide contractual administrative documents such as pay reports with pay requests.
    c. Do not supply progress deliverables with pay requests.

F. Upload the pay request PDF to the Contract Documents-GC Partial Pay Apps library on the Project Management Web Site.

3.2. PROJECT ARCHITECT PROCEDURE

A. The PA shall review the AIA-continuation sheets provided by the GC to determine if the Schedule of Values accurately reflects the work completed for the inclusive dates indicated.
B. The PA shall advise the CPM of any discrepancies in the schedule of values.
C. The PA shall work with the GC and the CPM to resolve any issues prior to signing the AIA - Application and Certificate for Payment.
D. When verified, the PA shall digitally sign the original PDF version of the AIA - Application and Certificate for Payment on the Project Management Web Site.

3.3. CITY PROJECT MANAGER PROCEDURE

A. The CPM shall review all documents submitted by the GC and work with the PA to ensure the schedule of values accurately reflects the work completed to date.
B. The CPM may elect to hold processing of any progress payment pending submittal of required progress payment milestones.
C. When verified, the CPM shall digitally sign the City Cover Sheet and forward the required documentation to the appropriate City agencies for further processing of the payment request.
D. The CPM shall add a scanned copy of any documents indicating the PP request processing was completed to the PMWS.

END OF SECTION

SECTION 01 31 13
PROJECT COORDINATION

PART 1 – GENERAL

1.1. SUMMARY

A. Project Coordination covers many areas within the execution of the Contract Documents and the requirements of proper coordination are the applicable to all contractors executing the Work of this contract.

B. This specification provides general information regarding project coordination for the General Contractor and all Sub-contractors. All contractors shall be familiar with project coordination requirements and responsibilities that may be defined in other specification within these Contract Documents.

C. The General Contractor shall at all times be responsible for the project, project site, and execution of the Contract Documents.

1.2. RELATED SPECIFICATIONS

A.	Section 01 29 76	Progress Payment Procedures
B.	Section 01 31 19	Progress Meetings
C.	Section 01 31 23	Project Management Web Site
D.	Section 01 32 16	Construction Progress Schedules
E.	Section 01 32 19	Submittals Schedule
F.	Section 01 33 23	Submittals
G.	Section 01 43 39	Mockups
H.	Section 01 45 16	Field Quality Control Procedures
I.	Section 01 60 00	Product Requirements
J.	Section 01 77 00	Closeout Procedures, including all specifications referenced therein
K.	Section 01 91 00	Commissioning

1.3. GENERAL REQUIREMENTS

A. The following general requirements shall applicable to all contractors:
   1. Cooperate with the Owner, all authorized Owner Representatives, Project Architect and all consultants of the Owner.
   2. Materials, products, and equipment shall be new, as specified and to industry standards except where otherwise noted.
   3. Labor and workmanship shall be of a high quality and to industry standards.

B. Existing conditions:
   1. Verify all existing conditions noted in the contract documents with actual filed locations. Verify dimensions, sizes and locations, of structural, equipment, mechanical and utility components.
   2. Report any inconsistencies, errors, omissions, or code violations in writing to the General Contractor (GC) immediately.
   3. Annotate any inconsistencies, errors, omissions on the GC As-Built record drawings immediately for future reference.

C. Contract Documents:
   1. The Contract Documents are intended to include everything necessary to perform the work. Every item required may not be specifically mentioned, shown, or detailed.
      a. Except where specifically stated all systems and equipment shall be complete, installed, and fully operable.
      b. If a conflict exists within the contract documents the contractor shall furnish the item, system, or workmanship of the highest quality, largest, largest quantity, or most closely fits the intent of the contract documents.

c. Manufacturers recommended installation details shall be verified and used prior to installation of products and equipment so as to not void warranties.

D. Errors and Omissions
1. No Contractor shall take any advantage of any apparent error or omission in the construction documents.
2. The City of Madison shall be permitted to make such corrections and interpretations as may be deemed necessary for the fulfillment of the intent of the construction documents.

E. Owners Representatives
1. All contractors shall be familiar with various Owner Representatives having Quality Management responsibilities for the duration of this project including but not limited to the following:
a. Project Architect, responsible for all decisions affecting the code compliance and design intent of the construction documents.
b. Consulting Architects and Engineers, responsible for providing consulting services to the Project Architect, Owner, and City Project Manager, also responsible for Quality Management of the construction documents.
c. Owner, the designated representative of the City Agency that will occupy the project upon completion.
d. City Project Manager, responsible for all day to day decisions regarding the execution and performance of this Public Works Contract.
e. Consulting City Staff, responsible for providing consulting services to the Project Architect, Owner, and City Project Manager, also responsible for Quality Management of the construction documents.
f. Commissioning Agent (CxA), responsible for ensuring that the project is meeting the Owner's Project Requirements and related quality assurance procedures.
2. Owner Representatives shall be attending progress meetings, pre-installation meetings, performing or being present for final testing and acceptance and quality management reporting during the execution of the contract documents as outlined in other specifications.

1.4. GENERAL CONTRACTOR PERFORMANCE REQUIREMENTS

A. Assume the responsibility for all Work specified in the Contract Documents except where specifically identified to be performed by the Owner or other contractor separately hired by the Owner.
1. Coordinate all work by Owner, equipment provided Owner, or contractor hired by the Owner into the project schedule.

B. Provide all construction management responsibilities as specified in other Division 1 specifications including but not limited to:
1. Scheduling of work
2. Coordination of work between other Trades and Sub-contractors
3. Construction administration and management
4. Site layout, cleanliness, and protection of completed work/stored materials
5. Waste Management
6. Quality Assurance and Quality Control

C. Use Diggers Hotline and private utility locating companies to accurately locate all public and private utilities on the property as needed. The GC is responsible for any repair or replacement to any public or private utility damaged during the execution of the Work

D. Report any inconsistencies, errors, omissions, or code violations in writing to the Project Architect immediately. Failure to report inconsistencies prior to beginning work shall indicate that the GC accepted all existing conditions.

E. The GC shall be responsible for assigning work and related responsibilities where the Contract Documents may not clearly state who is responsible for providing the work, material, or product.

F. Provide construction management oversight of all items described in Section 1.5 below.

G. Coordinate and assist CxA as outlined within 01 91 00 and as directed by Owner.

1.5. SUB-CONTRACTOR PERFORMANCE REQUIREMENTS

A. Be familiar with all of the contract documents as they pertain to your Work, adjacent work and the overall progress of the project.
1. All Sub-contractors shall be familiar with all Division 1 specifications as they may apply to progress, progress payments, quality control construction management, and closeout of the contract.

B. Coordinate your Work with all adjacent work and existing conditions.

1. Perform your work in proper sequence according to the GC's project schedule and in relation to the work of other trades.
2. Notify other sub-contractors and trades whose work may be connected to, combined with, or influenced by your work and allow them reasonable time and access to complete their work.
3. Join your work to the work of others in accordance with the intent of the Contract Documents.
4. Order materials and schedule deliveries to facilitate the general progress of the Work.

C. Cooperate with all other trades to facilitate the general progress of the work. This shall include providing every reasonable opportunity for the installation of work by others and the storage of their materials and equipment.
1. In no case shall any contractor exclude from the premises or work any Sub-contractor or their employees.
2. In no case shall any contractor interfere with the execution or installation of Work by any other Sub-contractor or their employees.

D. Arrange your work, equipment, and materials and dispose of your construction waste so as to not interfere with the work or storage of materials of others.

E. Coordinate all work as indicated during pre-installation meetings with Owner Representatives, the GC and other trades. Any work improperly coordinated shall be relocated as designated by the Owner Representative at no additional cost to the City.

F. Coordinate and assist CxA as outlined within 01 91 00 and as directed by Owner.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to identify various project related meetings and the responsible parties for scheduling, agendas, minutes, and required attendance.

B. This specification is not intended to be inclusive of all meeting types or a complete list of required meetings.

C. This specification is not intended to cover planning and execution meetings between the General Contractor (GC) and his/her sub-contractors.

1.2. RELATED SPECIFICATIONS

A. 01 31 23 Project Management Web Site

B. 01 32 16 Construction Progress Schedules

C. 01 43 39 Mockups

D. 01 91 00 Commissioning

1.3. PROJECT MEETING TYPES

A. The following project meeting types may be used but not limited to the following

1. Preconstruction Meeting
2. Project Management Web Site – Tutorial Meeting
3. Construction Progress Meetings
4. Pre-installation Meetings (including mock-up review meetings)
5. Weekly Trade Meetings
6. Special Meetings
7. Commissioning Meetings

1.4. GENERAL REQUIREMENTS

A. Representatives of Contractors, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

PART 2 – PRODUCTS – NOT USED IN THIS SECTION

PART 3 - EXECUTION

3.1. PRECONSTRUCTION MEETING

A. After execution of the Contract the City Project Manager (CPM) shall schedule and conduct the Preconstruction Meeting at the Owner's facilities. The CPM shall coordinate the meeting agenda with the Project Architect and the GC Project Manager.

B. The CPM shall be responsible for the final agenda.

C. The CPM and Project Architect shall take notes on the meeting and post completed meeting minutes.

D. Attendance shall be required by all of the following:

1. Owner Representative(s)

2. Architect and applicable sub consultant(s)
3. General Contractor and applicable subcontractors and suppliers
4. City Quality Management Staff
5. Commissioning Agent
6. Others, as may be invited for particular agenda items.

E. Topics of the Preconstruction Meeting shall include but not be limited to the following:
1. Staff and contractor introductions
2. Completion Date
3. BPW Administrative requirements and due outs
   a. Small Business Enterprise (SBE) (if applicable)
   b. Certified payroll forms
   c. Workforce profiles
   d. Best Value Contracting (BVC)
4. General Facility Management Division 1 Specifications, including:
   a. Section 01 29 76 Progress Payment Procedures
   b. Section 01 31 23 Project Management Web Site (overview)
   c. Section 01 45 16 Field Quality Control Procedures
   d. Section 01 77 00 Closeout Procedures
   e. Section 01 91 00 Commissioning
5. Project Meeting scheduling
   a. Section 01 31 19 Project Meetings
6. Construction Schedule
7. Commissioning Process

3.2. PROJECT MANAGEMENT WEB SITE – TUTORIAL MEETING

A. The CPM shall schedule and conduct a tutorial presentation of the PMWS prior to the beginning of construction.
B. The CPM shall be responsible for the final agenda, there will be no minutes.
C. The required attendance list in 3.1.D. above shall apply except for City Staff in items 1 and 4 who are already familiar with the PMWS system.
D. It is recommended that all contractors bring their lap top, tablet or other internet capable device with them including a fully charged battery and internet connection devices as necessary.

3.3. CONSTRUCTION PROGRESS MEETINGS

A. In general all of the following shall apply:
1. Representatives of Contractors, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
2. The attendance shall be from the required attendance list in 3.1.D. above.

B. The General Contractor Project Manager (GCPM) shall:
1. Schedule and conduct all construction progress meetings biweekly or more frequently as required.
2. Prepare agenda for meetings including, but not limited to the following:
   a. Safety
   b. Current Schedule, including review of the critical path and 6-week look ahead schedule
   c. Status of project related documentation (Submittals, RFIs, CBs, etc.)
   d. Quality Observation Log and status of correction of deficient items
   e. Project questions and issues from meeting attendees
   f. BPW Administration Check
   g. Other as needed
   h. Status of CORs and COs to be reviewed outside the standard progress meeting time.
3. Make physical arrangements for meetings.
4. GCPM to post meeting agendas to the appropriate libraries on the Project Management Web Site (PMWS) no less than two (2) working days prior to the scheduled meeting. Notify all required attendees, applicable parties to the contract, and others affected of the posted meeting agenda.
5. Preside at meetings.
6. Route a meeting attendance roster for attendees to sign-in on.
7. GCPM to record the minutes of the meeting; include significant proceedings and decisions. Post meeting minutes to the PMWS no more than two (2) working days after the completed meeting. Meeting minutes shall include a scanned copy of the attendance sign-in sheet. Notify all required meeting attendees, applicable parties to the contract, and others affected by decisions made at the meetings.

8. The above requirements do not apply to GC/sub-contractor meetings.

3.4. PRE-INSTALLATION MEETINGS

A. The GCPM shall schedule and conduct all pre-installation meetings, including mockup reviews, before each construction activity that requires coordination with other trades.
B. The GCPM shall be responsible for the final agenda and meeting minutes.
C. The GCPM will work with all concerned parties to resolve issues as needed and submit RFI's if necessary.
D. Required attendance shall be from the list in 3.1.D. above and shall be personnel having a stake in the outcome of the installation or knowledge of the system being installed.
E. In the event the Contractor installs equipment or materials without a pre-installation meeting the Contractor shall be solely responsible for removing, replacing, repositioning materials and equipment as instructed by the Project Architect or City Project Manager at no additional cost to the City.

3.6 PRE-CONTRACT CLOSEOUT MEETINGS

A. Two (2) Pre-contract Closeout Meetings shall be held to review the closeout procedures, requirements, and contract deliverables.
   1. Pre-contract Closeout Meeting #1 shall be scheduled prior to the 50% Progress Payment Request is being requested. This meeting shall discuss items such as closing out QMO reports, providing O&M drafts and finals, payroll and Affirmative Action documentation, and other contract deliverables.
   2. Pre-contract Closeout Meeting #2 shall be scheduled prior to the 80% Progress Payment Request is being requested. This meeting shall discuss, but not be limited to, the status of scheduling final regulatory inspections, cleaning up outstanding QMO's, demonstration and training, attic stock; and finalization review of payroll and other related documents.
B. The GCPM shall schedule, coordinate, and make physical arrangements for both meetings.
C. All of the following shall be required to attend both meetings:
   1. The GCPM and the GC Field superintendent
   2. All Subcontractor Project Managers regardless of the current status of their work.
      a. The GCPM may excuse a Subcontractor PM if he is confident that all contractual requirements for closeout by the subcontractor have been completed and/or delivered to the GCPM. The list of attendees shall be reviewed and agreed upon with CPM ahead of the meeting.
      b. At the option of these project managers the field supervisors may also attend.
   3. The Project Architect and at least one design consultant from each discipline represented by the plans and specifications to address open QMOs, final tests, reports, etc.
   4. The Owner
   5. The CPM
   6. Quality Management staff as needed to address open QMOs, final tests, reports, etc.
   7. The Commissioning Agent
D. The CPM shall publish an agenda and chair the meeting.

3.7 OTHER SPECIAL MEETINGS

A. The Contractor shall schedule special meetings per the requirements of the LEED Specification, the Project Quality Management Plan, the Commissioning Plan and as indicated by other specifications.
B. Special meetings include but are not limited to the following:
   1. Waste Management Conference
   2. Equipment start up meetings
   3. Testing and balancing meetings
   4. Commissioning meetings
   5. Other meetings as necessitated by the contract documents

END OF SECTION

SECTION 01 31 23
PROJECT MANAGEMENT WEB SITE

PART 1 – GENERAL

1.1. GENERAL DESCRIPTION

A. The City of Madison (CoM) has established a web based Project Management Tool (PMT) using a Microsoft product called SharePoint (SP).

B. The software is used throughout the design, construction and warranty process of major remodels and new construction projects executed as a City of Madison, Board of Public Works project.

C. Initially deployed in mid 2013, the PMT software has been successfully deployed on several projects, and we continue to modify/update/enhance the PMT on a regular basis.

1.2. SHAREPOINT PROCEDURE OVERVIEW

A. The CoM PMT is a system of consolidated Document & Form Libraries and Data Lists that assist in performing day to day functions of design/construction management while reducing the use of surface mail, email and email attachments.

1. Document libraries store a wide variety of documents in many different formats including but not limited to Word, Excel, PDF, photographs (all popular formats), etc.
2. Data Lists contain consolidated data information that can be generated and stored for further use. Punch Lists and Warranty issues will be examples of Data Lists.
3. Form libraries contain snapshot information associated with a particular Data Entry form. An example of this is the Quality Management Observation form.

B. The following libraries and sub-libraries on the PMWS are provided for specific workflows and contract documentation. Related specification numbers are in "( )" if applicable.

Contract Documents	Construction Administration	Construction Progress	LEED Documentation	Quality Control	Construction Closeout
Signed Contract	*Change Order Requests (COR Form) (01 26 57)*	*Schedules (01 32 16)*	*LEED Documents*	*Regulatory Inspections*	*Misc Closeout Documents*
GC Partial Pay Apps (01 29 76)	*Change Orders (CO Form) (01 26 63)*	*Progress Meetings (01 31 19)*	*Waste Management (01 74 19)*	*Commissioning Checklists*	*O & M Manuals (01 78 23)*
Construction Documents	*Construction Bulletins (CB Form) (01 26 46)*	*Daily Journal (DJ Form) (01 32 26)*		*System Performance Tests*	*Product Warranties /Guarantees (01 78 36)*
Regulatory Documents	*Request for Information (RFI Form) (01 26 13)*			*Quality Management Observation (QMO Form) (01 45 16)*	*As-Builts (01 78 39)*
Testing Contract	*Submittals (SUB Form) (01 33 23)*			*Safety and Incident Reports*	*Attic Stock (01 78 23)*
				Material Testing & Field Reports	*Demonstration and Training (01 79 00)*
					Warranty Issues (WI Form) (01 78 23)

C. A tutorial document on the web based PMT will be provided to the General Contractor (GC) who is awarded the contract. Additional training will be provided as needed for the GC and Sub-Contractors (SC) by the CoM.

D. The PMT has predefined work flows that channel automated alerts as documents are uploaded, reviewed, and completed. These workflows are designed for inbound information from the contractor as well as outbound information from the Architectural/Engineer consultant and the Owner.

E. The GC will be required to receive email notifications, access the internet to review related documentation and be able to upload/download documentation to the various project libraries.

F. The SC's will be required (at a minimum) to receive email notifications and access the internet to review related documentation. Prior to setting up the final PMT the GC and CPM shall meet to review all SP workflows, the GC will determine to what level over the minimum requirements the SC's will be involved.

1.3. RELATED SPECIFICATIONS

A. The following specification sections are directly related to the CoM PMT system.

1. 01 26 13 Request for Information (RFI)
2. 01 26 46 Construction Bulletins (CB)
3. 01 26 57 Change Order Request (COR)
4. 01 26 63 Change Order (CO)
5. 01 29 76 Progress Payment Procedures
6. 01 31 19 Project Meetings
7. 01 32 16 Construction Progress Schedules
8. 01 32 26 Construction Progress Reporting
9. 01 32 33 Photographic Documentation
10. 01 33 23 Submittals
11. 01 45 16 Field Quality Control Procedures (Owner)

PART 2 - PRODUCTS

2.1. SHAREPOINT SYSTEM RELATED PRODUCTS

A. SharePoint is a Microsoft Windows based software that requires no additional software installation, hardware or other special requirements/applications for the users. There are no costs associated with the use of this system.

B. Currently the CoM is using SharePoint 2010.

1. SharePoint works best if the user's computer is running Windows versions 7 through 8.1.
2. SharePoint works best when used with Internet Explorer versions 7, 8 and 9 (32 bit).
   a. At this time SharePoint is not fully supported by Internet Explorer versions 10 and 11.
   b. At this time SharePoint is not entirely compatible with other internet browsers such as Fire Fox, Google Chrome, and Safari.

PART 3 - EXECUTION

3.1. POST BID-OPENING

A. After bids have been opened, a successful bidder has been determined, and bid acceptance procedures have been initiated the City Project Manager (CPM) will contact the GC to provide the following information.

1. Project Management Software Tutorial. This tutorial is in a PDF printable format with screen shots and associated instructions on how to access and use the PMT.
   a. Tutorial instructions will include but not be limited to the following:
      i. Descriptions of various libraries, documents, and forms that will be used throughout the construction project.
      ii. Uploading procedures for various types of documents including standardized naming conventions.
2. A blank Project Directory in an Excel spread sheet format. The contractor shall provide the following information for GC and SC staffs as indicated on the spreadsheet. This will generally be the Project Manager for the GC as well as the Sub-contractors and the GC Site Supervisor.
   a. Last Name, First Name
   b. Company Name
   c. Email address (valid, work related)
   d. Work Phone Number (required, include area code)
   e. Cell Phone Number (not required, include area code)

3. The GC shall provide the above information for all SC's where the GC is not self-performing the work.
4. The GC may provide project foreperson information for work being self performed if he/she so desires.

3.2. POST PRE-CONSTRUCTION MEETING

A. The GCPM will return the completed Project Directory spread sheet to the CPM no later than the Pre-construction meeting.

B. The CPM is responsible for uploading all project directory data into SharePoint and coordinating with CoM Information Technology (CoM-IT) for creating the logins and passwords of non-city staff (GC/SC staffs).

C. All GC/SC staff will be notified through an automated email from CoM IT that logins and passwords are available. It is the responsibility of each GC/SC to call the CoM-IT number provided in the email to receive his/her login/password over the phone. Logins and passwords will not be released via email.

D. Once the GCPM has received his/her login/password uploading of contract related documents can begin. This would include but not be limited to project schedules, submittals, RFI's, and other documents as needed.

E. All workflows, review of documentation, and general archiving of construction related documentation will be conducted on the PMWS. These documents will generally not be emailed.

F. The following documents related to the execution of the contract will not be part of the PMWS:
   1. All documentation related to executing the contract, such as:
      a. Sub Contractors list
      b. Affirmative Action documentation
      c. Bonding documentation
      d. Documentation associated with payroll verification
      e. Final documentation associated with closing out the contract
   2. Any documentation required/generated by ordinance, code or statute, such as;
      a. Erosion Control inspections
      b. Building Inspection Department inspections

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULES

PART 1 – GENERAL

1.1. SCOPE

A. This specification is to identify various project related schedules associated with indicating construction progress and outlook. The following schedules are the responsibility of the General Contractor (GC).
   1. Overall Project Schedule
   2. 6 Week Look-out Schedule

B. This specification is not intended to include internal schedules generated by the contractors during their planning and execution of the contract.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 31 23 Project Management Web Site
C. Section 01 31 19 Progress Meetings
D. Section 01 74 13 Progress Cleaning
E. Section 01 77 00 Closeout Procedures
F. Section 01 78 23 Operation and Maintenance Data
G. Section 01 78 36 Warranties
H. Section 01 78 39 As-Built Drawings
I. Section 01 78 43 Spare Parts and Extra Materials
J. Section 01 79 00 Demonstration and Training
K. Section 01 91 00 Commissioning
L. Other specification within the construction documents that may indicate the need for scheduling any event with Owner, Project Architect, Owner Representatives, including any owner provided equipment.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. OVERALL PROJECT SCHEDULE (OPS)

A. The GC shall prepare an OPS that covers the duration of the contract from the pre-construction meeting through the end of construction to final contract closeout.
   1. The GC shall review Specification 01 77 00 Closeout Procedures to become familiar with definitions, differences, and requirements for closing out the construction and contract including the association with progress payments.
B. The GC shall provide copies and lead a discussion on the OPS during the pre-construction meeting.
C. The OPS shall indicate start and end dates of each task associated with the project.
D. The OPS shall clearly indicate the critical path of the project.
E. The GC shall update the OPS as often as necessary during the duration of the project. Updates will be briefed as needed during bi-weekly progress meetings.

3.2. 6 WEEK LOOK-OUT SCHEDULES (LOS)

A. The GC shall prepare the initial LOS to include detail of daily tasks for the first six (6) weeks of construction in depth for the Pre-construction meeting. The LOS shall be compatible and complimentary to the OPS.
B. The GC shall provide copies and lead a discussion on the LOS during the pre-construction meeting.

C. The LOS shall indicate start and end dates of each major task, associated related sub-tasks, and required parallel or pre-requisite tasks required to complete the major task on time.

D. The LOS shall also include identifying and scheduling such events as:
   1. Pre-installation meetings and mock-up review meetings.
   2. Quality management reviews of installations before they are covered.
   3. Owner provided equipment as designated by the contract documents.
   4. Work by others as designated by the contract documents.
   5. Critical submittal dates.

E. The GC shall update the LOS prior to each bi-weekly progress meeting to indicate the next 6 weeks of scheduled work. Updates will be briefed during each bi-weekly progress meeting.

3.3. PROJECT MANAGEMENT WEB SITE (PMWS)

A. The GC shall upload all project schedules and updates to the PMWS in an original PDF version of the scheduling document. Scans will not be permitted.

END OF SECTION

SECTION 01 32 19
SUBMITTALS SCHEDULE

PART 1 – GENERAL

1.1. SUMMARY

A. The General Contractor shall submit a complete and comprehensive list of all submittals anticipated during the execution of this contract.

B. The GC shall include the Administrative submittals identified in item 1.5 below and shall be required to up load them to the Project Management Web Site.

C. The initial Submittals Schedule shall be based on the original contract documents used at the time of bidding and any posted addenda through awarding of the contract.

D. The Submittal Schedule may be appended during the execution of the contract based on amendments to the contract in the form of Change Orders, Construction Bulletins, and other related documents that add, or change the scope of the work.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 31 23 Project Management Web Site
C. Section 01 33 23 Submittals
D. Section 01 91 00 Commissioning

1.3. RELATED DOCUMENTS

A. The following documents shall be used as the basis for initiating the original Submittals Schedule.
   1. Drawing documents and specifications (including general provisions) as provided with the bid set documents and any published addenda.

B. The following documents shall be used to amend the submittals schedule as needed during the execution of this contract.
   1. Documents associated with revisions or clarifications to number A.1 above after awarding of the contract, including but not limited to:
      a. Construction Bulletins
      b. Approved Change Orders

1.4. SUBMITTAL DEFINITIONS

A. Administrative Submittal: Any submittal that may be required by a Division 1 Specification and as noted in Section 1.5 below.

B. Critical Path Submittal: Any early submittal that needs a priority review due to early construction use or long lead times where a delay could affect the critical path of the construction schedule

C. Submittal: Any material, product, equipment, or general requirement as outlined in this and other specifications that require a favorable review or acceptance prior to proceeding with procuring the item or proceeding with the Work.

1.5. SUBMITTAL REQUIREMENTS

A. The GC and all Sub-contractors shall review the construction documents including the specifications of their individual Division or Trade to compile a complete list of all materials, products, or equipment that will require a positively reviewed submittal to be completed prior to procurement and installation.
   1. Submittals shall include but not be limited to any of the following that may apply:
      a. Shop Drawings
      b. Product Data
      c. Assembly Drawings
      d. Engineered Drawings
      e. Product Samples

B. The following items will require an approved submittal, verify with specifications for specific needs and requirements:
   1. Contractor certifications for specialized work such as asbestos removal, well drilling, controls, AV, etc.

1.6. ADMINISTRATIVE SUBMITTALS

A. The GC shall upload the following submittals within 15 working days of receipt of the City of Madison Start Work Letter. All Administrative Submittals shall be approved prior to requesting Progress Payment Number 1.
   1. Contractors Project Directory, see specification 01 31 23, discuss requirements with CPM
   2. Schedule of Values, see Specification 01 29 73
   3. Submittals Schedule, see Specification 01 32 19
   4. Waste Management Plan, see Specification 01 74 19
   5. Closeout Requirement Checklist, see Specification 01 77 00
   6. Warranty Checklist, see Specification 01 78 36

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. OVERALL RESPONSIBILITIES OF ALL CONTRACTORS

A. All contractors shall be responsible for reviewing the drawings and specifications within their Divisions of Work to provide a complete and comprehensive list of submittals to the General Contractor.

B. Each list shall indicate the title of the submittal, the associated specification of the submittal, whether the submittal can be considered an early/middle/late submittal, the anticipated date the submittal will be provided and the anticipated date the submittal needs to be approved.

C. Contractors shall be aware that the goals for submittal review by the Architect staff and City staff will be as follows:
   1. For items on the Critical Path as identified by the GC, five (5) working days
   2. For most other submittals ten (10) working days
   3. Additional time may be needed for complex submittals or if re-submittals are required.

D. The general format of the Submittal Schedule shall be tabular as per this example:

Title	Specification	Critical Path (Y or N)	Date provided	Date required	Remarks
Concrete Mix Design	03 30 00	Y	Oct 1, 2014	Oct 15, 2014	
Paint Draw Downs	09 90 00	N	Jan 2, 2015	Jan 20, 2015	

3.2. GENERAL CONTRACTORS RESPONSIBILITIES

A. The General Contractor shall be responsible for all of the following:
   1. Consolidating all submittal lists from individual contractors into one master list.
   2. Reviewing all submitted lists for completeness, timing with the overall contract, etc. The GC shall meet with individual contractors to make changes as necessary.
   3. Upload the completed Submittals Schedule to the Submittal Library on the Project Management Web Site for review as SD 003.0. See Specification 01 33 23 Submittals for more information on this procedure.
   4. Resubmit the schedule as needed after initial reviews have been completed.

B. The GC shall work with other contractors to amend the Submittals Schedule throughout the execution of the project based on changes and modifications as needed.

C. The GC and Project Architect shall be responsible for reviewing and briefing the submittal schedule and submittals status at each bi-weekly construction meeting.

3.3. STAFF REVIEW RESPONSIBILITIES

A. The Project Architect, consulting staff, Commissioning Agent (CxA), Owner, and city staff will review the Submittal Schedule for completeness per the plans and specifications within their divisions of work. The reviewing staff may provide comments as needed. Some examples might include the following:
   1. Submittal not required
   2. Provide photos of samples with digital submittal
   3. Insure one submittal for complete system
   4. Append the schedule to include…
   5. See Specification <xyz> for additional requirements

B. The Project Architect and City Project Manager will finalize review comments regarding the Submittal Schedule. Re-submittal of the submittal schedule may be required.

END OF SECTION

SECTION 01 32 26
CONSTRUCTION PROGRESS REPORTING

PART 1 – GENERAL

1.1. SUMMARY

A. Daily records of project activities, resources used, weather conditions, and other information related to the ongoing progress of the project are extremely important at all levels of Construction Management.

B. Daily records provide the base for weekly progress reports and updating progress schedules.

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 31 19 Project Meetings

B. Section 01 31 23 Project Management Web Site

C. Section 01 32 23 Photographic Documentation

1.3. PERFORMANCE AND QUALITY ASSURANCE REQUIREMENTS

A. The General Contractor (GC) shall be responsible for all Construction Progress Reporting as outlined in this and other specifications as noted.

B. The GC shall maintain daily progress journals in a format of his/her choosing provided it is legible and contains the information as outlined in Section3.1 below.

C. The journal shall be located in the job trailer and shall be reviewable by the Project Architect or City Project Manager if so requested.

PART 2 – PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. DAILY PROGRESS JOURNAL

A. The GC shall maintain a daily progress journal of daily Work activities for each day on which Work is performed by any employee or entity for which the GC is responsible. Such reports shall include all relevant data concerning the progress of Work activities the GC and Subcontractors are responsible for and the effect of that activity on the time of performance of the Contract.

B. Journal entries shall be made on the Daily Work Report Form located in the Construction Progress-Daily Journal Library on the Project Management Web Site. The form consists of the following areas:

1. Weather; include temperature, humidity, precipitation, wind and other related information such as significant storm events, times, and details.
2. Work completed by trade
3. Delays encountered
4. Deliveries received or delayed
5. Hot issues that need to be addressed
6. Safety issues
7. Photograph progress and upload to the Photo Library on the Project Management Web Site.
8. Other including inspections, testing, etc.
9. Space for attaching documents

C. Daily Work activity reports shall be completed and signed by the GC's Job Superintendent or other on-site representative authorized by the GC confirming each such report is current, accurate and complete.

D. If applicable the GC shall include schedules of quantities and costs, progress schedules, wage rates, reports, estimates, invoices, records and other data as requested by the CPM concerning Work performed or to be

performed under this Contract if the CPM determines such information is needed to substantiate Change Order proposals, claims, or to resolve disputes.

3.2. CONSTRUCTION PROGRESS MEETINGS

A. The GC shall provide a verbal summary of the previous two (2) weeks progress reports at each bi-weekly construction progress meeting.

END OF SECTION

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL

1.1. SCOPE

A. The General Contractor (GC) shall be required to take weekly digital photographs of construction progress and upload the photos directly to the Project Management Web Site (PMWS).

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 31 23 Project Management Web Site
B. Section 01 32 26 Construction Progress Reporting

PART 2 – PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. REQUIREMENTS FOR DIGITAL PHOTOGRAPHS

A. All digital photographs shall be taken with a good quality digital camera, cell phone, tablet, and other such digital device.
B. Digital photographs shall be properly zoomed in/out to capture a specific level of detail as necessary.
C. Digital photographs shall be formatted to achieve a good, clear, and detailed image where the final file size is between 600 KB and 1.2 MB (1200KB).
D. The camera default naming convention is acceptable. The GC does not need to rename or specifically identify pictures in the title.
E. All digital photographs shall be saved in a JPEG (.jpg) format and uploaded directly to the PMWS.

3.2. PICTURE CONTENT

A. The GC shall take exterior photographs from at least two (2) different angles.
   1. This requirement shall only be applicable when there is exterior work connected with the project.
   2. When applicable this requirement shall begin prior to commencing any site work.
   3. This requirement shall end when the exterior work has been substantially completed.
   4. This requirement may be suspended due to weather conditions or substantial delays in exterior progress.
B. The GC shall take interior photographs of interior construction, equipment installation, rough-ins and other such progress that helps document weekly progress reporting. Interior photographs should focus on specific significant installations as well as general progress throughout the progress of the contract.

3.3. PROJECT MANAGEMENT WEB SITE

A. The GC shall upload the digital photographs to the appropriate progress folder in the Project Images Library.
B. Progress folders are labeled with the Construction Week Number and the date for Monday of that week.
C. The GC shall notify the City of Madison Project Manager if additional progress folders need to be created.

END OF SECTION

SECTION 01 33 23
SUBMITTALS

PART 1 – GENERAL

1.1. SUMMARY

A. The General Contractor (GC) shall be responsible for providing submittals for review of all contractors and sub-contractors as designated in the construction documents. Submittals shall include but not be limited to all of the following:
   1. Equipment specified and pre-approved in the specification; to ensure quality, construction, and performance specifications have not changed since final design.
   2. Equipment specified by performance in the specification; to ensure that the intended quality, construction, and performance specified is met by the selected material or product.
   3. Shop, piece, erection, and other such drawings as indicated in the specifications to ensure all structural, dimensional, and assembly requirements are being met.
   4. Submittals indicating installation sequencing
   5. Submittals indicating control sequencing
   6. Contractor licensing, certification, and other such regulatory documentation when required by a specification.
   7. Other submittals as may be required by individual specifications.

B. The submittal process shall not be used to determine alternates to specified products or equipment. All considerations shall be reviewed during the bidding process and acceptable alternates shall be acknowledged by addendum prior to the closing of bidding. See bidding instructions for the information on submitting alternates for consideration.

D. In the event that a manufacturer has significantly changed a product (discontinued a model, changed dimension or performance data changed available colors, etc.) since bid opening the GC shall submit a Request for Information (RFI) to the Project Architect requesting other approved alternates prior to uploading a digital submittal.

E. Contractors and sub-contractors shall be responsible for knowing the submittal requirements of ALL sections within their scope of work under the contract. The Owner reserves the right to request documentation on any materials, equipment, or product being installed where a submittal is not on file. If the material, equipment, or product installed is determined not to meet the intent of the specification the contractor/sub-contractor shall be required to remove and replace the items involved. The GC shall be solely responsible for all costs associated with the removal and replacement.

1.2. RELATED REFERENCES

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 31 23 Project Management Web Site
C. Section 01 32 19 Submittals Schedule
D. Section 01 32 26 Construction Progress Reporting
E. Section 01 91 00 Commissioning
F. All Technical Specifications, contract documents, construction drawings, and any published addendums during the bidding process.
G. All contract documents generated during the execution of the contract including but not limited to Requests for Information (RFI) and Construction Bulletins (CB).

1.3. SUBMITTAL REQUIREMENTS

A. A completed submittal shall meet the following requirements:

1. Digital submittal shall be original PDF of manufacturer's data sheets or high quality color scan of the same.
    a. Submittals shall not include sales fliers or other similar documents that typically do not provide complete manufacturers data.
2. Documents within the PDF submittal shall be printable to a sized sheet no less than 8-1/2 by 11 inches and no larger than 24 by 36 inches.
3. At the beginning of each submittal the contractor shall identify the plan reference (WC-1, EF-3, etc.) in RED block letters that the submittal is for.
4. Where multiple model numbers appear in a table the contractor shall identify the specific model being submitted by using a RED square, box, or other designation to distinguish the correct model from others on the page.

B. A complete submittal will include all information associated with the product or equipment as presented in plans, equipment tables, and specifications. Information shall include but not be limited to the following:
1. Dimensional data
2. Performance data
3. Resource requirements, power, water, waste, etc
4. Clearance and maintenance requirements
5. Finish information, colors, textures, etc.
6. Warranty information

C. Where a submittal includes material samples (carpet, tile, paint draw downs, etc.) the contractor shall do the following:
1. The Contractor shall submit the sample(s) as indicated in the specification.
2. The Contractor shall include a quality photograph(s) of the product with the digital submittal. Photographs shall meet the following requirements:
    a. Formatted to be between 500Kb and 1.0 Mb in file size
    b. Have no glare or flash reflection on the sample
    c. Sample fills the frame of the photo and shows detail as needed. Include multiple photos from other angles as needed.
    d. Scanned copies of products or photos are not acceptable.

D. Uploaded submittals should be relative and related to a specific written specification.
1. Do not upload submittals under a broad category or division (I.E. HVAC 23 00 00). Always upload by the specific specification that identifies a required product or performance to be met.
2. Group related items together if the specification is written that way. (I.E. all of the plumbing fixtures and trim relative to one specific specification should be submitted together).
3. Submittals shall be grouped and adhere to the divisions in the submittal schedule. Submittals that do not conform to the submittal schedule and/or specification divisions will be rejected for re-submittal.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL CONTRACTORS PROCEDURES

A. All required submittals will be uploaded to the Construction Administration-Submittal Drawings Library on the Project Management Web Site (PMWS) by the GC.
1. The GC shall open a new Submittal Form in the Submittals Drawings Library for each required submittal from the Submittals schedule.
2. Fill in required information on the form that will be used for routing the review and comments.
3. Attach all documentation as described in Section 1.3 above.
    a. Submit samples under separate cover to the Project Architect when necessary.

B. Uploading the submittal indicates that the GC has reviewed and approved the submittal against the contract document requirements.

C. The GC shall discuss submittal status at all progress meetings and shall monitor submittal review/approval/re-submittal so as to not incur delays in the project schedule.

D. A completed upload of the submittal to the PMWS initiates the review process workflow.

E. The GC and sub-contractors shall provide re-submittals as required.

3.2. SUBMITTAL REVIEW

A. Upon completion of the submittal upload by the GC the PMWS automatically notifies the appropriate Architect/Engineer and Owner Representative, including CxA, by Division/Specification number that there is a submittal for review.

B. The submittal shall be reviewed internally by the required Architect/Engineer and Owner Representative and CxA in a timely fashion and provide commentary on missing items, incorrect information, or incomplete shop drawings, etc as needed.

C. When the internal review is completed the PMWS will notify the Project Architect the submittal is ready for final review.

3.3. PROJECT ARCHITECTS REVIEW

A. Upon completion of the internal review the Project Architect shall review all internal review comments, confer with the CPM and CxA as needed and determine the appropriate disposition status for the submittal (approved or resubmit).

C. The Project Architect shall summarize final internal review comments onto the submittal cover sheet, provide a final disposition of the submittal and update the review status of the submittal to “Complete…” (with or w/o comments) or “Rejected”.

D. A completed Final Review status initiates the PMWS to notify the GC and appropriate sub-contractor(s) that the review of the submittal has been completed.

END OF SECTION

SECTION 01 43 39
MOCKUPS

PART 1 – GENERAL

1.1. SUMMARY

A. Definition
   1. Mockups are field samples constructed, applied, or assembled at the project site for review by the Owner, Owners Representative, Architect and Consultants.
   2. Mockups are three dimensional, true scale models that illustrate materials and methods, equipment, workmanship, or location; based on plans, details, and assemblies.

B. Approved mockups establish the standard of quality by which the final work will be judged.

C. Approved mockups shall be properly documented and entered Into the Submittal Library on the Project Management Web Site like any other required submittal. See section 3.4 below for more information.

1.2. RELATED SPECIFICATIONS

A.	Section 01 26 13	Request for Information (RFI)
B.	Section 01 26 46	Change Bulletin (CB)
C.	Section 01 26 63	Change Order (CO)
D.	Section 01 31 19	Project Meetings
E.	Section 01 32 16	Construction Progress Schedules
F.	Section 01 33 23	Submittals
G.	Section 01 45 00	Quality Control

1.3. RELATED DOCUMENTS

A. The following documents shall be used for preparing mockups.
   1. All plans, specifications, and details including those derived as revisions (RFI, CB, CO).
   2. Construction Progress Schedules. Mockups shall be done and completed in a timely fashion for review and approval so as to not impact the Contractors project schedule.
   3. Any Manufacturers installation/assembly instructions.

1.4. PERFORMANCE REQUIREMENTS

A. All Contractors shall be responsible for providing and constructing mockups as specified in their Division of Work in the plans and specifications.

B. Materials to be used shall be as specified in the construction documents, full sized and properly assembled.

C. Completed mockups shall be of sufficient size to provide visible detail of all components as needed for the sample.

1.5. QUALITY ASSURANCE

A. The General Contractor (GC) shall be responsible for coordinating all of the following as needed:
   1. Designating the location for the mockup construction
   2. Coordinating the work of all contractors and materials required to complete the mockup
   3. Ensuring that the mockup meets the intent of the construction documents before scheduling the mockup review meeting.

PART 2 - PRODUCTS

2.1. MATERIALS

A. The materials used in mockups shall be only those materials indicated in the plans, specifications, and favorably reviewed submittals.

B. Mockups shall be made of full scale materials as delivered to the project site.

C. All materials associated with a particular detail, construction method, manufacturer's installation instructions shall be properly represented and visible in the mockup. This includes but is not limited to finished mortar joints, sealants, backer rods, tie bars, rebar, etc.

PART 3 - EXECUTION

3.1. REVIEW THE PLANS AND SPECIFICATIONS

A. The GC shall review the plans and specifications with all required contractors prior to constructing the mockup.

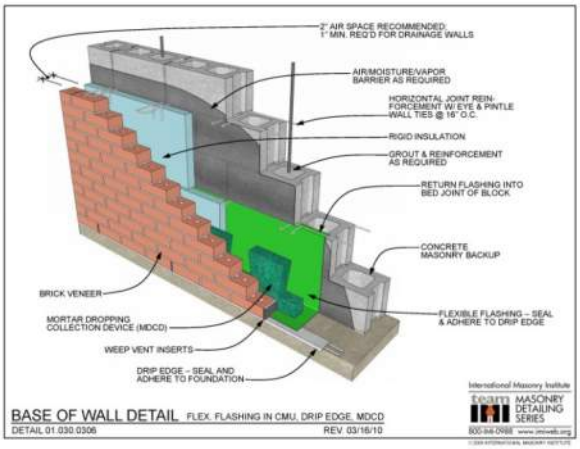
1. Mockups that will be built and remain in place, if favorably reviewed, will be installed in an area easily accessible for review.
2. Mockups that will not be built in place or will not remain will be constructed in a space on the project site protected from weather, construction traffic, and other such disturbances until such time as the associated work has been completed.
3. Insure all products being represented in the mockup meet the plans, specifications, and any published changes.

3.2. MOCKUP CONSTRUCTION

A. Mockups shall be of sufficient size to show various material adjacencies, connectivity, patterns, and other such related features.

B. Mockups shall be constructed in a layered fashion so that all products being used can be seen and evaluated.

C. The construction detail below is an example of a properly layered mockup.



D. **See Sheet 802 and SECTION 03 33 00 for mockup requirements**

3.3. MOCKUP REVIEW

A. The General Contractor and all associated Sub-contractors (Contracting Team) shall meet with the Owner, Owners Representative, Architect and Consultants (Design Team) as necessary to review the mock-up. Contractors shall be prepared to answer questions on materials and methods as necessary.

B. The Contracting and Design Teams shall review the mockup in detail for materials, methods, and workmanship with respect to the intent of the contract documents. Improvements or adjustments shall be discussed as needed.

C. If the mockup is incomplete or does not show sufficient detail of products and workmanship the General Contractor shall resubmit a new mockup.

D. Re-submittal of mockups to meet the intent of the contract documents shall be the responsibility of the General Contractor. No Change Orders will be processed for additional time or materials associated with re-submitting a mockup for approval.
   1. In the event that a submitted mockup meets the criteria of the contract documents but does not meet the expectations of the design team and alternative methods or materials are discussed the following procedure shall be used:
      a. Project Architect shall publish a Construction Bulletin (CB) to detail the required/recommended changes.
      b. The GC shall prepare and submit a new mockup.

3.4. FINAL SUBMITTAL

A. The field approved mockup shall be submitted by the General Contractor as any other submittal for project documentation purposes. The mockup submittal shall consist of the following:
   1. Digitally photograph the field approved mockup. Take as many detailed photos as necessary to capture the complexity of the mockup.
   2. Provide a written summary of the approved mockup. Include all recommended adjustments, level of expected workmanship, and other such detail as discussed during the mockup review.
   3. Submit the mockup to the Project Management Web Site. See Specification 01 33 23 Submittals for additional information.

END OF SECTION

SECTION 01 43 50
AIR BARRIER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, Division 07 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. This section includes administrative and procedural requirements for accomplishing an airtight building enclosure that controls infiltration or exfiltration of air.

B. Related Sections:
   1. Section 07 25 00: Weather Barriers.
   2. Requirements of this section relate to the coordination between subcontractors required to provide an airtight building enclosure, customized fabrication and installation procedures, not production of standard products.

1.3 DEFINITIONS

A. The airtight components of the building enclosure and the joints, junctures and transitions between materials, products, and assemblies forming the air-tightness of the building enclosure are called “the air barrier system”. Services include coordination between the trades, the proper scheduling and sequencing of the work, pre-construction meetings, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: The Contractor shall ensure that the intent of constructing the building enclosure with a continuous air barrier system to control air leakage into, or out of the conditioned space is achieved. The air barrier system shall have the following characteristics:
   1. It shall be continuous, with all joints sealed.
   2. It shall be structurally supported to withstand positive and negative air pressures applied to the building enclosure.
   3. Continuity of the air barrier materials and products with joints to provide complete assemblies.
   4. Continuity of all the enclosure assemblies with joints and transition materials to provide a whole building air barrier system.

B. Connection shall be made between:
   1. Foundation and walls.
   2. Walls and windows or doors.
   3. Different wall systems.
   4. Wall and roof.
   5. Wall and roof over unconditioned space.
   6. Walls, floor and roof across construction, control and expansion joints.
   7. Walls, floors and roof to utility, pipe and duct penetrations.

C. Air Barrier Penetrations: All penetrations of the air barrier and paths of air infiltration / exfiltration shall be made air-tight.

D. Compliance Requirements:

1. Assemblies: an air permeance not to exceed 0.03 cfm/ft2p under a pressure differential of 0.3 in. water (1.57psf) (0.15 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E1677.
2. Materials: Materials used for the air barrier system in the opaque envelope shall have an air permeance not to exceed 0.004 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178. Or,
3. Entire Building: The air leakage of the entire building (with the exception of the apparatus bay) shall not exceed 0.15 cfm/sf under a pressure differential of 0.3 in. water (1.57psf) (0.75 L/s.m2 @ 75 Pa) when tested according to ASTM E 779. The air leakage of the apparatus bay shall not exceed 0.4 cfm/sf under a pressure differential of 0.3 in. water (1.57psf) (0.75 L/s.m2 @ 75 Pa) when tested according to ASTM E 779.

1.5 SUBMITTALS

A. Field quality-control reports.

B. Testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

C. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making the inspection or test.
6. Designation of the Work and test method.
7. Identification of product and Specification Section.
8. Complete inspection or test data.
9. Test results and an interpretation of test results.
10. Ambient conditions at the time of sample taking and testing.
11. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting.

1.6 QUALITY ASSURANCE

A. Requirement for Contractor to provide an airtight building enclosure is not limited by quality-control services required by Architect, Owner, or authorities having jurisdiction and are not limited by provisions of this section.

B. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

1. Qualifications for Air Barrier Testing and Inspection Agencies: Engage Air Barrier inspection and testing service agencies, including independent testing laboratories, that are prequalified and that specialize in the types of air barrier system inspections and tests to be performed.

C. Specific quality-control requirements for individual construction activities are specified in the sections of the specifications. Requirements in those sections may also cover production of standard products. It is the Contractor's responsibility to ensure that each subcontractor is adequately and satisfactorily performing the quality assurance documentation, tests and procedures required by each section.

D. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.

1.7 PROJECT CONDITIONS

A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide coordination of the trades, and the sequence of construction to ensure continuity of the air barrier system joints, junctures and transitions between materials and assemblies of materials and products, from substructure to walls to roof. Provide quality assurance procedures, testing and verification as specified

herein. Facilitate inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction or by the Owner. Costs for these services are included in the Contract Sum.

B. Organize preconstruction meetings between the trades involved in the whole building's air barrier system to discuss where each trade begins and ends and the responsibility and sequence of installation of all the air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in the different sections, to be installed by the different trades.

C. Build a mock-up before proceeding with the work, satisfactory to the Architect, of each air-tight joint type, juncture, and transition between products. materials and assemblies.

D. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
   1. Provide access to the Work.
   2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
   3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
   4. Deliver samples to testing laboratories.
   5. Provide security and protection of samples and test equipment at the Project Site.

E. Duties of the Testing and Inspection Agency: The independent agency engaged to perform inspections, sampling, and testing of air barrier materials, components and assemblies specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.
   1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
   3. The agency shall not perform any duties of the Contractor.

F. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
   1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. Qualitative Testing and Inspection:
      a. Daily reports of observations, with copies to the Owner, Contractor and Architect.
      b. Continuity of the air barrier system throughout the building enclosure with no gaps, holes.
      c. Structural support of the air barrier system to withstand design air pressures.
      d. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions and mortar droppings, with mortar joints struck flush, or as required by the manufacturer of the air barrier material.
      e. Site conditions for application temperature and dryness of substrates.
      f. Maximum length of exposure time of materials to ultra-violet deterioration.
      g. Surfaces are properly primed.
      h. Laps in material are 2" minimum, shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
      i. Mastic applied on cut edges.
      j. Roller has been used to enhance adhesion.
      k. Measure application thickness of liquid-applied materials to manufacturer's specifications for the specific substrate.
      l. Materials used for compatibility.
      m. Transitions at changes in direction, and structural support at gaps.

n. Connections between assemblies (membrane and sealants) for cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.
o. All penetrations sealed.

2. ASTM E 1186/98 “Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems.”
a. Infrared scanning with pressurization/depressurization.
b. Smoke pencil with pressurization/depressurization.
c. Pressurization/depressurization with use of anemometer
d. Generated sound with sound detection
e. Tracer gas measurement of decay rate
f. Chamber pressurization/depressurization in conjunction with smoke tracers
g. Chamber depressurization using detection liquids

3. Quantitative Tests: Provide written test reports of all tests performed, with copies to the Owner, Contractor and Architect.
a. Material compliance for maximum air permeance, ASTM E 2178.
b. ASTM E 283, Determining rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.
c. Assemblies, ASTM E 1677, test pressure and allowable air leakage rate to be determined by design professional for interior design conditions and location of project.
d. CAN/CGSB 1986 Standard 149.10, Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method.
e. CAN/CGSB 1996 Standard 149.15 Determination of the Overall Envelope Airtightness of Office Buildings by the Fan Depressurization Method Using the Building’s Air Handling System.
f. Canadian National Master Specification Sections 07272 Air Barrier Systems for Exterior Walls of Low-Rise Buildings.
g. Canadian National Master Specification 07272.1 : Durability Assessment of Bead-Applied Urethane-Based Sealant Foam for Air Barriers.
h. Whole building, floors, or suites, ASTM E779, Determining Airtightness of Buildings Air Leakage Rate by Single Zone Air Pressurization.
i. Windows and connections to adjacent opaque assemblies, ASTM E783
j. Tracer gas testing, ASTM E741
k. Pressure test, ASTM E330
l. Bond to substrate, ASTM D4541-95
m. Minimum dry or wet film thickness for liquid-applied materials are per the manufacturer’s requirements.

3.2 REPAIR AND PROTECTION

A. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.

C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION

SECTION 01 45 16
FIELD QUALITY CONTROL PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

A. The City of Madison has developed a multi-faceted Quality Management Program that begins with contract signing and runs through contract closeout to ensure the best quality materials, workmanship, and product are delivered for the contracted Work.
   1. The Progress Management Web Site is a Construction Management tool that provides contractors and staff a single on-line location for the daily operations and progression of the Work.
   2. The Quality Management Observation (QMO) is an ongoing observation of the construction process as it progresses. The City of Madison does not use a "Punch List" or "Corrections List" as it is typically known throughout the construction industry. The QMO process acts as an "in progress punch list".
      a. By using the QMO process the City of Madison's goal is to have a zero item punch list prior to the 90% progress payment and owner occupancy.

B. All contractors shall be required to review the specifications identified in Section 1.2 below, and other related specifications identified therein to become familiar with the terminology and expectations of this City of Madison Public Works contract.

C. It is the intent of this specification to outline the requirements, expectations, and responsibilities of the General Contractor (GC), Project Architect, and other representatives of the Owner for items of Quality Assurance and Quality Control.
   1. This specification is not intended to conflict with Specification 01 40 00 Quality Requirements or other specifications requiring testing and inspecting services.
   2. This specification does not relieve the GC from any requirements associated with regulatory inspections performed by the City of Madison Building Inspection Unit, or inspectors from other agencies as required by code.
   3. Any testing performed by an Owner's Representative does not relieve the GC from performing any testing that may required by the construction documents.

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 26 13 Request for Information (RFI)
B. Section 01 29 76 Progress Payment Procedures
C. Section 01 31 13 Project Coordination
D. Section 01 31 23 Project Management Web Site
E. Section 01 40 00 Quality Requirements
F. Section 01 77 00 Closeout Procedures
G. Section 01 78 13 Completion and Correction List
H. Section 01 91 00 Commissioning

1.3. PERFORMANCE REQUIREMENTS

A. All contractors shall be responsible for a proper quality assurance/quality control (QA/QC) program throughout the execution of the Work defined within the construction documents, including all recognized construction industry standards and all applicable regulatory codes.

B. The GC shall be responsible for all of the following:
   1. Monitor the quality of all workmanship, supplies, materials, and products being installed by all contractors and installers to ensure they meet or exceed the minimum requirements set forth by the construction documents.
   2. Submit a Request for Information (RFI) whenever manufacturers' instructions or referenced standards conflict with the construction documents before proceeding with the Work.
   3. Ensure that Work requiring special certifications or licensing is being performed by is being performed and supervised by personnel that meet the appropriate requirements.
      a. Ensure that all certificates and licenses are current throughout the execution of the project.

C. The CoM and its representatives shall perform quality assurance and quality control activities throughout the execution of this project. This in no way relieves the GC of maintaining an acceptable QA/QC program. =

1.4. QUALITY ASSURANCE

A. The GC shall be responsible for the following:
   1. All materials, equipment, and products shall be new, clean, undamaged, and meet the performance specifications defined within the construction documents including favorably reviewed submittals.
      a. Any material, equipment, or product that does not meet the requirements of the construction documents shall be removed and replaced, including any adjacent and related work, at the GCs expense.
   2. All Work shall be performed by persons properly trained and/or qualified to produce workmanship of the quality specified in the construction documents.
   3. Providing access to updated as-builts, addenda, submittals, bulletins and other related construction documents at the project site.

B. The CoM and its representatives may be responsible for any of the following:
   1. Attend pre-installation meetings
   2. Attend construction progress meetings
   3. Review all submittals
   4. Conduct field visits for QA/QC purposes, provide feedback to the GC and sub-contractors using Quality Management Observation (QMO) reports.
   5. Review delivered equipment
   6. Witness equipment installations, startups, testing as specified in other specifications

1.5. QUALITY MANAGEMENT OBSERVATION REPORT

A. The Quality Management Observation report or QMO is used as a QA/QC tool by those entities responsible for QA/QC activities, including but not limited to, the GC, CoM, PA, CX agent, etc.

B. QMOs are designed to be an early observation of non-conforming construction work before it becomes buried by follow on work. As such it is most often used as an "in progress punch list".

C. QMO forms are part of the Quality Control Library on the Project Management Web Site.

PART 2 – PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. QUALITY MANAGEMENT RESPONSIBILITIES

A. While making routine progress visits to the construction project the GC, CPM, CxA and A/E, and applicable others shall observe the details of the construction and installations to ensure that the intent of the construction documents is being followed.

B. If during the progress visit there is a determination of contract non-conformance a QMO report shall be initiated to begin the documentation process.
   1. The GC field superintendent shall be informed immediately of any issue that may cause harm, damage to finished work, or be buried prior to properly filing a QMO report.

C. The following information when filing a QMO report:
   1. Open a QMO report in the Quality Control Library on the Project Management Web Site
   2. Enter the date and time of the field visit
   2. Provide references to construction documents if any (examples; specification, drawing page, details, approved submittals, RFI, CB, etc)
   3. Provide a short title for the observation being made
   4. Provide a detailed description of the observation being made

5. Select all categories (Sitework, Structure, Enclosure, Interior, etc) from the given list that may apply to the observation being reported.
    a. For each category selected additional boxes shall open with contractor names associated with each category.
6. Select all contractors from the lists provided that may need to be aware of the observation.
7. Provide any attachments that may help provide reference to the observation.
8. Click the SAVE button before closing the form.

D. The software for the Project Management Website will email notifications that a QMO report has been initiated. The software will automatically select and notify the following:
1. The GC, PA, and CPM for all observation reports being filed.
2. Others depending on the observation categories selected.
3. Contractors based on the selections made in the sub-contractors lists.

3.2. RESPONDING TO A QMO

A. All contractors receiving email notification of a QMO Observation shall review the details of the observation.
B. The GC shall be responsible for determining the course of action required to remedy the non-conforming issue and shall coordinate and direct the contractor(s) responsible for any work related to the observation.
C. All contractors assigned to remedy the observation by the GC shall provide follow-up responses on the QMO report as follows:
1. Open the QMO report in the Quality Control Library on the Project Management Web Site.
2. In the “Follow-Up Response” area enter a description of your follow-up response in the box provided.
    a. Click “Insert Item” if additional boxes are required.
3. Add attachments (pictures) if needed to show the work has been completed.
4. Click the SAVE button before closing the form.

3.3. GENERAL CONTRACTORS FOLLOW-UP

A. The GC shall inspect the work to ensure that all assigned contractors have remedied the observation to the intent of the construction documents.
B. The GC shall respond with any additional comments in his/her response box.
1. If no comments are to be made the GC at a minimum must date the response box to trigger the next work flow.
C. Click the SAVE button before closing the form.
D. The software will email a notification to the CPM and the person who initiated the QMO that the issue has been remedied.

3.4. QMO CLOSEOUT PROCEDURE

A. The person who initiated the QMO shall review the remedied work and if properly corrected shall close and date the QMO form.
1. Click SAVE and the software will email a notification to the CPM that final review of the Observation is required.
2. In the event there are still issues the Quality Manager can add additional comments in the response area, click SAVE and re-issue the QMO for additional review as needed.
B. Once the person who initiated the QMO has closed the item the CPM shall review and verify with the PA that the Observation has been properly remedied and provide final closure on the QMO.

3.5. CONSTRUCTION CLOSEOUT

A. The GC shall note that successful close out QMOs are required for construction closeout as follows:
1. Certain progress payments as identified in Specification 01 29 76 are contingent QMO reports being properly closed out.
2. Specification 01 77 00 defines all construction closeout requirements.

END OF SECTION

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.1. REQUIREMENTS INCLUDED

A. The Contractor shall employ and pay for the services of an independent testing laboratory to perform specified services and testing.

B. Testing Laboratory inspection, sampling and testing is required for:

1. Section 03 30 00: Cast-In-Place Concrete
2. Section 05 12 00: Structural Steel Framing
3. Section 05 40 00: Cold-Formed Steel Framing
4. Section 31 20 00: Earthwork

1.2. RELATED REQUIREMENTS

A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.

B. Related Requirements Specified in Other Sections:

1. Division 22 and 23: Testing of Mechanical Systems
2. Division 26: Testing of Electrical Systems

1.3. QUALIFICATION OF LABORATORY

A. Meet "Recommended Requirements of Independent Laboratory Qualification" published by American Council of Independent Laboratories.

B. Meet basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."

C. Authorized to operate in State in which the Project is located.

1.4. LABORATORY DUTIES

A. Cooperate with Owner, A/E and Contractor; provide qualified personnel after due notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction:

1. Comply with specified standards.
2. Ascertain compliance of materials with requirements of Contract Documents.

C. Promptly notify the Owner, A/E and Contractor of observed irregularities or deficiencies of work or products.

D. Promptly submit written report of each test and inspection; one copy each to A/E, Consulting Engineer, Owner and Contractor. Each report shall include:

1. Date issued.
2. Project Title and number.
3. Testing laboratory name, address and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.
7. Date of test.
8. Identification of product and specification section.
9. Location of sample or test in the Project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.

12. Interpretation of test results, when requested by A/E or the Contractor.

E. Perform additional tests as required by Owner, A/E or the Contractor.

1.5. LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:
1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portions of the Work other than those portions of the Work scheduled for testing.
3. Perform any duties of the Contractor.

1.6. CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to Work and to manufacturer's operations.

B. Secure and deliver to the laboratory, adequate quantities of representative samples of materials proposed to be used and which require testing. Submit concrete mix designs to A/E for approval prior to pouring concrete.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes that require control by the testing laboratory.

D. Furnish copies of Product test reports as required.

E. Furnish incidental labor and facilities:
1. To provide access to Work to be tested.
2. To obtain and handle samples at the Project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

G. Make arrangements with laboratory and pay for additional samples and tests required for Contractor's convenience.

H. Employ and pay for the services of a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required when initial tests indicate work does not comply with Contract Documents.

I. Temporarily halt the progress of the Work when tested materials do not comply with Contract Documents and promptly notify the Owner or his designated representative and A/E.

J. Remove and replace at no cost to the Owner, all defective materials discovered upon testing not to comply with Contract Documents, including cost for retesting and re-inspecting replaced Work that failed to comply with the Contract Documents.

1.7. SPECIFIC TEST, INSPECTIONS, AND METHODS REQUIRED

A. **Section 03 30 00: Cast-In-Place Concrete**
1. Secure sample of aggregates Contractor proposes to use and test for compliance with Specifications.
2. Certify compliance with Specifications of cement proposed for use by the Contractor.
3. Review and approve the Contractor's proposed concrete mix proportions for the required concrete strengths using materials Contractor proposed to use on the project. Incorporate specified admixtures and not less than amounts of cement specified.
4. Perform appropriate laboratory tests, including compression tests of cylinders and slump test to substantiate mix designs.
5. Inspect and test materials during concrete work to substantiate compliance with Specifications and mix requirements.
a. Testing:
i. Sample and test concrete in accordance with ASTM C 31, ASTM C 143, ASTM C 172, and ASTM C 231.
ii. Perform slump tests in accord with ASTM C 143 from same concrete batch used for test cylinders and record results and comments on compression test reports.
iii. Perform compression tests in accordance with ASTM C39.
iv. When air-entrained concrete is used, a minimum of one (1) air content test shall be performed in accordance with ASTM C 231 for each set of test cylinders taken.
v. Identify all test cylinders with symbols to indicate location on the job where concrete test was made. Record on project record drawings.
vi. Strength tests shall be made for: each day's pour; each class of concrete; each change of supplies or sources; and for each 100 cubic yards of concrete or fraction thereof.

vii. One slump test shall be made for each set of test cylinders taken following the procedure in ASTM C 143.

b. Test Cylinders for all Concrete

i. Each test shall consist of a minimum of four cylinders.

ii. Make test cylinders in conformity with ASTM C 31.

iii. After 24 hours three cylinders to be carefully transported to the testing laboratory for moisture curing and one cylinder to be field cured.

iv. One field cured cylinder to be tested at 7 days and two laboratory cured cylinders to be tested at 28 days. Reserve one cylinder for further testing.

v. The average of all strength tests representing each class of concrete, as well as the average of any three consecutive strength tests for each class of concrete, shall be equal to or greater than the specified strength.

vi. If the A/E has reason to believe that cylinder strength tests are not representative of the strength of concrete in place, A/E shall require drilled cores to be cut and tested at the Contractor's expense. Coring and testing shall be in accordance with ASTM C 42 Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

B. **Section 05 12 00: Structural Steel Framing**

1. Welding:

a. Provide inspection of shop and field welding in accordance with Section 6 of AWS D1.1.

b. Visually inspect all welds, perform appropriate non-destructive tests on apparent defective welds. Verify conformance with Specifications.

c. Non-destructive testing shall be performed on 20 percent of the total length of all full penetration welds. If a sufficient number of welds are deficient, additional testing may be performed at the discretion of the testing lab, at no cost to Owner.

2. Bolting:

a. Visually inspect all connections for proper number, size and type of bolt.

b. Review all bolted connections for compliance with "snug tight" requirements of AISC.

c. No Slip-critical (SC) connections/bolts are required for this project.

d. Shear Connectors, Headed/Deformed Bar Concrete Anchors:

i. Verify pre-production test records for installation of shear connectors, concrete anchors and threaded studs.

ii. Shear connectors shall be struck with a hammer. Those not producing a "clean" pinging sound indicative of a fully attached shear connector shall be bent 15 degrees off vertical towards the nearest support by striking with a hammer. If shear connector does not become loose and weld is not broken, it shall be considered acceptable, and shall be left in the bent position. Replace failing shear connectors and test as before.

iii. A visual inspection shall be made of shear connectors and headed/deformed bar concrete anchors after installation. If visual inspection reveals that a sound weld and a 360 degree flash has not been obtained, the connector/anchor shall also be tested by bending a minimum of 15 degrees off vertical opposite to the missing weld/flash, irrespective of the results of the "ping" test required for shear connectors. If the connector/anchor does not become loose it shall be considered acceptable and shall be left in this position. Replace failing connector/anchors and inspect as before.

C. **Section 05 40 00: Cold Formed Steel Framing**

1. As directed by A/E, Contractor's testing agency may inspect the maintenance of a quality control program including spot checking weldments and welding procedures in accordance with AWS standards.

D. **Section 31 20 00: Soil Compaction Control and Trenching and Backfilling**

1. Soils Engineer to be onsite during excavation operation.

2. Visually inspect, test, and certify that exposed undisturbed underlying soil is suitable for required footing bearing capacity and placement of fills.

3. Maximum and minimum density of fill soil for compaction percentage of relative density and moisture density shall be determined in accordance with ASTM Designation D 1557. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

4. Number of tests as follows:

a. Subgrade, Undisturbed and Demolition Surfaces: Visual inspection and probe; test if required.

b. Interior Fills: One test per 2,500 sq. ft for each two foot or less lift.

c. Exterior Fills: One test per 2,500 sq. ft for each two foot or less lift.

d. Utility Trenches: One test per 50 lineal feet for each two foot or less lift.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes general procedural requirements for temporary facilities and controls including, but not limited to the following:
   1. Temporary Utilities
   2. Telecommunications Services
   3. Temporary Sanitary Facilities
   4. Barriers
   5. Fencing
   6. Exterior Enclosures
   7. Security
   8. Vehicular Access and Parking
   6. Waste Removal
   7. Project Identification
   8. Field Offices

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 31 19 Progress Meetings
B. Section 01 31 23 Project Management Web Site
C. Section 01 74 19 Construction Waste Management and Disposal

1.3. QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
   1. Building Code requirements
   2. Health and safety regulations
   3. Utility company regulations
   4. Police, Fire Department and Rescue Squad rules
   5. Environmental protection regulations
   6. Joint Commission - Hospital Accreditation Standards

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities".

C. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code".

1.4. TEMPORARY UTILITIES

A. Contractor will provide and pay for (both installation cost and consumption costs) the following:
   1. Electrical power and metering
   2. Water supply

B. General:
   1. No existing facilities on property
   2. New permanent facilities may be used.

C. Water Service: hydrant with backflow preventer and temporary heat (if needed) to be provided by contractor.
   1. Use trigger-operated nozzles for water hoses, to avoid waste of water.

D. Temporary Electric Power Service: Electrical Contractor to provide.

E. Temporary Lighting: Electrical Contractor shall provide temporary lighting with local switching
   1. Install and operate temporary lighting, minimum of 30 fc, to fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for all areas of work, including construction operations and traffic conditions.

F. Temporary Heat: General Contractor shall provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
   1. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.
      a. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.

1.5. TELECOMMUNICATIONS SERVICES AND WI-FI

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization through construction closeout.

B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications.
   2. Shared access to the internet via WIFI or similar wireless connection.
      a. Access must be capable to support minimum of 10 wireless devices.
   3. Email Account/address dedicated for GC Project Manager of GC Supervisor on site.

1.6. TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Temporary toilets: Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
   1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials foreach facility. Provide covered waste containers for used material.
   2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.

C. Maintain daily in clean and sanitary condition

D. Water: Provide potable water approved by local health authorities

1.7. BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

1.8. FENCING

A. Construction: Refer to Plan Documents and Specification Section 01 76 00: Fencing Materials and Barricades

1.9. EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10. SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.11. VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
B. Coordinate access and haul routes with governing authorities and Owner.
C. Provide and maintain access to fire hydrants, free of obstructions.

1.12. WASTE REMOVAL

A. See Section 01 74 19 - Waste Management, for additional requirements.
B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
C. Provide containers with lids. Remove trash from site periodically.
D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13. PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated in Section 01 58 13.
B. Erect on site at location determined by Owner.
C. No other signs are allowed without Owner permission except those required by law.

1.14. FIELD OFFICES

A. Office: Weather tight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
B. Field Office shall be located on project site .
C. Provide space for Project Meetings with table and chairs to accommodate a minimum of fifteen (15) persons.
D. Provide a minimum of a 40” LCD monitor or other digital projection device to be connected to the computer identified in Section 1.4 Telecommunications Services (above), for use during progress meetings in connection with reviewing construction progress information posted to the Project Management Web Site (Specification 01 31 23) hosted by the Owner.

PART 2 - PRODUCTS

2.1. TEMPORARY PARTITIONS

A. Provide dustproof partitions to limit dust and dirt migration and to separate occupied areas from fumes and noise.
    1. Non-fire rated partitions, standard
        a. Wood stud framing, 6-mil polyethylene

2.2. EQUIPMENT

A. Temporary Lifts and Hoists: Contractors requiring temporary lifts and hoists shall provide facilities for hoisting materials and employees.
B. Electrical Outlets: Electrical Contractor shall provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
C. Electrical Power Cords: Contractors requiring power cords shall provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

D. Lamps and Light Fixtures: Electrical Contractor shall provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
E. Heating Units: General Contractor shall provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
F. First Aid Supplies: General Contractor shall provide first aid supplies complying with governing regulations.
G. Fire Extinguishers: General Contractor shall provide hand-carried, portable UL-rated, fire extinguishers of NFPA recommended classes for the exposures, extinguishing agent and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1. TEMPORARY FIRE PROTECTION

A. Until fire protection needs are supplied by permanent facilities, General Contractor shall install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses.
B. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations".
C. Locate fire extinguishers where convenient and effective for their intended purpose.
D. Store combustible materials in containers in fire-safe locations.
E. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires.
F. Prohibit smoking on the premises.
G. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
H. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site
I. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.2. COLLECTION AND DISPOSAL OF WASTE

A. Collect waste from construction areas and elsewhere daily
B. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly.
C. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F.
D. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

3.3. ENVIRONMENTAL PROTECTION

A. Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result.
B. Avoid use of tools and equipment which produce harmful noise.
C. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.4. REMOVAL OF TEMPORARY UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials prior to Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.
E. Restore new permanent facilities used during construction to specified condition.

END OF SECTION

SECTION 01 58 13
TEMPORARY PROJECT SIGNAGE

PART 1 – GENERAL

1.1. SECTION INCLUDES
A. Project identification sign.

1.2. QUALITY ASSURANCE
A. Design sign and structure to withstand 50 miles/hr wind velocity.
B. Sign Painter: Experienced as a professional sign painter for minimum three years.
C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.3. SUBMITTALS
A. See Section 01 30 00 – Administrative Requirements for submittal procedures.
B. Shop Drawing: Show content, layout, lettering, color, structure, sizes.

PART 2 - PRODUCTS

2.1. SIGN MATERIALS
A. Structure and Framing: New, wood, structurally adequate.
B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum ¾" thick, standard large sizes to minimize joints.
C. Rough Hardware: Galvanized

2.2. PROJECT IDENTIFICATION SIGN
A. One painted sign, 32 sq ft area, bottom 6 feet above ground.
B. Content:
1. Project title, City of Madison, Fire Department logo and name of Owner as indicated on Contract Documents.
2. Names and title of Architect.
3. Name of Prime Contractor.
4. Full color project rendering from high resolution image as furnished by Architect.

PART 3 - EXECUTION

3.1. INSTALLATION
A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
B. Erect at designated location.
C. Install sign surface plumb and level, with butt joints. Anchor securely.

3.2. REMOVAL
A. Remove sign, framing supports, and foundations at completion of Project and restore the area.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide general guidelines and responsibilities related to the receiving, handling, and storage of all materials and products from arrival on the job site through installation.
   1. Immediate inspection of delivered goods means a timely replacement if damaged.
   2. Proper storage helps prevent damage and loss by weather, vandalism, theft, and job site accidents.
   3. Proper storage helps with job site performance and safety.
   2. Proper handling helps prevent damage and job site accidents.

B. Each Contractor shall be directly responsible for the receiving, handling, and storage of all materials and products associated with the Work of their Division or Trade.

C. Each Contractor responsible for Work associated with Owner provided materials or products shall be responsible for the receiving, handling and storage of the material/product as outlined in Section 3.8 below..

1.2. RELATED SPECIFICATIONS

A. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public Works Construction".
   1. Use the following link to access the Standard Specifications web page:
      http://www.cityofmadison.com/business/pw/specs.cfm
      a. Click on the "Part" chapter identified in the specification text. For example if the specification says "Refer to City of Madison Standard Specification **2**10.2" click the link for Part II, the Part II PDF will open.
      b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.
      c. City Standard Detail Drawings (SDD) may be located from the index in Part VIII.

B. Section 01 57 21 Indoor Air Quality

C. Section 01 74 13 Progress Cleaning

D. Section 01 76 00 Protecting Installed Construction

E. Other Divisions and Specifications that may address more specifically the requirements for the storage and handling of materials and products associated Work of other Divisions or Trades.

1.3. QUALITY ASSURANCE

A. The GC shall be responsible for ensuring that these minimum storage and handling requirements are met by all contractors on the project site including but not limited to the following:
   1. Receiving deliveries of materials, products, and equipment.
      a. Inspect all deliveries upon arrival for damage, completeness, and compliance with the construction documents.
         i. Deliveries shall remain in original packaging or crates, shipping manifest shall be kept with the delivery and the packaging shall have visible identification of the items within the packaging.

b. Immediately report any damaged products or equipment to the GC, begin arrangements for immediate replacement.
c. Materials or equipment that have been damaged, are incomplete, or do not comply with the construction documents shall not be permitted to be installed.

2. All materials and products shall be stored within the designated limits of the project site. Only store the amount of material necessary for upcoming operations so as not to interfere with other construction activities and access to Work by the Owner and Architect. Any offsite storage shall be at the expense of the contractor storing the material or product. All offsite storage requirements shall comply with this specification. All offsite storage of materials is subject to Owner Representative Quality Management review at any time.
3. Large storage containers may be used but shall be weather tight, securable, placed on concrete blocks, timbers, or jack stands and shall be level.
4. When lifting equipment is required the equipment rating shall be greater than the loading requirements of the item being lifted. In addition all of the following shall apply as necessary:
   a. Only designated and/or designed lift points shall be used.
   b. Large items shall have tag lines and handlers at all times during lifting operations.
   c. Lift at multiple points as needed to prevent bending.
5. Materials and products stored inside of the structure shall comply with all of the following:
   a. Storage shall not be allowed to impede the flow of work in progress.
   b. Storage shall not be allowed to hide completed work from review and inspections.
   c. Storage shall not exceed the design loads of the structural components it is being stored upon.
6. All materials and products shall be stored according the manufacturers minimum recommended requirements. All of the following shall be considered before storing any product or material:
   a. Dust and dirt
   b. Moisture and humidity, including rain and snow
   c. Excessive temperatures, direct sun, etc
   d. Product or material weight and size
   e. Potential for breakage
   f. Product incompatibility with other products such as corrosiveness, chemical reactions, flammability, etc.
   g. Product or material value and replacement cost
7. The Contractor shall be responsible for providing fully functional tarps or plastic wrap, to protect materials and products from the weather. All coverings shall be free of large holes and tears, and shall be tied, strapped, or weighted down to resist blowing.
8. The Contractor shall be responsible for any temporary heating, cooling, or other utility requirement that may be associated with the storage of a material or product.
9. The Contractor shall be responsible for securing materials and products of value such as copper, A/V equipment, etc. Such items shall be stored in securable shipping containers, job trailers or other such storage devices. Container shall be kept secured when not in use.

B. The GC shall inspect the job site daily to ensure that all products and materials stay weather tight and are secured against vandalism or theft as required by this specification.
C. The Owners Representative may at any time request improvements regarding storage of any material or product being provided under these construction documents.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL CONTRACTOR REQUIREMENTS

A. Designate material storage and handling areas as needed including all of the following:
   1. Designate specific areas of the site for delivery and storage of materials to be used during the execution of the Work.
   2. Designated areas shall not be located so as to interfere with the installation of any Work including Work by others such as the installation of utilities or the maintenance of existing utilities. This shall include not storing items in active utility easements as designated by the site plan.
B. Arrange for openings in the building as needed to allow delivery and installation of large items. Openings shall be appropriately sized to include the use of booms, slings, and other such lifting devices that may be larger than the item being installed.

1. When openings are required in completed Work (new or existing) the GC shall be responsible for providing an appropriate opening and for restoring the opening to the original or better condition upon completion. Restoration shall be weather tight and complete.

C. Repeated moving and handling of items being stored shall not be allowed. The GC shall be responsible for any damage and replacement because of mishandling or excessive handling.

3.2. BULK MATERIAL

A. Bulk material such as sand, gravel, top soil and other types of fill shall be stored away from the construction area and shall be stock piled as follows:
1. All bulk material shall be piled safely and efficiently in as small an area as practical. Only store the amount of material necessary for upcoming operations so as not to interfere with other construction activities and access to Work by the Owner and Architect.
2. All stock piles shall have silt fence/sock properly installed around the perimeter to prevent erosion and loss of material. Refer to City of Madison Standard Specification Section 210.1(f) and other related specification or details.
3. Fine grained material shall be protected with tarps to prevent blowing. Tarps shall be weighted or staked to stay in place.

B. Bulk material such as brick, concrete block, stone, and other palletized materials shall be stored on original shipping pallets until ready for use.

3.3. DRY PACKAGED MATERIAL

A. Dry packaged material such as cement, mortar, etc shall be stored on pallets, on slightly elevated ground or clear stone pad to keep water away from the base of the material being stored. Protect from moisture.

3.4. STRUCTURAL AND FRAMING MATERIAL

A. All structural and framing material shall be stored in an organized manner arranged by type, size and dimension. Materials shall be stored on pallets or timbers as necessary and shall not be allowed to lie directly on the ground.

B. Long and heavy items shall be supported at several points to prevent bending and warping.

3.5. EQUIPMENT

A. Equipment delivered to the site shall be stored away from all construction activities until the item can either be moved inside or properly installed.

B. Equipment shall be stored on slightly elevated ground or clear stone pad to keep water away from the base of the equipment.

3.6. FINISH PRODUCTS

A. Finish products such as flooring, tile, counters, lockers, toilets, partitions, lighting, and other similar items should not be delivered and stored until the structure has been enclosed, is weather tight, temperature controlled and the contractor is ready for such items to be installed.
1. Storage of finished products outside for any length of time shall not be allowed.

B. Products that cannot be stored inside the structure shall be stored in secured containers or job trailers until such time as they are ready to be installed.

C. Products with a high potential for breakage such as glass, mirrors, tiles, toilet fixtures, etc. shall be stored with additional protection as necessary such as but not limited to the following:
1. Store in original shipping containers until ready for installation.
2. Do not store in high traffic areas.
3. Shield with other materials such as cardboard, plywood, or similar products.

3.7. DUCTWORK, PIPING, AND CONDUIT

A. All piping and conduit shall be stored horizontally unless otherwise specified by the manufacturer or Division and Trade Specifications.
1. Do not store directly on grade.
2. Cover metal pipes and tubes to prevent rust and corrosion, allow ventilation to prevent condensation.
3. Whenever possible use pipe stands for storing pipe and conduit to prevent tripping and rolling hazards.

B. All ductwork shall be stored horizontally or vertically as necessary unless otherwise specified by the manufacturer or Division and Trade Specifications.
1. During storage, both ends of each duct shall be protected with plastic sheathing to prevent dust and dirt from getting inside the duct. Sheathing shall be sufficiently taped to the duct.

2. After installation, free/open ends shall remain protected with taped plastic sheathing and or temporary filters as specified by division or Trade specifications.

3.8. OWNER PROVIDED, CONTRACTOR INSTALLED EQUIPMENT

A. Section 3.8.A. shall apply to all equipment being provided to any contractor directly from the Owner for installation under the contract.
   1. The Owner or Owners Representative shall do the following:
      a. Inspect all deliveries upon receipt and notify manufacturer of any issues directly.
      b. Review the received shipment with the contractor.
         i. Only provide products or materials to the contractor that were not damaged through shipping or handling.
         ii. Confirm missing products or materials and anticipated delivery schedule if known.
   2. The Contractor responsible for the installation of Work associated with Owner provided materials or products shall "take ownership" and provide safe and secure storage and handling as previously described within this specification.
      i. The Contractor shall be liable for the repair or replacement of any material or product damaged after taking ownership of the product from receipt through final acceptance.

B. Section 3.8.B. shall apply to all equipment being provided by the Owner but shipped directly to any sub-contractor or the project site for installation under the contract.
   1. The GC and/or Contractor responsible for the Work associated with the Owner provided materials or products shall do the following:
      a. Inspect all deliveries upon receipt and notify the Owner or Owners Representative of any issues directly.
         i. Owner or Owners Representative shall notify manufacturer of any issues directly.
      b. Review the received shipment with the Owner or Owners Representative
         i. Confirm missing products or materials and anticipated delivery schedule if known.
   2. The Contractor shall "take ownership" and provide safe and secure storage and handling as previously described within this specification.
      i. The Contractor shall be liable for the repair or replacement of any material or product damaged after taking ownership of the product from receipt through final acceptance.

END OF SECTION

SECTION 01 71 23
FIELD ENGINEERING

PART 1 – GENERAL

1.1. REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field engineering services required for the Project:
   1. Land surveying services required to execute the Work, to include building addition location and layout, and location and layout of pavements and all proposed site improvements.
   2. Verification of existing building dimensions, elevations, and relationship to proposed additions.
   3. Professional Engineering services to execute Contractor's construction methods.
   4. Registered Professional Engineer in the State of Wisconsin to determine the load capacity of the existing structure for use of Contractors temporary facilities, equipment, lifts, machinery, material storage, etc.

1.2. RELATED REQUIREMENTS

A. Conditions of the Contract

1.3. PROCEDURES

A. A property survey has been prepared for the Owner and has been bound with Contract Drawings. Surveys shall describe physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. If information is incomplete, notify Owner to furnish additional information. Verify easement locations, front, side, and rear yard restrictions, if any; and property line locations. Verify control points, and establish bench marks. Locate and layout roads, walks, parking areas and all civil structures and all proposed site improvements.

B. Verify locations of underground services, utilities, structures, etc. which may be encountered or affected by the Work.

1.4. PROJECT SURVEY REQUIREMENTS

A. Using datum, the lot lines and present levels have been established as indicated on the Drawings. Other grades, lines, levels and benchmarks, shall be established and maintained by the Contractor, who shall be responsible for them. As work progresses, the Contractor shall layout on forms and floor, the locations of all partitions, walls and fix column centerlines as a guide to all trades. The Contractor shall make provision to preserve property line stakes, benchmarks, or datum point. If any are lost, displaced or disturbed through neglect of any Contractor, Contractor's agents or employee, the Contractor responsible shall pay the cost of restoration.

B. Establish lines and levels, locate and layout, by instrumentation and similar appropriate means, additions, column locations, floor levels, stakes for walks, etc.

C. Provide data to all Subcontractors for their use as applicable.

D. From time to time, verify layouts by same methods.

1.5. RECORDS

A. Maintain a complete, accurate log of all control and survey work as it progresses.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes general procedural requirements for cutting and patching including, but not limited to the following:
   1. Examination
   2. Preparation
   3. Performance
   4. Cleanup and Restoration

1.2. RELATED SPECIFICATION SECTIONS

A. Divisions 02 through 32 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
B. Division 07 Section "Penetration Fire Stopping" for patching fire-rated construction.

1.3. DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.
C. Level Alpha

1.4. QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that may result in increased maintenance or decreased operational life or safety.
C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that may result in increased maintenance or decreased operational life or safety. Some miscellaneous elements include the following:
   1. Water, moisture, or vapor barriers
   2. Membranes and flashings
   3. Exterior curtain-wall construction
   4. Equipment supports
   5. Piping, ductwork, vessels, and equipment
   6. Noise and vibration control elements and systems
D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.5. WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

B. All cutting and patching work performed under this contract shall be warranted like new work as defined by the Specification governing the work.

PART 2 - MATERIALS

2.1. GENERAL

A. Comply with requirements specified within other sections of the Specifications.

B. In-Place Materials: Use materials identical to existing in-place materials. For exposed surfaces use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction and existing conditions during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations. If the failure to protect, or the lack of protection, of in-place construction and/or existing conditions results in damage, the contractor shall be responsible for repair to previous condition.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to eliminate interruption to occupied areas.

3.3. PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 3l Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

D. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

3.4. CLEANUP AND RESTORATION

A. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

1. Clean piping, conduit, and similar features before applying paint or other finishing materials.
2. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
5. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.
7. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
8. Any smoke and fire caulking that has been disturbed must be replaced by the Contractor as required by code.

END OF SECTION

SECTION 01 74 13
PROGRESS CLEANING

PART 1 – GENERAL

1.1. SUMMARY

A. Throughout the execution of this contract all contractors shall be responsible for maintaining the project site in a standard of cleanliness as described in this specification.

B. All contractors shall also comply with the requirements for cleaning as described in other specifications.

C. Work included in this specification shall include but not be limited to:

1. Safety Cleaning
2. Project Site Cleaning
3. Progress Cleaning
4. Final Cleaning

1.2. RELATED SPECIFICAITONS

A. Section 01 35 00 Special Procedures
B. Section 01 60 00 Product Requirements
C. Section 01 74 19 Construction Waste Management and Disposal
D. Section 01 76 00 Protecting Installed Construction

1.3. QUALITY ASSURANCE

A. The General Contractor (GC) shall conduct daily inspections, more often if necessary, of the entire project site to ensure the requirements of cleanliness are being met as described within these specifications.

B. All contractors shall comply with other regulatory requirements as they apply to waste recycling, reuse, hauling, and disposal requirements of any governmental authority having jurisdiction.

C. The Owner reserves the right to have work done by others in the event any contractor fails to perform cleaning as described within these specifications. The cost of any Owner provided cleaning shall be charged to the contractor through a deduct change order.

PART 2 - PRODUCTS

2.1. CLEANING MATERIALS AND EQUIPMENT

A. The Contractor shall provide all required personnel, equipment, and materials necessary to maintain the required level of cleanliness as described in this specification.

B. Use only cleaning materials and equipment that are compatible with the surface being cleaned, as recommended by the manufacturer, or as approved by the A/E.

C. Use only cleaning materials, equipment, and methods as recommended in the manufacturers care and use guide of the material, finish or equipment being cleaned.

PART 3 - EXECUTION

3.1. SAFETY CLEANING

A. All Contractors shall be responsible for safety cleaning as required by OSHA and other regulatory requirements as applicable.

B. Safety Cleaning shall include but not be limited to the following:
   1. All work areas, passageways, ramps, and stairs shall be kept free of debris, scrap materials, pallets, and other large items that would obstruct exiting routes. Small items such as tools, electrical cords, etc are picked up when not in use.
   2. Form and scrap lumber shall have nails/screws removed or bent over. Lumber shall be neatly stacked in an area designated by the GC.
   3. Spills of oil, grease, and other such liquids shall be cleaned immediately or sprinkled with sand/oil-dry first, then cleaned.
   4. Oily, flammable, or hazardous items shall be stored in appropriate covered containers and storage devices unless actively being used.
   5. Oily, or flammable rags, and other such waste shall only be disposed of in authorized covered containers.
   6. Disposal by burning shall not be allowed at any time.

3.2. PROJECT SITE CLEANING

A. This section applies to the general cleanliness of the project site as a whole for the duration of the execution of this contract.

B. Exterior Project Site Areas
   1. The GC and other Contractors as appropriate shall ensure the following levels of cleanliness are applied to the exterior project site areas.
      a. The overall appearance of the project site is neat and orderly. Defined areas for material storage, material waste, job trailers, and the project area are clean and well maintained.
      b. The construction fence is maintained, erect with no gaps, and properly posted per all regulatory requirements.
      c. All erosion control measures are properly maintained, cleaned, and repaired as necessary.
      d. All loose materials (construction or waste) are properly tied or weighted down to resist blowing.
      e. All construction materials are properly covered with fully functional tarps or plastic wrap, protected from the weather, coverings are tied, strapped, or weighted down to resist blowing.
      f. Dust control is applied as necessary or as required by any regulatory requirement.

C. Interior Project Site Areas
   1. All Contractors shall ensure the following levels of cleanliness are applied to the interior project site areas.
      a. The overall appearance of the project site is neat and orderly. Defined areas for material storage, material waste, and project area are clean and well maintained.
      b. Stored materials are kept in original shipping containers whenever possible. Stored materials not in shipping containers are properly stored and protected according to other applicable specifications.
      c. All scraps and debris shall be properly disposed of as often as necessary to keep work areas, passageways, stairs, and ramps free of debris and clear for emergency exiting.
      d. Boxes, pallets, and other such shipping containers, are broken down, stored in a consolidated area or, disposed of as often as is necessary.
      e. Hand tools, supplies, materials, electrical cords not being used are picked up and sptored in gang boxes, not left as walking hazards in work areas, passageways, etc.

D. Job Trailer
   1. The interior of the job trailer shall be kept clean and available as a work space at all times. The GC shall ensure that the following is provided for within the job trailer:
      a. Meeting space including tables and chairs.
      b. Sufficient space for all contractors to access the official construction documents, provide updates, etc.

3.3. PROGRESS CLEANING

A. This sub-section shall apply to all Progress Cleaning prior to the installation of finishes, fixtures, and trim (IE rough-in).
   1. For the purposes of this section “clean” shall be defined as a level of cleanliness free of dust and other material capable of being removed by use of reasonable effort using a good quality janitor broom and shop-vac.
   2. Daily cleanings shall be conducted by all contractors at the end of the work day as follows:
      a. Debris in excavated areas shall be removed prior to backfill and compaction.
      b. Debris in wall cavities, chase spaces, etc shall be removed prior to enclosing the spaces.

c. Large items shall be properly stored, returned to designated areas, or disposed of as necessary.
d. Loose materials shall be properly secured.
e. Flammable or hazardous materials are properly stored or disposed of.

3. Weekly cleaning shall be conducted by all contractors as designated by the GC. Weekly cleanings shall include all the above for a daily cleaning and other necessary cleaning as designated by the GC.

B. This sub-section shall apply to Progress Cleaning in preparation for the installation of finishes, fixtures, and trim.
a. Surfaces receiving finishes shall be thoroughly cleaned prior to contractors applying finish materials. The GC shall be responsible for inspecting the area and surfaces being cleaned for finish prior to the sub-contractor applying the finish. This shall include but not be limited to the following:
i. Wall surfaces shall be wiped clean of dirt and oily residues, vacuumed free of dust, and shall be free of surface imperfections prior to painting or installing wall coverings.
ii. Metal surfaces shall be wiped clean of dirt and oily residues, and be free of surface imperfections prior to painting.
iii. Flooring shall be broom swept of large and loose items then vacuumed clean of dust and small particles, and damp mopped clean and dried prior to installing any flooring finish. Additional cleaning may be required depending on the preparation requirements recommended by the flooring material manufacturer.

C. This sub-section shall apply to Progress Cleaning after the installation of finishes, fixtures, and trim.
1. For the purposes of this section "clean" shall be defined as a level of cleanliness free of dust and other material capable of damaging or visually disfiguring finished work, finishes, fixtures, and trim.
2. Progress Cleaning at this point in the contract shall be conducted immediately as follows:
a. Dust, dirt, etc shall be swept and vacuumed off of finish flooring and trim.
b. Liquid spills shall be cleaned up according to the spill type. This shall include drips and spills caused by paint, stain, sealants, and other such items.
3. The Contractor(s) at no additional cost to the Owner shall be responsible for replacing any finished work, finishes, fixtures, and trim damaged or disfigured because of inadequate or improper cleaning.

3.4. FINAL CLEANING

A. As noted in Specification 01 29 76 Progress Payment Procedures, Progress Payment Milestone Schedule, Final Cleaning shall not be conducted prior to requesting the 90% contract total progress payment and all of the following shall be complete:
1. All final regulatory inspections including but not limited to Building Inspection Department and Madison Fire Department inspections have been successfully completed.
2. All Quality Management Observation (QMO) reports have been closed out.
3. All Demonstration and Training has been completed.
4. All Attic Stock has been consolidated and located to its designated area
5. All protection for installed construction shall be removed prior to final cleaning by the contractor responsible for providing the protections. This shall include the removal of any adhesive residues left behind from tapes. Contractors shall only use manufacturer authorized cleaning materials for removing adhesives, etc.

B. For the purposes of this section "clean" shall be defined as a level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

C. The GC shall be responsible for ensuring that all requirements under this section are being met.

D. General Requirements
1. Employ experienced personnel or professional cleaners for final cleaning as necessary for the areas or equipment being cleaned.
2. Cleaning equipment used shall be commercial grade equipment commonly used by professional cleaners.
3. Cleaning equipment and materials shall be cleaned, rinsed, or replaced to ensure a uniform level of cleanliness is being maintained during the final cleaning. This shall include but not be limited to the following:
a. Vacuum cleaner bags and/or filters are changed and/or cleaned as often as necessary.
b. Dust & wipe down rags are washed, rinsed, or replaced before starting each room.
c. Mopping equipment
i. Mop water for washing shall have cleaning solution added to the amount and temperature per manufacturer's recommendations. Mop washing water shall be replaced often to maintain the levels of the cleaning solution and temperature required.
ii. Mop water for rinsing shall remain clean, clear, and be replaced as often as necessary.

iii. Mop heads shall be rinsed often and replaced as necessary.
iv. Mop heads and buckets shall be thoroughly rinsed with each change of water.
v. Only new mop heads shall be used for rinsing.

E. Refer to all other specifications in this contract for specific requirements regarding final cleaning of finishes, fixtures, equipment, etc.

F. Exterior Cleaning shall include but not be limited to the following:
1. All exterior glazing surfaces have been professionally cleaned and are free of dust and streaking.
2. Metal roofs, siding, and other surfaces shall be clean of dirt and free of splashed or excess materials such as sealants, mortar, paint, etc.
3. All exterior furnishings shall be clean, waste receptacles shall be empty.
4. Paved areas shall be clean, free of dirt, oily stains and other such blemishes
5. Exterior lights and diffusers are clean and free of dust.

G. Interior Cleaning shall include but not be limited to the following:
1. Remove all labels, stickers, tags, and other such items which are not required by code as permanent labels.
2. All interior glazing surfaces, including mirrors, have been professionally cleaned and are free of dust and streaking.
3. All interior surfaces have been cleaned of excess materials such as paint, sealants, etc and have been wiped free of dust.
4. Interior metals, fixtures, and trim have been cleaned free of dust and oily residues
5. Carpet flooring has been thoroughly cleaned; vacuumed free of dust, excess glues and other stains removed per manufacturers use and care instructions.
6. Resilient flooring has been thoroughly cleaned; vacuumed free of dust, excess glues and other stains removed, mopped and buffed per manufacturers use and care instructions.
7. Interior non-occupied concrete floors shall be broom cleaned, vacuumed free of dust, excess glues and other stains removed per manufacturers use and care instructions.
8. Light fixtures, lamps, diffusers and other such items have been dusted and cleaned as necessary.

3.5. CALL BACK WORK

A. The GC shall be responsible for ensuring that any contractor returning to the project site for completion or correction work has re-cleaned and restored the area to the levels described in section 3.4 above upon completion of the work. This shall include but not be limited to the following:
1. The immediate area(s) where work was completed.
2. Adjacent areas where dust or debris may have traveled.
3. Other areas occupied during the completion of the call back work.
4. Path of entrance/exit, to/from the area(s) of work.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 – GENERAL

1.1. SUMMARY

A. This specification includes administrative and procedural requirements for the recycling, re-use, salvaging, and disposal of non-hazardous construction and demolition waste.

B. The General Contractor (GC) shall be fully responsible for complying with all applicable ordinances and other such regulatory requirements during the execution of this contract.

1.2. RELATED SPECIFICAITONS

A. 01 29 76 Progress Payment Procedures
B. 01 31 23 Project Management Web site
C. 01 32 19 Submittals Schedule
D. 01 33 23 Submittals
E. 01 77 00 Closeout Procedures
F. Other Divisions and Specifications that may address the proper disposal of construction or demolition waste as it pertains to work being conducted under that particular specification.

1.3. CITY ORDINANCES

A. There are two (2) Madison General Ordinances (MGO) that the City of Madison has regarding construction and demolition waste.
   1. MGO 10.185, Recycling and Reuse of Construction and Demolition Debris, describes the requirements associated with this ordinance including definitions, documentation requirements, and penalties.
   2. MGO 28.185, Approval of Demolition (Razing, Wrecking) and Removal, describes the requirements associated with applying for and receiving a demolition permit.

B. All City of Madison, Board of Public Works, contracts being conducted by City Engineering, Facility Management, for construction, remodeling, or demolition shall comply with the above ordinances regardless of project type or size.

1.4. DEFINITIONS

A. Clean: Untreated and unpainted material, free of contamination caused by oils, solvents, caulks, and other chemicals.

B. Construction and Demolition Debris: Materials resulting from the construction, remodeling, repair, and demolition of utilities, structures, buildings, and roads.

C. Disposal: Off-site removal of construction and demolition debris and the subsequent sale, recycling, reuse, or deposit in authorized landfill or incinerator.

D. Hazardous: Exhibiting the characteristics of hazardous substance, i.e. ignitability, corrosiveness, toxicity, or reactivity and including but not limited to asbestos containing materials, lead, mercury and PCBs.

E. Non-hazardous: Exhibiting none of the characteristics of a hazardous substance.

F. Nontoxic: Not immediately poisonous to humans or poisonous after a long period of exposure.
G. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product.
H. Recycle: Any process by which construction or demolition debris is diverted from final disposal as solid waste at a permitted landfill and instead is collected, separated, and/or processed into raw materials for new, reused, or reconstituted products; or for the recovery of materials for energy production processes.
I. Recycler: Any recycling facility, transfer station, or other waste handling facility which accepts construction and demolition debris for recycling, or for other transferring to a recycling facility.
J. Recycling: The process of sorting, cleaning, treating, or reconstituting solid waste and other discarded materials for the purpose of preparing the material to be recyclable. Recycling does not include burning, incinerating or thermally destroying waste.
K. Return: To give back reusable items or unused products to vendors for credit.
L. Reuse: Shall mean any of the following:
    1. The on-site use of reprocessed construction and demolitions debris.
    2. The off-site redistribution of a material, for use in the same manner or similar manner at another location.
    3. The use of non-toxic, clean wood as an alternative fuel source.
M. Salvage: To remove a waste material from the project site for resale or reuse by the Owner or others.
N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
O. Trash: Any product or material unable to be re-used, returned, recycled, or salvaged.
P. Waste: Extra materials or products that have reached the end of its useful life or its intended use. Waste includes salvageable, returnable, recyclable and re-useable construction and demolition materials, and trash.

1.5. PERFORMANCE REQUIREMENTS

A. The GC shall develop a Waste Management Plan that results in end-of-project rates for salvage/recycling/reuse of 95 percent (minimum) by weight of the total waste generated by the Work. Percentages may be adjusted on a project by project basis depending on selected LEED goals associated with the project.
B. The GC shall salvage or recycle 100 percent of all uncontaminated packaging materials including but not limited to the following:
    1. Paper
    2. Cardboard
    3. Beverage containers
    4. Boxes
    5. Plastic Sheet and film
    6. Polystyrene packaging
    7. Wood crates and pallets
    8. Plastic pails and buckets
C. Promote a resourceful use of supplies and materials through proper planning and handling. Generate the least amount of waste possible by minimizing errors, poor planning, breakage, mishandling, contamination or other similar factors.
D. Use all reasonable means to divert construction waste from landfills and incinerators through recycling, reuse, or salvage as appropriate.

1.6. SUBMITTALS AND DELIVERABLES

A. The GC shall provide his/her completed Waste Management Plan to the Project Management Web Site as a submittal for review by the Project Architect and City Project Manager.
    1. See item 1.8 below for Waste Management Plan submittal requirements.
    2. The Waste Management Plan shall be completed, submitted, and approved as a pre-requisite for Progress Payment number 1.
    3. Copies of all documentation required by this specification shall be submitted to the appropriate Project Management Web Site Library. Documentation shall be reviewed by the City Project Manager during all Progress Payment reviews for compliance and accuracy.
B. The Waste Management Coordinator shall provide copies of items 1 through 5 below to the appropriate Project Management Web Site Library and shall update the Waste Management Summary Log to reflect the records being submitted.
    1. Records of Donations: Indicate receipt and acceptance of itemized salvageable waste donated to individuals or organizations. Indicate if the organization is tax exempt.

2. Records of Sales: Indicate receipt and acceptance of itemized salvageable waste sold to individuals or organizations. Indicate if the organization is tax exempt.
3. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts and invoices.
4. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts and invoices.
5. Statement of Refrigerant Recovery: The Refrigerant Recovery Technician responsible for recovering refrigerant shall provide the GC with a statement indicating all of the following:
    a. All recovery was performed according to EPA Regulations.
    b. All refrigerant present was recovered; indicate the total quantity recovered by unit.
    c. Date of Recovery.
    d. Name, address, company name, and phone number of technician performing the recovery.
    e. Technician shall sign and date the statement.

C. LEED Submittal: The GC shall provide the following information using the appropriate LEED letter template upon project completion: indicating that the requirements of the credit have been met. *NOTE: This requirement shall only apply to projects having a LEED certification goal.*
1. Total waste material generated.
2. Total waste material diverted by diversion method; recycling, salvage, re-use, etc.
3. Statement that the credit requirements have been met.
4. GC shall sign the letter.

1.7. QUALITY ASSURANCE

A. Waste Management Coordinator: The GC shall be responsible for designating a Waste Management Coordinator. Coordinator may be the GC Supervisor, GC Project Manager or other member of the GC staff having knowledge of proper waste management procedures and all applicable regulations.
B. Regulatory Requirements: comply with all hauling and disposal regulations of authorities having jurisdiction.
C. The Waste Management Coordinator shall comply with Specification 01 31 19 Project Meetings, Section 3.7.B.1 and conduct a Waste Management Conference at the job site. This conference shall be repeated as necessary as additional trades are added to the Work. The conference shall include but not be limited to the following:
1. Identify the Waste Management Coordinator; provide trade contractors with name, phone, and email information.
2. Review and discuss the Waste Management Plan and the roles of the Coordinator.
3. Review the requirements for documenting and reporting procedures of each type of waste and its disposition.
4. Review procedures for material separation; indicate availability and locations of containers and bins.
5. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
6. Review waste management procedures specific to each trade.

D. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.8. WASTE MANAGEMENT PLAN

A. Develop a plan consisting of waste identification, a waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume. Use the same units of measure throughout the waste management plan.
1. Waste Identification: Indicate anticipated types and quantities of site clearing, demolition waste, and construction waste that will be generated during the execution of this contract. Include assumptions for the estimates.
2. Waste Reduction Work Plan: The work plan shall consist of but not be limited to all of the following:
    a. Identify methods for reducing construction waste. Re-using, framing and forming materials, re-planning material cuts to minimize waste, etc.
    b. Identify what types of materials will be recycled. Provide lists of local companies that receive and/or process the materials. Include names, addresses, and phone numbers.
    c. Identify what types of materials will be disposed of and whether it will be disposed of in a landfill facility or by incineration facility. Provide lists of local companies that receive and/or process the materials. Include names, addresses, and phone numbers.
    d. Identify methods to be used on site for separating waste including all of the following:
        i. Sizes of containers to be used.
        ii. Labels to be used on the containers to identify the type of waste allowed in the container.

iii. Designated locations on the project site for waste material containers.

B. If project requires demolition incorporate the ordinance required (MGO 28.185) Recycling and Reuse Plan into the Waste Management Plan.

C. Provide all of the following for the Waste Management Coordinator:
   1. Name, employer, employer address, phone number, and email address of the designated coordinator.
      a. The GC shall also provide this information with the required Project Directory Submittal at the beginning of the project.

D. If at the option of the GC, he/she chooses to contract with a Waste Management Disposal Company that allows comingled and unsorted waste materials, the GC shall include with his/her Waste Management Plan the following:
   1. Name, address, phone number, state permitting information, and other pertinent information about the disposal company.
   2. Documentation from the disposal company indicating company policies and procedures regarding comingled and unsorted waste materials to include:
      a. GC responsibilities on the project site.
      b. Disposal company procedures for receiving, sorting, recycling, and disposing of comingled and unsorted waste material.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. PLAN IMPLEMENTATION

A. Implement the approved waste management plan. Provide adequate containers, storage space, signage, transportation and other items required to implement the plan during the execution of this contract.

B. The GC and Waste Management Coordinator shall be responsible for monitoring and reporting the status of the Waste Management Plan and shall monitor the waste management practices on site as frequently as needed.

C. Train all workers, sub-contractors, and suppliers on proper waste management procedures as appropriate for the work being conducted on the project site.
   1. Distribute the waste management plan to everyone concerned within seven (7) days of submittal approval.
   2. Distribute the waste management plan to new workers, sub-contractors, and suppliers when they first appear on the project site.
   3. Conduct additional training as needed during the execution of the contract to keep a positive focus on the waste management plan.

D. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent and used facilities.
   1. Designate and label specific areas on the project site necessary for separating materials to be salvaged, recycled, reused, donated, and sold.
   2. Comply with any specification or regulatory requirements pertaining to dust, dirt, environmental protection, and noise control.

3.2. HAZARDOUS AND TOXIC WASTE

A. The Owner shall be responsible under separate contract for the removal of any asbestos related materials. All other materials shall be removed by the GC.

B. All hazardous and toxic waste shall be separated, stored, and disposed of according to all applicable regulations.

C. All hazardous and toxic materials on site shall have a Material Safety and Data Sheet (MSDS) available that indicates storage requirements, emergency information, and disposal requirements as necessary.

3.3. GENERAL GUIDELINES FOR ALL WASTES

A. Recycle all paper and beverage containers used by workers, sub-contractors, suppliers and visitors to the project site.

B. All revenues, savings, rebates, tax credits, and other such incentives received from recycling, reusing, or salvaging waste materials shall accrue to the GC unless specified otherwise in the contract documents.

C. Separate recyclable, reusable, and salvageable waste from other waste materials, trash, and debris except where Waste Management Disposal Company allows comingled waste materials, see section 1.8.D above.
   1. Separate by type in appropriate containers or designated areas according to the approved waste management plan away from the construction area. Do not store within the drip lines of existing trees.

2. Inspect containers and bins frequently for contamination and inappropriately sorted materials. Remove contaminated materials and resort as necessary.
3. Stockpile bulk materials such as sand, topsoil, stone, etc., on site away from the construction area and without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water, and cover to prevent windblown dust. Do not store within the drip lines of existing trees.
4. Whenever possible store items off the ground and/or protect them from the weather.

3.4. GUIDELINES FOR RECYCLABLE, RE-USABLE, AND SALVAGEABLE WASTE

A. The following guidelines is not a complete or all inclusive list and shall be adjusted as needed by the methods and procedures identified in the Waste Management Plan.
B. Asphalt Paving: Break-up into transportable pieces or grind, transport to an authorized recycling facility.
C. Carpet and Pad: Separate carpet and pad scraps, containerize and transport to an authorized recycling facility.
D. Ceiling System Components: Suspended ceiling system components shall be sorted by material type as follows:
   1. Broken, cut, or damaged tiles shall be containerized, transport to an authorized recycling facility.
   2. Damaged, or cut tracks, trim and other metal grid system components shall be sorted with other metals of similar types, palletize, transport to an authorized recycling facility.
E. Clean Fill: When allowed by Division 31 Specifications; concrete, masonry, stone, asphalt pavement, sand and other such materials may be used as clean fill on this project site. The GC shall verify with the Project Architect, Structural Engineer, or Civil Engineer as necessary prior to using any materials as clean fill. Materials shall be processed, placed, and compacted as specified. If not being re-used on site, transport to an authorized recycling facility.
F. Clean Wood Materials: Including but not limited framing cutoffs, wood sheathing or paneling materials, structural or engineered wood products, and pallets or crates. Clean Wood shall be free of paints, stains, oils, preservatives and other such contaminates.
   1. Useable pieces shall be sorted by type and dimension, bundled and transported off site by the GC or returned to the supplier.
   2. Non-useable pieces shall be palletized or containerized, transport to an authorized recycling facility.
   3. Clean, uncontaminated sawdust and wood shavings shall be bagged, transport to an authorized recycling facility.
G. Concrete: Break-up into transportable pieces, remove all reinforcing and other metals, transport to an authorized recycling facility.
H. Glass Products: Shall be sorted by types, do not include light fixture lamps and bulbs. Products broken in shipment shall be returned to the supplier. Broken or cracked items still in frames shall be taped to prevent further breakage and injury to workers. Transport to an authorized recycling facility.
I. Gypsum Board: Stack large clean pieces on wooden pallets or container, store in a dry location, transport to an authorized recycling facility.
J. Light Fixture Lamps and Bulbs: Fluorescent tubes shall be containerized, transport to an authorized recycling facility.
K. Masonry and CMU: Remove all metal reinforcing, anchors, and ties, clean undamaged pieces and neatly stack on pallets, transport damaged pieces to an authorized recycling facility.
L. Metals: Sort metals by type as follows, this does not include piping:
   1. Architectural metals including but not limited to siding, soffit, and roofing panels shall be sorted by material, palletize or bundle as needed and transport to an authorized recycling facility.
   2. Structural steel, sort by size and type; palletize and transport to an authorized recycling facility.
   3. Miscellaneous metals such as aluminum, brass, bronze, etc shall be sorted by type, containerized or palletized as necessary, transport to an authorized recycling facility.
M. Packaging and shipping materials
   1. Cardboard boxes and containers: Breakdown all cardboard boxes and containers into flat sheets. Bundle and store in a dry location until transported for recycling.
   2. Pallets:
      a. Whenever possible require deliveries using pallets to remove them from the project site.
      b. Neatly stack pallets in preparation for reusing them or providing them to other companies for salvage or re-use.
      c. Break down pallets into component wood pieces that comply with the requirements for recycling clean wood materials. Neatly stack or palletize pieces in preparation for transportation.
   3. Crates: Break down crates into component wood pieces that comply with the requirements for recycling clean wood materials. Neatly stack or palletize pieces in preparation for transportation.
   4. Polystyrene Packaging: Separate and bag materials.

N. Piping and conduit: Reduce all piping and conduit to straight lengths, sort and store by size, material and type. Remove supports, hangers, valves, boxes, sprinkler heads, and other such components, sort and store by size, material and type. Transport to authorized recycling facilities according to material types.

O. Roofing: Roofing materials shall be sorted and containerized by type, transport to authorized recycling facilities according to material types.

P. Site-Clearing Waste: Sort all site waste by type.

1. Only stockpile soils types and quantities required for re-use on the project site. All remaining quantities shall be transported off site to an authorized facility that receives such materials.
2. Brush, branches, and trees with no marketable re-use shall be transported to facilities for chipping into mulch.
3. Trees with a marketable re-use shall be salvaged and transported to facilities that specialize in processing trees for future use as wood products.

3.5. GUIDELINES FOR DISPOSAL OF WASTES

A. The following guidelines shall be adjusted as needed by the methods and procedures identified in the Waste Management Plan.

B. Any waste that is contaminated, organic, or cannot be recycled, re-used, or salvaged shall be legally disposed of in an authorized landfill or incinerator. Disposal methods shall follow all applicable regulatory requirements.

C. No waste material of any kind, except those types designated as clean fill in section 3.4 above, shall be allowed to be buried on the project site at any time.

D. No burning of any kind of waste material shall be permitted on this project site at any time.

E. Paint and Stain: Paints, stains, and their containers shall be disposed of as follows:

1. Whenever possible containers should be thoroughly cleaned immediately after emptying and sorted with as appropriate (metal or plastic) for recycling
2. Empty containers, regardless of type or base material, may be disposed of with lids off with general garbage.
3. Latex paint may be placed with general garbage if properly solidified as follows:
   a. Small amounts (an inch or less in can): Remove lids and allow paint to dry out in the can and harden. Protect cans from rain and freezing.
   b. Large amounts (more than one inch): Mix paint with equal amounts of cat litter, stir and allow to completely dry. Alternate method: mix with commercial paint hardener.
4. Oil-based or combustible paints and stains, regardless of liquid or solid, shall be transported to an approved facility that takes such items such as Dane County Clean Sweep Sites.

F. Treated Wood Materials: Treated wood materials including but not limited to wood that has been painted, stained, or chemically treated shall not be recycled or incinerated.

END OF SECTION

SECTION 01 76 00
PROTECTING INSTALLED CONSTRUCTION

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide clear responsibilities, guide lines, and requirements related to providing protection to already installed construction.

B. Already installed construction shall include but not be limited to the following:

1. Any existing site feature such as pavement, curbs, drainage features, utilities, landscaping features (trees, shrubbery, plantings, flagpoles, etc) and other such exterior items not associated with the building whether on or adjacent to the project site.
2. Any existing structure on or adjacent to the project site.
3. Any existing interior work that may be adjacent to the new work including all paths of ingress/egress to areas associated with accessing the Work.
4. Any existing feature of any kind within the public right-of-way that may be on the project site property, adjacent to the project site or across the street from the project site.

C. All contractors shall be familiar with the specifications of their Division of Work for specific requirements on protection of the Work.

D. The requirements noted within this specification do not relieve any contractor of the responsibility for compliance with any code, statute, ordinance, or other such regulatory requirement having jurisdictional authority over these contract documents.

1.2. QUALITY ASSURANCE

A. It shall be the responsibility of every contractor and worker assigned to the project to be diligent in protecting all existing work, and newly installed construction.

B. It shall be the General Contractors' (GC) responsibility under the contract to provide all reasonable protection methods, materials, or precautionary measures required to protect new or existing construction as described in within this specification to the project as a whole.

1. The GC shall be responsible to ensure any damaged new or existing construction is repaired or replaced at no additional cost to the Contract.
2. The GC at his/her discretion may direct other contractors to provide and maintain protection of completed work associated with their Division of Work. I.E.: The carpet installer may be required by the GC to provide carpet protection along traveled paths, ingress/egress, etc after installation.

C. It shall be the responsibility of the GC to ensure that all materials being used to protect installed construction are compatible with, and/or adjacent to, the materials being protected. This shall include but not be limited to the material used as covering, tapes used to fasten protective materials, etc.

1.3. RELATED SPECIFICATIONS

A. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public Works Construction".
   1. Use the following link to access the Standard Specifications web page:
      http://www.cityofmadison.com/business/pw/specs.cfm
      a. Click on the "Part" chapter identified in the specification text. For example if the specification says "Refer to City of Madison Standard Specification **2**10.2" click the link for Part II, the Part II PDF will open.
      b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.
      c. City Standard Detail Drawings (SDD) may be located from the index in Part VIII.

B. Section 01 60 00 Product Requirements

C. Section 01 74 13 Progress Cleaning

PART 2 - PRODUCTS

2.1. FENCING MATERIALS AND BARRICADES

A. Except where noted in other areas of the construction documents, the responsible contractor shall provide fencing around the construction site as shown on the Civil Drawings of an appropriate construction as identified below. For temporary barricade situations, the responsible contractor may provide one of the following that sufficiently provide a sturdy physical barrier and/or visual barrier as necessary for the intended application.
   1. Standard orange construction barrels each with a standard rubber base ring and reflective tape
      a. Provide flashing amber lights as needed to increase night time visibility
   2. Steel "T" style fence posts
   3. 4'0" high standard orange construction fence
   4. Traffic barricades
   5. Jersey barriers
   6. Other types of fencing or barricades typically used in the construction industry

B. The contractor responsible for providing the fencing materials and barricades shall also be responsible for maintaining them. This shall include but not limited to fixing damaged fencing, standing up barrels that have been knocked over, realigning barrels, and ensuring flashing lights are fully operational at all times.

C. The following fencing and barricade designations, and their use descriptions shall be used throughout this specification to provide uniformity in describing protection requirements.
   1. Type A, Jersey Barriers, to be used as permanent blocking devices to deny access to alternate project site entrances or exits.
   2. Type B, Traffic Barricades, to be used as temporary blocking devices to deny access to alternate project site entrances or exits.
   3. Type C, Construction Barrels without construction fencing shall be used for lane closures, temporary blocking devices to deny access and the protection of single locations (I.E. identify the location of an access structure) that do not require fencing.
   4. Type D, Construction Barrels with construction fencing where it becomes necessary to surround an object with a complete visual barricade and it is impractical or unacceptable to install fence posts. The surround shall be constructed in such a manner as to provide a buffer zone around and access to the item being protected.
   5. Type E, Steel "T" Fence Posts shall be used at the project lines, as indicated on the Civil Drawings, with six foot galvanized chain link fencing to surround an object with a complete visual barricade and it is practical to install fence posts. The surround shall be constructed in such a manner as to provide a buffer zone around and access to the item being protected. All posts shall be driven installed. Surface mounted posts to only be used for temporary barricades.
   6. Type X, Other fencing or barricade types that may be designated and detailed within the construction documents shall use additional alpha numeric designations.

2.2. EROSION CONTROL PROTECTION

A. Refer to City of Madison Standard Specification 210.2 for authorized materials associated with erosion control materials.

2.3. INTERIOR FINISH PROTECTION MATERIALS

A. Except where noted in other areas of the construction documents or this specification the responsible contractor:
   1. Shall not provide the cheapest or least effective method as an effort to meet any protection requirement.
   2. Shall provide materials of sufficient quality, and durability to provide adequate protection based on the seasonal conditions and the anticipated duration at the time the protection will be needed.
   3. Shall provide sufficient quantity of protection material to protect the construction as needed.

B. Prior to installing protective measures the responsible contractor shall propose to the GC, Project Architect (PA) and City Project Manager (CPM) the proposed plan for protection, materials to be used and samples as necessary.
   1. The PA and CPM reserve the right to disapprove any proposed method and/or material and/or make alternate proposals.

PART 3 - EXECUTION

3.1. GENERAL EXECUTION REQUIREMENTS

A. The GC shall be responsible for ensuring all of the following procedures and requirements are implemented as needed for the duration of the Work performed under this contract.

B. The GC shall also be responsible for the following:
   1. Reporting any incident of damage to existing property, right-of-way, or utility to the CPM immediately upon rendering the incident safe, and notifying emergency response teams, and emergency utility crews as needed.
   2. Conduct a site walk through prior to leaving at the end of each day to assess:
      a. Protection measures are properly in place, provide correction actions as necessary.
      b. Note damage to existing completed work and schedule repair/replacement as needed.
   3. Ensure all contractors and workers are being diligent in protecting existing work, and newly installed construction.

3.2. PROTECT ADJACENT PROPERTIES

A. Whenever possible through the design process the City of Madison shall have previously provided notice to adjacent property owners that work will be occurring on or near their property. The City of Madison shall also have obtained any permanent or temporary easements that may be necessary to complete any Work on adjacent properties.

B. It shall be the responsibility of the GC to do the following for all Work under this contract being performed on or adjacent to the property line:
   1. Contact the adjacent property owner and provide him/her with information on the work to be done, equipment to be used, and estimated duration of the work. Information to be updated and communicated to property owner(s) as construction progresses and site conditions change.
      a. If any adjacent property is a rented or leased space the GC shall also make contact and provide the same information to the tenants.
      b. Determine from the owner and/or tenants if there are any concerns for children, pets, special plantings, or other concerns.
   2. Discuss the following with all contractors performing work on or near the property line.
      a. Work to be completed and timeline.
      b. Concerns of adjacent property owners/tenants from item 1 above.
      c. Which protective measures will be necessary to protect adjacent properties and address the concerns of adjacent property owners/tenants.
   3. Ensure all protective measures are placed and maintained during the execution of Work on or adjacent to the property line. Interact with the adjacent property owners/tenants as needed.

C. Any contractor doing work on or adjacent to the property line shall install and maintain any protective measure identified in the contract documents, this specification, or as directed by the GC.

D. The GC shall be responsible for restoring any damage to structure and property located on or adjacent to the property line.
   1. Restoration shall include but not be limited to repair or replacement using like materials and finishes to its original condition or better.
   2. Restoration of landscaping materials shall include watering of any seed, sod, or other planting of any kind for a reasonable period of time to encourage germination and root development.

E. The GC shall keep the CPM informed directly to any issues pertaining to adjacent property owners and tenants.

3.3. PROTECT LANDSCAPING FEATURES

A. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.
   1. Whenever possible do not install new landscape features until exterior building construction has been completed, equipment such as scaffolding and lifts are no longer needed and have been removed, and heavy equipment operation is no longer required.
   2. Whenever possible remove and temporarily store all existing landscape features such as benches, waste receptacles, signage, and other such features that will be within the area of Work that can be removed.
   3. Landscape features that cannot be removed such as flag poles, light poles, light bollards, etc. shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil.
   4. Planting beds shall be protected using Type E fencing around the exposed perimeter of the planting bed as needed.
   5. The City of Madison Standard Specification 107.13 shall apply to all tree protection in and around the project site at all times.

3.4. PROTECT UTILITIES

A. The contractor shall be responsible for notifying all utilities to determine emergency response procedures and protection requirements prior to installing any construction protection.
   1. This includes requesting utility marking through Diggers Hotline.
      a. Call 811 or 1-800-242-8511 to request a public utility locate
      b. For emergency locate call (262) 432-7910 or (877) 500-9592
   2. Contact the Owner and CPM for any available private utility information on the property that may be available prior to calling a private utility locating company.

B. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.
   1. Hydrants, lamp posts, electrical transformers, and other utility pedestals shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil. Fence posts shall be located so as to not be directly over the utility main.
   2. Storm sewer structures in pavement shall have proper inlet protection according to City of Madison Standard Specification 210.1(g) and Type C Construction Barrels when necessary.
   3. Storm sewer structures in turf and other landscaped areas shall have proper inlet protection according to City of Madison Standard Specification 210.1(g) and Type E fencing for areas on soil.
   4. Stormwater management features such as greenways, retention/detention ponds, bio-filtration ponds and other such features shall be properly protected according to the appropriate erosion control measure specified on the Erosion Control Plan. See multiple sections of City of Madison Standard Specification 210.1
      a. For the protection of hard to see items such as structures, castings, inlets, etc. in grassy areas provide Type E fencing for areas on soil.
      c. For the protection of storm water management features having special soils and plants such as bio-filtration ponds provide Type E fencing for areas on soil.
   5. Other structures and covers including but not limited to cleanouts, wiring hand holes, valve boxes, access structures, grease trap structures, etc shall be protected as follows:
      a. Provide Type E fencing for areas on soil.
      b. When paving operations are complete provide a construction barrel or cone near structures as necessary depending on required heavy construction traffic.

3.5. PROTECT PUBLIC RIGHT OF WAY

A. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.
   1. All public right-of-way (area from behind the sidewalk to the centerline of the street) shall remain open and accessible except during periods of active work. At such times the public right of way shall be properly closed and signed as referenced in City of Madison Standard Specification 107.9.
   2. Bus stops and bus stop structures shall remain accessible at all times.
   3. Traffic signage and traffic signals, traffic control boxes shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil.
      a. Protection at traffic signage/signals shall not obstruct the viewing of the sign/signal for its intended purpose at any time.

B. When additional protection for traffic control is required, the use of barricades, guardrails, lane closures and other such procedures will be detailed within the construction documents.

C. When additional protection for overhead sidewalk cover is required the contract documents shall indicate the specific location and structural requirements of the protective structure.

3.6. PROTECT STORED MATERIALS

A. All contractors shall refer to Specification 01 60 00 Product Requirements for all storage and protection requirements of building materials and products delivered to the site.

3.7. PROTECT WORK - EXTERIOR

A. Provide all temporary services that may be required to protect the installed material from heat, cold, humidity, etc, while materials such as concrete, mortar, sealants, paints, etc, are drying and/or curing.

B. Open trenches, pits, and other such excavations shall be properly covered, lined, or shored as needed during periods of inclement weather to prevent the caving of soils onto existing work in progress. Refer to the appropriate specifications and/or regulatory requirements governing this type of work as necessary.

C. Provide adequate protection at all openings with heavy duty tarps, plastic sheathing, or wood framing and sheathing as needed to protect interior work in progress from inclement weather as needed.

D. Protect exterior finishes of all kinds with heavy duty tarps or plastic sheathing as needed while landscaping is being installed through full germination of seeded areas or installation of filter fabric and mulches to keep dust, dirt, and mud off of finished exterior surfaces.

E. Designate specific curb mounting points and provide wood blocking where small vehicles, skid loaders and other such equipment may need access to areas being landscaped.

F. Provide plywood turning pads for skid loaders to turn on to prevent tire marking on new pavement.

G. Do not permit the parking of vehicles with any kind of fluid leaks to park on new pavement.

H. The contractor shall be responsible for cleaning, repairing, or replacing any completed work or work in progress under this specification as deemed necessary by the CPM without additional cost to the contract.

3.8. PROTECT WORK - INTERIOR

A. The GC shall do all of the following:

1. Provide all temporary services that may be required to protect the installed material from heat, cold, humidity, etc, while materials such as concrete, mortar, sealants, paints, etc, are drying and/or curing.
2. Provide adequate visual and/or physical protection as needed to protect newly completed interior work such as paint, flooring material, sealants, grouts, etc that may be drying and/or curing.
3. Provide adequate space and materials for cleaning boots, tool boxes, supplies, and other items coming into the project site once finish work has begun.
4. Clean dirtied areas and repair/replace damaged areas immediately.

B. The contractors responsible for interior work shall be responsible for protecting their work and finishes from dirt, mud, snow, spills, splatters, and physical damage after installation as follows:

1. Protect vinyl composite, rubber composite, painted/stained concrete, and tiled flooring as follows:
   a. Define foot traffic areas and protect with Ramboard Temporary Floor Protection products as a minimum basis of design or other protection product(s) compatible with installed flooring product if Ramboard is not compatible. Products to be used shall be new.
      i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do not allow any debris or other material between the installed flooring and the protection material.
      ii. Repair tears immediately, replace worn areas with like material as necessary.
2. Protect carpeted areas as follows:
   a. Define foot traffic areas and protect with a minimum of 6mil, clear, polyethylene sheeting 3 feet wide. Products to be used shall be new.
      i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do not allow any debris or other material between the installed flooring and the protection material.
      ii. Repair tears immediately, replace worn areas with like materials as necessary.
3. Protect all finished walls in high traffic areas with Ramboard Temporary Wall protection products or approved equal.
      i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do not allow any debris or other material between the installed flooring and the protection material.

ii. Repair tears immediately, replace worn areas with like materials as necessary.

3. Protect counter tops, cabinets, and other finished surfaces with large sheets of thick cardboard or Ramboard products. Do not allow toolboxes, finish materials, parts and other such items to be placed on finished materials.

C. All protection shall stay in place until the CPM, PA, and GC mutually deem the project is ready for Final Cleaning. The contractors responsible for protecting the work shall be responsible for removing the protection and removing any adhesive residue at that time. Contractors shall only use manufacturer authorized cleaning materials for removing adhesives, etc.

D. Contractors doing work in un-protected areas of finished work shall be required to provide drop cloths and other protection as noted within this specification for the duration of their work.

1. Finished areas shall be sufficiently covered to accommodate all equipment, and materials being used to complete the work being done.
2. Finished areas shall be sufficiently covered to prevent splatters, over spray, etc when doing touch-up work.
3. Contractors who do not provide sufficient protection under this sub-section shall be responsible for any costs associated with cleaning, repairing or replacing already finished construction at no additional cost to the contract.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to clearly define and quantify the requirements associated with closing a City of Madison Public Works Contract for facility related work.

B. All contracts have two distinct but related paths. Each path needs to be properly closed independently in order to close the contract as a whole.

1. Construction closeout is related to closing out all of the Work associated with the construction documents.
   a. It shall be the responsibility of all contractors to be fully aware of the required Work and closeout requirements involved in their individual trades.
2. Contract closeout is related to closing out all of the administrative aspects of the contract in general.
   a. It shall be the responsibility of all contractors to be fully aware of the administrative requirements required by the contract and to provide the supporting documentation required.
3. Construction Closeout must be completed before Contract Closeout can begin.

C. This specification will provide general knowledge associated with the following areas:

1. Construction Closeout Requirements
2. Construction Closeout Procedure
3. Contract Closeout Requirements
4. Contract Closeout Procedure
5. Final Payment and Certificate of Completion

1.2. RELATED SPECIFICATIONS

A. Contractors shall review all references to other specifications including specifications relating to the execution of the Work associated with their Division or Trade.

B.	Section 01 29 76	Progress Payment Procedures
C.	Section 01 31 23	Project Management Web Site
D.	Section 01 32 26	Construction Progress Reporting
E.	Section 01 45 16	Field Quality Control Procedures
F.	Section 01 74 13	Progress Cleaning
G.	Section 01 45 16	Construction Waste Management and Disposal
H.	Section 01 76 00	Protecting Installed Construction
I.	Section 01 78 13	Completion and Correction List
J	Section 01 78 23	Operation and Maintenance Data
K.	Section 01 78 36	Warranties
L.	Section 01 78 39	As-Built Drawings
M.	Section 01 78 43	Spare Parts and Extra Materials
N.	Section 01 79 00	Demonstration and Training
O	Section 01 91 00	Commissioning

P. Other requirements as noted in the contract documents signed by the General Contractor

1.3. DEFINITIONS

A. ***Substantial Compliance***: A letter provided to the City of Madison Building Inspection and signed by the Project Architect indicating that all Work has been completed to a level that would allow Owner Occupancy and that all construction is in compliance with the construction documents. A copy of this letter is also provided to the State of Wisconsin Department of Health and Safety as necessary to clear plan review requirements. This letter does not represent construction closeout.

B. ***Certificate of Occupancy***: The Regulatory letter from the City of Madison Building Inspection Department indicating that all regulatory requirements and inspections have been completed and the building may now be occupied for its intended use. This letter does not represent construction closeout.

C. ***Certificate of Substantial Completion***: A letter provided by the Department of Public Works, signed by the City Engineer indicating that Construction activities are substantially complete. This letter does represent construction closeout and the date of this letter begins the date of the Warranty Period.

D. ***Construction Closeout***: The point in the contract where all contractual requirements associated the execution of the Work as described in the plans, specifications, and other documents have been successfully met and the items described in 1.3.A, .B, and .C above have been completed.

E. ***Final Progress Payment***: The progress payment associated with achieving Construction closeout as described in 1.3.D above. At this point the contractor may request all monies associated with the contract be paid with the exception of held retainage.

F. ***Contract Closeout***: The point in the contract where all contractual requirements associated with the City of Madison, Board of Public Works contract has been successfully met.

G. ***Final Payment***: The final contract payment submittal that may be approved by the City of Madison after all contractual requirements of the Public Works Contract have been met and any remaining monies (retainage) due to the contractor may be released for the Final Payment.

1.4. QUALITY ASSURANCE – CONSTRUCTION CLOSEOUT

A. All contractors shall be responsible for properly executing the construction closeout requirements associated with their Work as described in the specifications governing their Work.

B. The GC shall be responsible for all of the following:

1. Ensuring that all contractors have met the construction closeout requirements associated with their Work.
2. Coordinate the collection of all construction closeout deliverables from all contractors, provide the deliverables to the Project Architect and City Project Manager for review as necessary, and ensure all contractors correct deficiencies of deliverables and resubmit as needed for final acceptance.
3. Ensure all closeout requirements identified in the Construction Closeout Checklist below have been completed as intended by the construction documents.

1.5. QUALITY ASSURANCE – CONTRACT CLOSEOUT

A. The City of Madison, Department of Civil Rights (DCR) monitors contract compliance for construction and procurement contracts to ensure that local, state and federal regulations are followed by contractors working on City of Madison Public Works (PW) projects. DCR will monitor all PW projects from contract award through the final payment at the close of the project. Contractors will be required to submit reporting paperwork throughout the PW project process.

1. Contractors are encouraged to visit the web site identified below for additional information, checklists, forms, and other information provided by DCR as it relates to Contract Compliance.
   http://www.cityofmadison.com/Business/PW/contractCompliance.cfm
2. Questions regarding the process should be directed to parties and offices as identified on the various forms, documents, and instructions or contact:
   City of Madison, Department of Civil Rights
   210 Martin Luther King Jr. Blvd., Room 523
   Madison, WI 53703
   (608) 266-4910

B. All Sub-Contractors have submitted the applicable required documents described in item 1.5.D below to the General Contractor (GC) for Contract Closeout.

C. The GC has submitted the required applicable documents described in item 1.5.D below for all contractors to the appropriate City of Madison Agency per instructions associated with each submittal.

D. The documents required for submittal to the City of Madison for Contract Closeout may include any/all of the items listed below depending on contract type. It is the sole responsibility of all contractors to know and submit the required and complete documentation in a timely fashion.

1. Weekly Payroll Reports
2. Employee Utilization Reports
3. Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination
4. Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination
5. Documentation required for Small Business Enterprise (SBE) goals
6. Other documents as maybe required or requested through the Finalization Review Process

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. CONSTRUCTION CLOSEOUT CHECKLIST

A. All contractors shall be responsible for reviewing the drawings and specifications within their Divisions of Work to provide a complete and comprehensive list of all Construction Closeout Requirements to the GC.
   1. The checklist shall include all items identified within the construction documents that require any of the following (and examples) prior to moving into Contract Closeout Procedures:
      a. Documents indicating a specified level of performance has been achieved, such as:
         i. Test reports of all types
         ii. Startup reports
      b. Required documentation, such as:
         i. As-builts and record drawings
         ii. Operation and maintenance data
      c. Physical items to be turned over to the owner, such as:
         i. Attic stock
         ii. Keys
      d. Required maintenance completed, such as:
         i. Ducts cleaned
         ii. Filters replaced
      e. Commissioning and LEED related items and submittals
      f. Owner and Maintenance Training

B. Each list shall indicate the title of the closeout requirement, the associated specification of the requirement, the required result or deliverable, the responsible contractor(s), and a column to verify the item has been turned in and completed.

C. The GC shall be responsible for all of the following:
   1. Consolidating all the closeout lists into one master Construction Closeout Checklist.
      a. The checklist shall be in a tabular data format similar to the sample below
   2. Upload the completed checklist to the Contract Closeout-Miscellaneous Documents Library on the Project Management Web Site for review.
   3. Resubmit the checklist as needed after initial reviews have been completed.

D. The GC shall work with all contractors to amend the Construction Closeout Checklist throughout the execution of the project based on changes and modifications as necessary.

Title	Specification	Description	Responsibility	Completed
Quality Management Observation Reports	01 45 16	All QMO reports have been properly responded to, reviewed and closed by the CPM.	All, GC	
As-Built Drawings	01 78 39	As-Built drawings have been reviewed and accepted per the specification	All, GC	
Testing and Balancing of HVAC	23 09 23	Provide final TnB reports indicating design performance has been achieved	HVAC	

3.2. CONSTRUCTION CLOSEOUT REQUIREMENTS

A. The timely submittal or completion of closeout requirements shall go hand in hand with the Progress Payment Milestone Schedule that can be found in Specification 01 29 76 Progress Payments. No payments shall be made until all requirements for that payment have been met.
   1. The GC and all major Subcontractors, PA, and CPM, shall review all requirements for Construction/Contract Closeout during two (2) special meetings.

a. The first meeting shall be held at the 50% Contract Total Payment milestone. This meeting shall discuss the requirements associated with various construction/contract closeout documentation and events when they are due with respect to progress payments.
b. The second meeting shall be held at the 70% Contract Total Payment milestone. This meeting shall review the contractors progress regarding the closeout checklist, begin making plans for upcoming deadlines such as scheduling training, where to put attic stock, and when they are due with respect to progress payments.

2. The GC, PA, and CPM, shall utilize the Construction Closeout checklist to ensure that all construction closeout requirements have been met.

3.3. CONSTRUCTION CLOSEOUT PROCEDURE

A. Upon successful completion and final acceptance of all Construction Closeout Requirements the GC may submit to the CPM and PA the request for Final Progress Payment (100% contract total, less retainage).

B. The PA will confirm with the design consultants, CPM, and other City of Madison staff that all requirements of the Work have been completed and will do the following:
1. Approve the final progress payment application
2. Provide the required signed payment documents to the CPM
3. Provide the required Letter of Substantial Compliance to the following as required:
a. State Safety and Building Division
b. Local Building Inspection office
c. GC
d. CPM

C. The CPM shall draft the City Letter of Substantial Completion for signature by the City Engineer. This letter shall state any of the following that may still be tied to the contract and/or warranty:
1. Indicate that the date of the letter shall also be the beginning of the Warranty period.
2. Indicate any allowed due outs, reasons for them, and anticipated dates of finalization.
a. QMO issues such as off season testing of equipment
b. Off season training of equipment

D. The GC and all subcontractors shall finalize all warranty letters associated with their Work using the date noted on the City Letter of Substantial Completion, and provide the CPM with all warranties as described in Specification 01 78 36 Warranties. Upon receipt and final approval of the Warranties the CPM may initiate final processing of the Final Progress Payment (100% contract total, less retainage).

3.4. CONTRACT CLOSEOUT REQUIREMENTS

A. The GC and all sub-contractors shall follow all requirements associated with documenting contract compliance and provide documentation as required or requested by DCR or PW staff. All contractors are encouraged to stay current with submissions of the following documentation:
1. Weekly Payroll Reports no later than the Progress Payment equal to 50% of the contract total.
2. Employee Utilization Reports
3. Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination
4. Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination
5. Documentation required for Small Business Enterprise (SBE) goals
6. Other documents as maybe required or requested through the Finalization Review Process

B. Near the Progress Payment equal to 80% of the contract total the GC shall request in writing a Finalization Review. At that time DCR or PW staff shall prepare a report of all contract documentation submitted to date. A list of missing items or outstanding issues will be emailed to the GC. <u>No additional follow-up will be generated by DCR or PW Staff</u>.

3.5. CONTRACT CLOSEOUT PROCEDURE

A. The Contract Closeout Procedure will not begin until the Construction Closeout Procedure has been completed.

B. When the GC feels he/she has successfully met all of the Contract Closeout Requirements associated with Section 3.3 above the GC may submit to the request for Final Payment to the CPM.

C. The CPM shall sign and submit the Final Payment request for processing.

D. DCR and PW staff shall do a complete review of all documentation associated with item 3.3.A above.

E. The GC shall be notified directly by DCR or PW Staff of any documentation that may still be missing, have incomplete information, or other outstanding issues. It shall be the responsibility of the GC to continue follow-up with DCR and PW staff until all documentation has been successfully submitted and accepted.

F. When all required documentation associated with Contract Closeout has been successfully submitted and accepted by DCR and PW Staff the City of Madison shall process the Final Payment of any remaining monies including retainage.

END OF SECTION

SECTION 01 78 13
COMPLETION AND CORRECTION LIST

PART 1 – GENERAL

1.1. SUMMARY

A. The City of Madison has developed a multi-faceted Quality Management Program that begins with contract signing and runs through contract closeout to ensure the best quality materials, workmanship, and product are delivered for the contracted Work.

1. The Progress Management Web Site is a Construction Management tool that provides contractors, consultants, and staff a single on-line location for the daily operations and progression of the Work.
2. The Quality Management Observation (QMO) is an ongoing observation of the construction process as it progresses. The City of Madison does not use a "Punch List" or "Corrections List" as it is typically known throughout the construction industry. The QMO process acts as an "in progress punch list". Work identified as not in compliance with the contract documents by the Owner, Owner Representatives, Owner Consultants, etc. shall be resolved immediately at the Contractor's expense. Unresolved issues will be subject to withholding of progress payment(s) until completed.
3. Very stringent expectations are tied to Construction Closeout and Contract Closeout procedures. Specific milestones throughout the project need to be met and the milestones are tied to the Progress Payment Schedule.

B. All contractors shall be required to review the specifications identified in Section 1.2 below, and other related specifications identified therein to become familiar with the terminology and expectations of this City of Madison Public Works contract.

1.2. RELATED SPECIFICATIONS

A.	Section 01 29 76	Progress Payment Procedures
B.	Section 01 31 23	Project Management Web Site
C.	Section 01 45 16	Field Quality Control Procedures
D.	Section 01 77 00	Closeout Procedures

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide clear responsibilities and guide lines related to providing well documented and complete Operation and Maintenance (O&M) Data related to general facility use, equipment, systems, finishes, and materials to City of Madison Staff (Owner, Owner Representatives, Maintenance, and Custodial Personnel) as needed.

B. Operation and Maintenance Data shall apply to both of the following categories except where specific requirements are noted under their separate titles as follows:

1. Operation and Maintenance Data: Generally shall mean the owner manual that provides information on start-up, shut-down, operation, troubleshooting, maintenance, parts, and other such documentation as it pertains to all equipment and systems installed under the Work.
2. Use and Care instructions: Where applicable use and care instructions shall also be considered O&M for such things as flooring, tile, partitions, and other such finishes and trim related items, installed under the Work.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 31 23 Project Management Web Site
C. Section 01 77 00 Closeout Procedures
D. Section 01 78 13 Completion and Correction List
E. Section 01 78 19 Maintenance Contracts
F. Section 01 78 36 Warranties
G. Section 01 79 00 Demonstration and Training
H. Section 01 91 00 Commissioning
I. Other Divisions and Specifications that may address more specifically the requirements for O&M Data.

1.3. QUALITY ASSURANCE

A. All O&M Data shall meet the requirements identified in Section 1.4 below.

B. All contractors shall provide O&M Data for each piece of equipment, system, or finish installed during the installation of the Work. O&M Data shall be provided to the General Contractor (GC) for verification and submittal.

C. The GC shall be responsible for receiving all required O&M Data files from all contractors for verifying that all files submitted meet the requirements in Section 1.4 below.

1.4. O&M DATA REQUIREMENTS

A. O&M Data shall be provided in digital PDF format as follows:

1. PDF files shall be complete first generation consumer useable editions of PDF documents as provided by any of the following:
   a. Product manufacturer
   b. Supplier of product
   c. Product manufacturer internet site

2. Acceptable PDF files shall have the following functionality:
    a. Word searchable
    b. Key areas are bookmarked
    c. Table of Contents and/or Index linked to content is preferred whenever possible.
3. Scanned printed material, with word searchable capabilities, saved as a PDF, is not acceptable and will be rejected without further review.

B. O&M Data shall include but not be limited to the following manufacturers' published information as appropriate for the equipment, system, material, or finish:
1. Installation instructions
2. Parts lists, assembly diagrams, explosion diagrams
3. Wiring diagrams
4. Start-up, shut-down, troubleshooting and other related operation procedures
5. Lubrication, testing, parts replacement, and other such maintenance procedures
6. General use, care, and cleaning instructions
7. Special precautions and safety requirements
8. A list of certified equipment vendors, service companies, parts suppliers including company name, address, and phone number
9. A list of the recommended spare parts to have on hand at all times
10. A list by type of all recommended lubes, oils, packing material, and other maintenance supplies
11. Copies of final test reports, balance reports, and other related documentation
12. Warranty information for equipment and systems

1.5. O&M DATA SUBMITTALS

A. O&M Data shall be prepared as identified in this specification and shall be submitted for review as per the schedule identified in Specification Section 01 29 76, Progress Payment Procedures.

B. O&M Data Draft submittals will be reviewed for content, procedure, and compliance only. A general critique with recommendations for improvement will be made but re-submittals will not be required.

C. O&M Data Final submittals will be reviewed for content, procedure, and compliance. Re-submittals will be required until such time as each submittal is accepted.

NOTE: Acceptance of O&M Data Final submittals is required to be complete prior to scheduling and conducting owner related training and construction closeout.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. O&M DATA PREPARATION - GENERAL

A. All contractors shall prepare O&M Data for draft and final submission as follows:
1. Obtain digital PDF files for each piece of equipment, system, material or finish as described in Sections 1.4.A.1 and 1.4.A.2 above.
2. Verify that all information as described in Section 1.4.B above is included with the PDF file. Obtain missing information as necessary for a complete submittal.

B. Rename each individual PDF file as follows.
1. Do not use special characters such as #, %, &, /, etc. These characters are reserved by the Project Management Web Site software the City of Madison uses; however the under-score (or under-bar) '_' is an allowed character.
2. Use the following format and examples for renaming your file:
    a. Format: ***Equipment name_What_Project name_Contract number_Year***
        i. *Equipment Name* represents the name of any equipment, system, material or finish as designated in the Contract Documents.
        ii. *What* represents what the file is about
        iii. *Project Name* represents the title of the project or contract. A shortened version of the title may be identified by the City Project Manager to be used by all contractors.
        iv. *Contract number* is the specific identification number the Work was bid under and appears on the plan set title sheet and in each sheet title block
        v. *Year* represents the year the contract will be closed out
    b. Examples of file names

i. AHU 2_Operation Manual_Fire Admin_1234_2015
ii. CPT 2_Use and Care_MPD West_9876_2011

C. All contractors shall submit the completed digital PDF files to the GC in sufficient time for the GC to meet the O&M Data submission deadlines as described in Specification Section 01 29 76, Progress Payment Procedures.

D. O&M Data shall be submitted and reviewed as described in sections 3.2 and 3.3 below.

3.2. O&M DATA DRAFT SUBMITTAL

A. All contractors shall prepare and submit the following for an O&M Data Draft review submittal:
1. Prepare three (3) complete O&M Data file samples as described in section 3.1 above.
2. Review all specifications within his/her Division of Work and prepare a complete O&M Data checklist listing all equipment, systems, materials, or finishes. Checklist shall be in tabular form similar to the example below and shall indicate the title (and plan identifier when applicable) of the O&M Data, the associated specification, and a column to verify the item has been turned in and completed.

B. The GC shall be required to review all contractors' samples and checklists for compliance with this specification and shall return any to the originating contractor that are insufficient for re-submittal.
1. When acceptable to the GC, he/she shall upload each O&M Data draft submittal file to the O&M Draft library on the Project Management Web Site.

C. The Project Architect, City Project Manager, CxA, Consulting Staffs and Owner Representatives shall review the O&M Data draft submittals and checklist within fifteen 15 working days as follows:
1. Provide general critique comments by Division on O&M Data samples submitted. Critique is intended to provide all contractors with information on strengths and weaknesses of their submittals.
a. Re-submittal of the O&M Data samples will not be required.
2. Review in detail the O&M Data Checklist for completeness. Provide comments as needed.
a. Re-submittal of the O&M Checklist will be required until accepted.

Title	Specification	Completed
Overhead Door Operator	08 36 00	
Air Handling Unit (AHU-3)	23 00 00	
Water Heater (WH-1)	22 30 00	

3.3. O&M DATA FINAL SUBMITTAL

A. All contractors shall prepare and submit the following for an O&M Data Final review submittal:
1. Prepare complete O&M Data files as described in Section 3.1 above according to their approved checklist as described in Section 3.2 above.
2. Submit completed checklist and all final O&M Data files to the GC for final submittal review.

B. The GC shall be required to spot check all contractors' submittals for completeness against their checklists and for compliance with this specification and shall return any to the originating contractor that are insufficient for re-submittal.
1. When acceptable to the GC, he/she shall upload each O&M Data final submittal file to the O&M Final library on the Project Management Web Site.

C. The Project Architect, City Project Manager, CxA, Consulting Staffs and Owner Representatives shall review the O&M Data final submittals and checklist within fifteen (15) working days as follows:
1. Review the files submitted against the checklist and request any missing files through the GC.
2. Review in detail all of the O&M Data files for completeness.
a. Submittals shall be accepted or rejected as individual PDF files.
b. Contractors shall re-submit entire O&M submittal if any portion is rejected or incomplete.

3.4. CONSTRUCTION CLOSEOUT

A. All contractors shall review Specification 01 77 00, Closeout Procedures and Specification 01 79 00 Demonstration and Training.
1. Acceptance of all final O&M Data submittals is required prior to scheduling Demonstration and Training Sessions.
2. Completion of all Demonstration and Training Sessions is required to receive the Substantial Compliance for Occupancy Certificate, and to begin Construction Closeout procedures.

END OF SECTION

SECTION 01 78 36
WARRANTIES

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide clear responsibilities and guide lines related to providing all Warranties and Guarantees related to the Work, workmanship, materials, equipment, and other such items required by the Construction Documents.

B. Manufacturers' disclaimers and limitations on product warranties do not relieve any contractor of the warranty on the Work that includes the product.

C. Manufacturers' disclaimers and limitations on product warranties do not relieve suppliers, manufacturers and any contractor required to provide special warranties under the contract documents.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 31 23 Project Management Web Site
C. Section 01 77 00 Closeout Procedures
D. Section 01 78 23 Operation and Maintenance Data
E. Section 01 91 00 Commissioning
F. Other Divisions and Specifications that may address more specifically the requirements for Warranties related to the installation of all items and equipment installed under the execution of the Work.

1.3. DEFINITIONS

A. See specification 01 77 00 for the definitions of the following terms that may also be used in this specification:
1. Substantial Compliance
2. Certificate of Occupancy
3. Certificate of Substantial Completion
4. Construction Closeout
5. Contract Closeout

B. Emergency Repair: The Owner or Owner Representative reserves the right to make emergency repairs as required to keep equipment or materials in operation or to prevent damage to property and injury to persons without voiding the contractors warranty or bond or relieving the contractor of his/her responsibilities during the warranty period.

C. Installer: The company or contractor hired to install a finished product that was manufactured and supplied specifically for the Work within this contract. The Installer may or may not be the same company that supplied the product. See the definition for supplier.

D. Supplier: Any company that makes a specific finished product for the Work from information within the Contract Documents. Examples of suppliers would include custom cabinets, steel stairs and railings, etc. A supplier would not be a company that distributes items manufactured by others such as an electrical or plumbing supplier.

E. Warranty: A written guarantee from the manufacturer to the owner on the integrity of a product and its installation, and the manufacturers' responsibility to repair or replace the defective product or components within a specified time from the date of ownership. Warranty may also be used interchangeably with Guarantee. The following warranty types may be part of any specification within the Work associated with the Construction Documents:

1. Expressed Warranty: A warranty that provides specific repair or replacement for covered components of a product over a specified length of time.
2. Implied Warranty: A warranty that is not stated explicitly by a seller or manufacturer that the product is merchantable and fit for the intended purpose.
3. Standard Product Warranty: Preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner. Standard warranties may be for any amount of time but shall not be for anything less than one (1) year from the warranty date.
4. Special Warranty: A written warranty required by the Contract Documents either to extend the time limit provided under a standard warranty or to provide greater rights to the Owner.

F. Warranty Date: The effective date that begins all warranty periods required for products, installations, and work-manship associated with the execution of the Work for this contract. The Warranty Date shall be set by the CPM.

G. Related Damages and Losses: When correcting failed or damaged Warranted Work, remove and reinstall (or replace if necessary) the construction that has been damaged as a result of the failure or the construction that must be removed and replaced to obtain access for the correction of Warranted Work.

H. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected reinstate the warranty by a new written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation unless specifically noted otherwise in a specification.

I. Replacement Cost: All costs that may be associated with Work being replaced under warranty including but not limited to the following:
1. Related damages and losses
2. Labor, material and equipment
3. Permits and inspection fees
4. This shall be regardless of any benefit the Owner may have had from the Work through any portion of its anticipated useful service life.

J. Replacement Work: All materials, products, required labor, and equipment necessary to replace failed or damaged warranted to an acceptable condition that complies with the requirements of the original Construction Documents.

K. Owners Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, and remedies.
1. Rejection of Warranties: The Owner reserves the right to reject any warranty and to limit the selection of products with warranties not in conflict with the requirements of the contract documents.
2. Where the Contract Documents require a Special Warranty or similar commitment on the Work or product, the Owner reserves the right to refuse acceptance of the Work until the Contractor presents evidence the entities required to countersign such required commitments have done so.

1.4. GENERAL CONTRACTORS RESPONSIBILITIES

A. The General Contractor (GC) shall be responsible to remedy, at his/her expense, any defect in the Work and any damage to City owned or controlled real or personal property when the damage is a result of:
1. The GC's failure to conform to Contract Document requirements.
   a. Any substitutions not properly approved and authorized may be considered defective.
2. Any defect in workmanship, materials, equipment, or design furnished by the GC or Sub-contractors.

B. All warranties as described in this specification and these Contract Documents shall take effect on the date established by the CPM, as noted in Section 1.3F above.
1. All warranties shall remain in effect for one (1) year thereafter unless specifically stated otherwise in the Contract Documents or where standard manufacturer warranties are greater.

C. The GC's warranty with respect to Work repaired or replaced, including restored or replaced Work due to damage, will run for one (1) year from the date of Owner Acceptance of said repair or replacement.
1. This shall be regardless of any benefit the Owner may have had from the Work through any portion of its anticipated useful service life.

D. Warranty Response
1. See Section 3.5 of this specification.

PART 2 – PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. WARRANTY CHECKLIST

A. All contractors shall be responsible for reviewing the drawings and specifications within their Divisions of Work to provide a complete and comprehensive list of all Warranty Requirements to the GC.

B. Each list shall indicate the title (and plan identifier when applicable) of the warranted item, the associated specification of the warranted item, the terms of the warranty (years), and a column to verify the item has been turned in and completed.

C. The GC shall be responsible for all of the following:

1. Consolidating all the warranty lists into one master Warranty Checklist.
   a. The checklist shall be in a tabular data format similar to the sample below.
2. Upload the completed checklist to the Submittal Library on the Project Management Web Site for review. See Specification 01 33 23 Submittals for more information on this procedure.
3. Resubmit the schedule as needed after initial reviews have been completed.

D. The GC shall work with all contractors to amend the Warranty Checklist throughout the execution of the project based on changes and modifications as necessary.

Title	Specification	Terms	Completed
Overhead Door Operator	08 36 00	MFR 2yr	
Exterior Bench and Trash Receptacles	12 93 00	MFR 3 year warranty on finish	
Kitchen Sink (SK-1)	22 42 00	MFR 5 year	
Disposal (D-1)	22 42 00	MFR 7 year parts and in-home service	
Toilet (WC-1)	22 42 00	MFR 1 year limited	

3.2. LETTERS OF WARRANTY

A. All letters of warranty shall be in a typed letter format and provide the following information:

1. The letter shall be on official company stationary including company name, address, and phone number.
2. Indicate project name, contract number, and contract address the warranty is for on the reference line.
3. Provide a description of the warranty(ies) being provided.
   a. Include Division, Trade, or Specification information as necessary.
   b. Only combine warranties of related Divisional Work together. Create new letters for additional Divisions as necessary.
4. Indicate the effective Warranty Date. As noted in Section1.3.F above, the Warranty Date shall be the date the Certificate of Substantial Completion was signed by the City Engineer.
5. Contractor Letters of Warranty shall only be signed by a principal officer of the company.
6. After signing the letter provide the GC with a high quality color scanned image in PDF format and the original signed letter.

B. The GC shall be responsible for the Final Warranty submittal as identified in Section 3.4 below.

C. The GC shall obtain letters of warranty from all of the following:

1. The General Contractor shall provide warranty letters for all Work that was self performed under the contract documents, identify all trades or Divisions of Work.
2. All Sub-contractors shall provide warranty letters for Work performed under the contract documents; identify all trades or Divisions of Work.
3. Suppliers, as required by other specifications within the Construction Documents where the manufacture of a specific product unique to the Work of this contract was required.
   a. The terms and conditions of the Supplier Letter of Warranty shall be as defined by the specifications associated with the Work but shall not be less than the industry standard of repair, or replace defective materials and workmanship within one (1) year of the warranty date.
   b. When the supplier is also the installer a single written letter may be submitted identifying both the warranty for the manufacture of the product and the warranty for the installation of the product.
4. Installers as required by other specifications within the Construction Documents where the installation of a specific product unique to the Work of this contract was required.
   1. The terms and conditions of the Installer Letter of Warranty shall be as defined by the specifications associated with the Work but shall not be less than the industry standard of repair,

or replace defective materials and workmanship associated with the installation of the product within one (1) year of the warranty date.

5. Special Letters of Warranty shall be required from any contractor, supplier, installer or manufacturer who agrees to provide warranty services required by any Division Specification in excess of their Standard Product Warranty.

3.3. STANDARD PRODUCT WARRANTY

A. All contractors shall be responsible for collecting and providing copies of all standard product warranties for commercially available products purchased and installed under this contract.

B. Only one copy of the manufacturers' standard warranty needs to be submitted as representative for all quantities of the same model number used throughout the Work.

C. Provide the manufacturers certificate, letter, or other standard documentation for each Standard Product Warranty submitted as follows:

1. Whenever possible a PDF version of the document shall be used.
    a. If a PDF version is used all additional information shall be completed using simple PDF editing tools such as text boxes, highlight, etc.
    b. If a PDF version is not available and an original document is furnished the additional information shall be neatly hand written and highlighted on the document in such a fashion so that it does not obscure any part of the written warranty.
2. Provide the following additional information on each warranty document:
    a. Contract warranty date.
    b. Provide the manufacturer name and model number of the product if not specified within the warranty.
        i. Where the manufacturer name and model number is specified within the warranty it shall be highlighted for visibility.
    c. Provide the plan identifier (LAV-1, WC-2, etc) when applicable.

D. Each completed warranty shall be saved as a digital PDF. The file shall be named using the specification number and item description. I.E. 22 42 00 Toilet (WC-1).pdf
    a. Where an original certificate was furnished provide a high quality colored scan of the completed document with the additional information. Save the scanned image in PDF format and use the same naming convention as indicated above.

E. Provide all PDF files and any original documents to the GC for final consolidation to be provided to the Owner.

3.4. FINAL WARRANTY SUBMITTAL

A. The GC shall receive all required warranties (digital PDF and any original documents) from all contractors, suppliers, installers and manufacturers.

B. The GC shall inventory all received warranties with the Warranty Submittal List to ensure all required warranties have been received and all warranty periods are correct according to the specifications.

C. Provide with each Operation and Maintenance Manual a complete copy of any associated warranty.

D. Scan all warranties into a single organized electronic PDF file as follows:
1. Organize the PDF file into an orderly sequence based on the table of contents of the Specifications.
2. Provide a typed Table of Contents for the entire file at the front of the document.
3. Provide bookmarks and links to each individual PDF to enable quick navigation through the PDF document.

E. Upload the warranty submittal to the appropriate document library on the Project Management Web Site for review by the PA and CPM.

F. Correct any deficiencies or omissions and resubmit as necessary.

3.5. WARRANTY NOTIFICATION, RESPONSE, EXECUTION AND FOLLOW-UP

A. Warranty Notification:
1. The City of Madison, Project Management Web Site, uses an email notification system for all warranty related issues. The GC will be required to provide, and keep current during the warranty period, a minimum of two (2) email addresses and phone numbers of current employees to receive email notifications and provide response regarding Work associated with these construction documents.
    a. In the event a Warranty Issue is deemed by the City of Madison to be an emergency, the GC shall first receive a phone call with a follow-up email from the Project Management Web Site.
    b. The Contract Closeout-Warranty Issue Library on the Project Management Web Site uses a form for each warranty issue that is logged into the system.

i. The GC shall open each warranty issue form, review the issue description and any attached documentation or photos.
ii. The GC shall also notify any other sub-contractor, supplier, or installer that may be required to review the warranty issue.

B. Warranty Response:
1. The GC shall upon notification by the City of Madison provide warranty response as follows:
a. Critical Systems or equipment: Where damage to equipment and other building components, or injury to personnel is probable provide immediate emergency shut-down information and an on-site response team as soon as possible but in no case shall on-site response exceed 24 hours.
b. For non-critical responses where damage or injury is unlikely provide on-site response no later than the next business day.
c. Where Technical Assistance support is part of the written warranty provide all assistance necessary via phone, text, or internet systems as indicated by the warranty. If issues cannot be resolved provide on-site response no later than the next business day.
d. If the request cannot be supported in sufficient time as outlined above the Owner (or Owner Representative) reserves the right to contact other contractors or service companies having similar capability to expedite the repair or replacement and shall invoice all associated costs to the Owner back to the GC.

C. Warranty Execution:
1. The GC shall provide all repairs or replacements as necessary to restore broken or damaged Work to the original level of acceptance as intended by the Contract Documents.
a. Provide all materials, equipment, products, and labor necessary to complete the repair or replacement associated with the Warranty Issue.
b. Provide all cleaning services as may be required before, during, and after the repair or replacement as per Specification 01 74 13 Progress Cleaning.
c. Provide any protection necessary for existing construction as per Specification 01 76 00 Protecting Installed Construction
d. Provide new letters of warranty when required.

D. Warranty Follow-up:
1. Logged Warranty Issues:
a. The GC shall provide complete documented responses of all logged Warranty Issues. Responses shall provide a description of work completed, by who, inclusive dates, and photos of completed or repaired work.
i. Provide call back response if work is not acceptable.
b. The City Project Manager shall review the submitted response documentation and do a field inspection if necessary.
i. If work is not acceptable, contact GC to review details and expectations of the repair as needed.
ii. If work is acceptable close the Warranty Issue.
2. Quarterly Warranty Reviews:
a. The GC shall be responsible for scheduling quarterly on-site review with all of the following:
i. City Project Manager, and other City staff as needed
ii. Owner and Owner Tenant Representative
iii. Commissioning Agent (CxA)
iv. Plumbing, Heating, Electrical Sub-contractors
v. Other Sub-contractors that may be responsible for open Warranty issues
b. Quarterly reviews shall be scheduled at 3 months, 6 months, and 11 months after the effective date of the warranty. The review meetings shall:
i. Review the status of all open Warranty Issues, determine course of action and estimated date of completion.
ii. In the appropriate quarter, provide shut-down, start-up, testing, and training of off-season equipment as required by the contract documents.
iii. The 11th month review shall review all open Warranty Issues, final plan for resolution, and all Warranty Issues where a new letter of warranty may have been issued.

END OF SECTION

SECTION 01 78 39
AS-BUILT DRAWINGS

PART 1 – GENERAL

1.1. SUMMARY

A. This specification is intended to provide clear guidelines and identify the responsibilities of all contractors as they pertain to City of Madison contract procedures regarding the accurate recording of the Work associated with the execution of this contract. This shall include but not be limited to work that will be hidden, concealed, or buried.

B. Each contractor shall be responsible for maintaining an accurate record of all installations, locations, and changes to the contract documents during the execution of this contract as it may relate to their specific division or trade.

C. The General Contractor (GC) shall be responsible for ensuring all contractors provide as-built record information to the Master As-Built Document Set as described in this specification.

1.2. RELATED SPECIFICAITONS

A. 00 31 21 Survey Information
B. 01 26 13 Request for Information
C. 01 31 23 Construction Bulletin
D. 01 32 33 Photographic Documentation
E. 01 26 63 Change Orders
F. 01 29 76 Progress Payment Procedures
G. 01 31 23 Project Management Web Site
H. 01 33 23 Submittals
I. 01 77 00 Closeout Procedures
J 01 91 00 Commissioning
K. Other Divisions and Specifications that may address more specifically the requirements for field recording the installation of all items associated with the execution of this contract by Division or Trade.

1.3. RELATED DOCUMENTS

A. Other related documents shall include but not be limited to the following:
1. Bidding documents including drawings, specifications, and addenda.
2. Required regulatory documents of conditional approval.
3. Field orders, verbal or written by inspectors having regulatory jurisdiction.
4. Shop drawings and installation drawings.

1.4. PERFORMANCE REQUIREMENTS

A. The GC shall be responsible for maintaining the “Master As-Built Document Set” in the job trailer at all times during the execution of this contract. This document set shall include all of the following:
1. Master As-Built Plan Set
2. Master As-Built Specification Set
3. Other Document Sets

B. The GC shall designate one person of the GC staff to be responsible for maintaining the Master As-Built Document Set at the job trailer. This shall include, posting updates, revisions, deletions and the monitoring of all contractors posting as-built information as described in this specification.

C. All contractors shall use this specification as a general guideline regarding the requirements for documenting their completed Work. Contractors shall explicitly follow additional specification requirements within their own Division of Trade as it may apply to this specification.

1.5. QUALITY ASSURANCE

A. The GC shall be responsible for all of the following:
   a. Spot checking all sub-contractors field documents to insure daily information is being recorded as work progresses.
   b. Discuss as-built recording to the plan set at weekly job meetings with all sub-contractors on site.
   c. Schedule time with sub-contractors in the job trailer for recording as-built information to the plan set.
   d. Insure that all sub-contractors are providing clear and accurate information to the plan set in a neat and organized manner.
   e. Insure sub-contractors who have completed work have finalized recording all as-built information to the plan set before releasing them from the project site.

B. The Project Architect, the City Project Manager, Commissioning Agent and other design team staff will perform random checks of the Master As-Built Document Set during the execution of this contract to ensure as-built information is being recorded in a timely fashion as the Work progresses. An updated and current Master As-Built Document Set is a stipulation for approval of the progress payment.

PART 2 – PRODUCTS

2.1. OFFICE SUPPLIES

A. The GC shall provide a sufficient supply of office products in the job trailer at all times for all contractors to use in recording as-built information into the plan set. This shall include but not be limited to the following:
   a. Red ink pens, medium point. Pens that bleed through paper, markers, and felt tips will not be accepted.
   b. The use of highlighters is acceptable. Assign colors to various trades for consistency in recording information.
   c. Straight edges of various lengths for drawing dimension, extension and other lines.
   d. Civil and Architectural scales
   e. Clear transparent, non-yellowing, single sided tape.
   f. Correction tape or correction fluid for correcting small errors.

PART 3 - EXECUTION

3.1. FIELD DOCUMENT AS-BUILTS

A. The GC and all Sub-contractors shall be responsible for keeping their own field set of as-built documents including plans, specifications and published changes.

B. Field sets shall be kept dry and in good condition at all times.

C. No Work shall be buried, covered, or hidden, by any additional Work, regardless of Contractor or Trade, until locations of all materials and equipment has been properly documented as described below.

D. All contractors shall be required to record the following as-built information:
   a. Notes on the daily installation of materials and equipment.
   b. Sketches, corrections, and markups indicating final location, positioning, and arrangement of materials and equipment such as pipes, conduits, valves, cleanouts, pull boxes and other such items. Note all final locations on plan sheets, indicate dimension off identifiable building features. Riser diagrams need only be corrected for significant changes in locations, routing or configuration.
      i. The use of photographs in lieu of hand drawn sketches is acceptable.
      ii. Photos shall be taken according to Specification 01 32 33 Photographic Documentation
      iii. Print photo and markup with dimensions or notes as necessary.
   c. Identify by the use of existing plan symbology and notes the size, type, quantity, and use as applicable of materials such as pipes, valves, conduits, etc.

d. Note whether horizontal runs are below slab or above ceiling, include dimensions above or below finished floor elevation.

E. All contractors shall be responsible for transferring the information from their field set of documents to the Master As-Built Plan Set kept in the GC job trailer. See Section 3.3.D. below for the proper procedure.

F. All contractors shall update the GC Master Plan Set as often as necessary, but not less than once per work week.

3.2. SITE SURVEY AS-BUILT

A. The Land Surveyor Sub-Contractor shall provide digital as-built information including but not be limited to the following:

a. For underground buried utility laterals and services of all types locate all of the following that may apply:

i. Connection points at all mains
ii. Storm discharge points to open air
iii. All corners and bends regardless of angle, large radius sweeps shall have multiple point locations sufficient to define the sweep.
iv. All vertical drops
v. All wells
vi. Private buried utilities such as buried electrical cables, irrigation systems, etc.
v. Other information that may need to be located in the future by the owner prior to digging

b. Record all surface features including but not limited to the following:

i. Building corners, pavement edges, and other permanent structural features.
ii. All surface covers for inlets, catch basins, cleanouts, access structures, curb stops and other such devices.
iii. Other permanent surface features such as hydrants, lamp posts, and other permanent site amenities.

c. The following data shall be recorded while locating items in sub-sections 3.2.a and 3.2.b above:

i. Flow lines at both ends of pipes
ii. Pipe sizes and material types
iii. Rim elevations for all covers
iv. Sump elevations and invert elevations of all structures
v. Spot elevations for all pads, driveways, walks, stoops, and floors

B. The Surveyor shall provide the final digital as-built on a media and in a format specified in Specification 00 31 21 Survey Information to the GC for turn in to the Project Architect and the Civil Engineer.

C. The Surveyor shall provide two printed as-built site plans to the GC for inclusion in the Master As-Built Plan Set as follows:

1. One sheet to show all features (but not contour information) with text neatly organized for each item identified.
2. One sheet showing contours, contour labels, and features from item 1 above, but with no additional text.

3.3. MASTER AS-BUILT DOCUMENT SET

A. The GC shall be responsible for maintaining the Master As-Built Document Set in the job trailer at all times.

1. The Master As-Built Plan Set (Plan Set) shall begin with one complete bid set of drawings and any additional sheets that were supplied by published addenda during the bidding process. The cover sheet shall be titled as the “Master As-Built Plan Set” in large bold red letters approximately 2” in height and shall not be used for any other purpose.

a. The Plan Set shall be kept dry, legible, and in good condition at all times.

b. The Plan Set shall be kept up to date with new revisions within two (2) working days of supplemental drawings being issued. Revisions shall be posted as follows:

i. Insert new, revised sheets into the plan set. Void old sheets but do not remove them from the plan set. Indicate date received and what document (RFI, CB, CO, etc) caused the change.
ii. Insert new, revised individual details into the plan set. Void old details, tape new details over the old details with a “tape hinge” to allow them to be viewed. Indicate date received and what document (RFI, CB, CO, etc) caused the change.
iii. Add new details in appropriate white space on relevant sheets. If no space is available use the back side of the previous sheet or insert a new sheet. Indicate date received and what document (RFI, CB, CO, etc) caused the change.

c. The Plan Set shall be available at anytime for easy reference during progress meetings and for emergency location information of new work already completed.

2. The Master As-Built Specification Set (Spec Set) shall begin with one complete bid set of specifications and any additional specifications that were supplied by published addenda during the bidding process. The Spec Set shall be provided in three "D" ring type binders of sufficient thickness to accommodate the specification set. Multiple binders are allowed as necessary. Label the front cover and binding edge with "Master As-Built Specifications" in bold red letters. Provide other information as necessary to distinguish the contents of multi-volume sets.
   a. The Spec Set shall be kept dry, legible, and in good condition at all times.
   b. The Spec Set shall be kept up to date with new revisions within two (2) working days of supplemental drawings being issued.
   c. The Spec Set shall be available at anytime for easy reference during progress meetings.
3. Other Document Sets may be kept at the GCs option in three "D" ring type binders of sufficient thickness to accommodate the documentation. Other documentation sets may include but not be limited to RFIs, CBs, COs, etc.

C. The Land Surveyor Sub-Contractor shall be required to use digital surveying for all exterior site surveying, and provide deliverable digital as-builts as specified in Specification 00 31 21 Survey Information. As soon as practical the surveyor shall provide the GC with a preliminary copy of installed buried utilities for inclusion with the plan set in the job trailer. The surveyor shall provide final digital as builts as per section 3.2 above.

D. All contractors shall be responsible for updating the Plan Set from their field sets at least once per work week. Updates shall include but not be limited to the following procedures:
   a. All updates shall be done only in red ink. Place a "cloud" around small areas of correction to call attention to the change.
   b. Whenever possible place general work notes, field sketches, supplemental details, photos, and other such information on the reverse side of the preceding sheet. Installation notes including dates shall be kept neatly organized in chronological order as necessary.
   c. Accurately locate items on the plan set as follows:
      i. For items that are located as dimensioned provide a check mark or circle indicating the dimension was verified.
      ii. For items that are within 5 feet of the location indicated on the plans leave as shown and:
         - Provide correct dimensions to existing dimension strings or,
         - Accurately locate with new dimension strings
      iii. For items that are more than 5 feet from the location indicated on the plans
         - Accurately draw the items in the new location as installed and,
         - Accurately locate with new dimension strings and,
         - Note that the existing location is void.
   d. Include dimensioned locations for items that will be buried, concealed, or hidden in the ground, under floors, in walls or above ceilings.
      i. Dimensions shall be pulled from identifiable building features, not from centers of columns or other buried features.
      ii. When necessary pull more dimensions as needed from opposing directions to properly locate single items.

3.4. AS-BUILT REVIEW AND ACCEPTANCE

A. The GC shall provide the Master As-Built Plan Set to the Project Architect (PA), the City Project Manager (CPM), the Commissioning Agent (CxA) and other design team staff for content review prior to the Progress Payment Milestone indicated in Specification 01 29 76 Progress Payment Procedures. The submitted plan set shall include the digital survey information produced under Section 3.2 above.
   1. If the plan set is not approved:
      a. The PA and CPM shall only be required to generalize deficiencies by trade there shall be no requirement or expectation to generate a "punch list" of required corrections.
      b. The GC and Sub-contractors as necessary shall be responsible for inspecting the installation and correcting the drawings as needed.
      c. The GC shall re-submit the plan set for review.
   2. If the plan set is approved the PA shall take possession of the plan set to be used in providing the owner with digital CAD record drawings. Upon completion of transferring the information to CAD the PA shall provide the Owner with CAD record drawings, record PDFs, and the Master As-Built Plan Set.

3.5. CHANGES AFTER ACCEPTANCE

A. No Contractor shall be responsible for making changes to the As-Built record documents after acceptance by the PA and CPM except when necessitated by changes resulting from any Work made by the Contractor as part of his/her guarantee.

END OF SECTION

SECTION 01 78 43
SPARE PARTS AND EXTRA MATERIALS

PART 1 – GENERAL

1.1. SUMMARY

A. This specification is intended to provide clear guidelines and identify the responsibilities of all contractors as they pertain to City of Madison contract procedures regarding spare parts, special tools, special materials, and extra materials.

B. Each contractor shall be responsible for knowing the specific requirements of their Division Specifications as they may relate to the general information provided in this specification.

C. The General Contractor (GC) shall be responsible for ensuring all contractors provide spare parts and extra materials as described in this specification.

1.2. RELATED SPECIFICAITONS

A. 01 29 76 Progress Payment Procedures

B. 01 31 23 Project Management Web Site

C. 01 77 00 Closeout Procedures

D. Other Divisions and Specifications that may address more specifically how to proceed with spare parts, special tools, special materials, and extra materials.

1.3. DEFINITIONS

A. Spare Parts: Any component of a product or assembly that comes pre-packaged or was specially ordered for the explicit use of the product or assembly. This shall include but not be limited to fastening devices, mounting brackets, replacement parts, wheels, pulleys, wiring, alternate assembly pieces, etc.

B. Special Tools: Any tool of any kind that was pre-packaged or specially ordered, and is required to be used for the installation or maintenance of an installed product or assembly as part of this contract.

C. Special Materials: Any oil, lubricant, glue, touch-up paint, or other such material that comes pre-packaged or was specially ordered and is required to be used for the installation or maintenance of an installed product or assembly as part of this contract.

D. Extra Materials (Attic Stock): Any surplus materials in new and useable condition that was installed a part of this contract. Attic Stock shall include but not be limited to the following: ceiling tiles, paint, stain, floor coverings, ceramic tiles, light bulbs/lamps, filters, strainers, etc. Attic Stock shall include partially opened bulk items and additional unopened quantities as directed by other specifications.

1.4. PERFORMANCE REQUIREMENTS

A. All contractors shall be responsible for consolidating spare parts, special tools, special materials, and attic stock as it pertains to the specific Work within their Division or Trade.

B. All contractors shall use this specification as a general guideline regarding the requirements for turning spare parts, special tools, special materials, and attic stock over to the owner. Contractors shall explicitly follow specification requirements within their own Division of Trade.

1.5. QUALITY ASSURANCE

A. The General Contractor (GC) shall be responsible for all of the following:

1. Coordinate the location for and the delivery of all spare parts, special tools, special materials, and attic stock being provided by all contractors under this contract to one centralized location as designated by the Owner.
2. Verify that all items being delivered are:
   a. Clean, new, and in a usable condition.
   b. Properly sealed, protected, and labeled
   c. Properly documented

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. PACKAGING

A. Whenever possible all surplus items should remain in their original packaging such as parts envelopes.
B. Package small parts in re-sealable plastic bags (Ziploc) or envelopes with clasp fasteners. Do not use envelopes that seal with glue or tape envelopes closed. Do not leave packaging unsealed.
C. Package like parts together for products or assemblies. I.E. keep all spare parts for flushometers together.
D. Many small packages may be grouped together into a larger container by trade.
E. Do not use unrelated boxes or containers for packaging spare items. I.E. do not use a light fixture box for spare breakers, or flushometers parts.

3.2. LABELING

A. Whenever possible the original labeling indicating part numbers and other pertinent information shall remain on the original packaging.
B. If original labeling is not available the contractor shall label all parts and packages using tape or labels and permanent black markers. Tape or labels being used shall absorb the permanent marker without bleeding or allowing ink to be smeared or rubbed off.
C. Labels shall include the name of the product or equipment the item belongs to, part number and/or name, and any other information that would assist maintenance personnel in identifying the piece and related product.
D. Labels shall include plan or specification designations (WC-1, LAV-3, DF-2, CPT-1, etc) that identify the particular product or finish material it represents.
E. Labels for parts stored in clear re-sealable plastic bags may be placed inside the bag. Label shall face out and be able to be read from one side. Multiple bags shall be numbered individually for identification.
F. Label the outside of large containers with the trade name (Plumbing, Electrical, etc).

3.3. INVENTORY

A. All contractors shall provide the GC with complete inventories of all spare parts, special tools, special materials, and attic stock that they are providing at the end of the contract. The inventories shall be organized as follows:
   1. The cover sheet shall indicate the Contractors name, address, phone number, identify that the document is the “Spare Parts and Extra Materials Inventory”, and identify the Division or Trade the inventory is for.
   2. Provide an inventory in a tabular format of all items being provided under this and other specifications. The minimum information to be provided for each item on the inventory shall be as follows:
      a. Bag or container number, all items of one bag or container shall be grouped together on the inventory
      b. Item description
      c. Item size (if applicable)
      d. Total quantity provided
      e. Identify if item is a spare part, tool, special material, or attic stock
B. The GC shall consolidate inventories from all sub-contractors into one tabular data sheet organized by Division or Trade of Work.
   1. Upon completing the consolidated list the GC shall upload the completed inventory to the Contract Closeout-Attic Stock Library on the Project Management Web Site.
   2. The GC shall notify the Project Architect and City Project Manager that the scans have been uploaded.
   3. Consulting Staff and Owner Staff shall review the inventories prior to Final Review to verify that minimum required quantities have been met. Deficiencies shall be noted and returned back to the GC for corrective action.

3.4. STORAGE

A. Prior to the 80% Progress Payment milestone the GC shall coordinate with the City Project Manager and Maintenance Personnel where spare parts, special tools, special materials, and attic stock shall be stored.

B. The GC shall instruct all contractors as to the location and proper storage procedures.

C. The GC shall be responsible for ensuring the storage area is kept neat and orderly as follows:

1. Like items are stored together by material, product, or trade as necessary.
2. Liquids are stored in sealable containers and the lids have been properly installed to prevent drying out, spillage, etc.
3. All labels are clearly visible and provide the required information.

D. Large items shall be stored so as not to damage other items. Do not stack heavy items or items with distinct shapes/outlines on softer items that may get crushed or imprinted.

3.5. CLOSEOUT PROCEDURE

A. Prior to the 90% Progress Payment milestone the GC shall review all attic stock already stored by the contractors to ensure the following:

1. Materials are stored in the proper location(s).
2. All boxes, containers and items are properly labeled according to the submitted/approved inventory.
3. Quantities are correct according to the submitted/approved inventory.

B. The GC shall ensure that all deficiencies are corrected prior to conducting Demonstration and Training Sessions.

C. The GC shall review with Maintenance Staff all inventories and labeling during the scheduled Demonstration and Training Sessions.

D. Any discrepancies associated with Attic Stock shall be resolved and verified prior to the CPM releasing the 90% CT progress payment.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide clear responsibilities and guidelines related to providing Demonstration and Training (D&T) Sessions related to general facility use, equipment, systems, finishes, and materials to City of Madison Staff (Owner, Owner Representatives, Maintenance, and Custodial Personnel) as needed.

B. All D&T shall be coordinated through the General Contractor (GC), Project Architect (PA) and City Project Manager (CPM), and will be based on or customized to the needs of City of Madison Staff being trained. New equipment and systems may have complete D&T sessions as described in this specification while equipment or systems staff is familiar with may have sessions more focused on maintenance only.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 78 13 Completion and Correction List
C. Section 01 78 19 Maintenance Contracts
D. Section 01 78 23 Operation and Maintenance Data
E. Section 01 78 36 Warranties
F. Section 01 78 39 As-Built Drawings
G. Section 01 78 43 Spare Parts and Extra Materials
H Section 01 91 00 Commissioning
I. Other Divisions and Specifications that may address more specifically the requirements for D&T sessions related to the installation of all items and equipment installed under the execution of the Work.

1.3. QUALITY ASSURANCE

A. All contractors shall have the responsibility of preparing for and conducting D&T sessions as determined by this and other Division or Trade related specifications, Owner Operation and Maintenance Manuals, and other such documentation related to the Work.

B. The GC shall have responsibility for:

1. Ensuring that all contractors required to conduct a D&T session have successfully completed all of the following:
    a. Turned in all required documentation for review and documentation has been approved/accepted prior to scheduling D&T sessions.
    b. Other required documentation as needed is available and ready for use during the D&T session.
    c. All systems have been started, tested, and running as per appropriate specification and/or manufacturers recommendations prior to scheduling D&T sessions.
    d. All contractors are sufficiently prepared for their D&T session
    e. Documents the D&T session including date, time, contractor and company name, attendees and other information regarding the session
2. Organizing the coordination and scheduling of all D&T sessions between all contractors and the appropriate representatives of the Owner. These representatives may include any of the following depending on the Work of the Contract:

a. Owner – end users
b. Facility Maintenance personnel
   i. Facility general operation procedures including custodial services
   ii. Electrical
   iii. Mechanical
   iv. Plumbing
   v. Site
c. Information Technology (IT) Department
d. Traffic Engineering – Radio Shop
e. Architects, Engineers and Facility Management staff as project completion overview

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL REQUIREMENTS

A. The GC shall develop a specific D&T plan to be scheduled and conducted as described below but no sooner than the meeting discussed in 3.2.A.2 below.

C. The GC shall not schedule D&T sessions to preclude required personnel from attending multiple sessions.

3.2. COORDINATING AND SCHEDULING THE TRAINING

A. The GC, PA, CxA and CPM, shall review all Training and Demonstration requirements during two (2) special meetings.
   1. The first meeting shall be held at the 50% Contract Total Payment. During this meeting the following shall be discussed:
      a. Preliminary schedule of training dates to be completed prior to beginning construction closeout.
      b. List of documentation and items that need to be completed and available before and during the training session.
      c. Who (Owner, Maintenance, etc) will be attending what training session(s).
   2. The second meeting shall be held at the 80% Contract Total Payment. This meeting shall review due outs that have not yet been completed for the 90% Contract Total Payment and the requirements necessary for Construction Closeout. All Demonstration and Training sessions shall be completed prior to receiving the 90% progress payment and beginning Construction Closeout Procedures (see Specification 01 77 00).
      a. This does not include any requirement associated with off season equipment preparation and/or demonstration and Training Sessions.

B. All of the Construction Work shall be operationally ready prior to conducting training as follows:
   1. All contractors shall have their As-Built Drawing Records available for reviewing locations of system components during training.
   2. All <u>final and approved</u> Operations and Maintenance Data shall be completed no less than two (2) full weeks prior to the scheduled training.
   3. All systems shall have been started, functionally tested, balanced, and fully operational, and all piping and equipment labeling complete at least two (2) days prior to the scheduled training.
      a. Seasonal equipment shall not be trained out of season. Contractors having seasonal equipment shall work with the GC and CPM for coordinating additional training sessions as appropriate for seasonal equipment.

C. Correction list items that prevent a piece of equipment or system from being fully operational for training shall be corrected prior to conducting the training.

3.3. TRAINING OBJECTIVES

A. For each piece of equipment or system installed train on the following objectives/topics as applicable:
   1. System design, concept, and capabilities
   2. Review of related contractor as-built drawings
   3. Facility walkthrough to identify key components of the system
   4. System operation and programming including weekly, monthly, annual test procedures
   5. System maintenance requirements
   6. System troubleshooting procedures
   7. Testing, inspection, and reporting requirements associated with any regulatory requirements
   8. Identification of any correction list items still outstanding

9. Review of system documentation including the following:
    a. Operation and maintenance data
    b. Warranties
    c. Valve charts, tags, and pipe identification markers

B. For each piece of specialty equipment train on the following objectives/topics as applicable:
1. Manufacturers operations instructions
2. Manufacturers use and care instructions
3. Manufacturers maintenance and troubleshooting instructions
4. System operation and programming including weekly, monthly, annual test procedures
5. Identification of any correction list items still outstanding
6. Review of system documentation including the following:
    a. Operation and maintenance data
    b. Warranties

C. End User Orientation
1. Facility walkthrough
2. Security and emergency features
3. General facility operation procedures

D. Facility General Use and Custodial Services – if requested
1. Facility walkthrough
2. Security and emergency features
3. General facility operation procedures
4. Care and maintenance of specialty items, finishes, etc as requested
5. Attic stock inventory and material designations

3.4. DEMONSTRATION AND TRAINING PROGRAM PREPARATION

A. Each contractor having a responsibility for providing D&T sessions shall meet with the GC, CPM, and other City Staff as needed to review the extent of the Training Objectives in section 3.3 above needed for each piece of equipment, system, finish, etc. This meeting shall occur no less than four (4) weeks prior to the anticipated training session.

B. The contractor shall use the information from item 3.4.A above to prepare a formal training program for each piece of equipment or system based on the Training Objectives in 3.3 above.
1. The formal training program shall include the following information:
    a. Session title
    b. List of systems, equipment, use, care, etc to be covered during the session
    c. Provide the following for each systems, equipment, use, care, etc to be covered during the session
        i. Name and affiliation of each instructor to be used. As needed and discretion of the Owner the GC to require attendance by the installing technician, installing Contractor and the appropriate trade or manufacturer's representative.
        ii. Qualifications of each instructor to be used. Practical building operation expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment as installed in this project is required by the training personnel. If Owner determines training was not adequate, the training shall be repeated until acceptable to Owner.
        iii. A checklist of all documentation and system/equipment requirements necessary to complete a successful training session and the current status of each
        iv. Any additional documents, training aids, video or other items to be used to complete the training
        v. Any special requirements or needs associated with item iv above to complete the training
    d. The intended audience for the training
    e. The approximate duration of each objective or topic to be covered
2. Submit the completed training program to the GC for review and approval by the PA and CPM.

C. The PA and CPM shall work with staff as necessary to ensure all points of anticipated training needs have been met. The PA and CPM will approve the program as submitted or recommend changes for re-submittal as necessary.

3.5. CONDUCTING A DEMONSTRATION AND TRAINING SESSION

A. All contractors shall conduct their required D&T Sessions as follows:
1. Begin with a classroom session
    a. Provide a sign in sheet indicating all training to be conducted, instructors, etc.

b. Provide an overview of the training to be conducted including the approximate schedule.

2. Conduct a general walk-through of the site.
   a. Point out locations of various equipment, valves, charts, and other related items.
   b. Use the Division or Trade As-Built record drawings to indicate locations of hidden or buried items.
3. Provide a demonstration of general equipment/system operation including using the O&M manual.
   a. Startup and shutdown procedures.
   b. Normal operational levels as depicted by any gauges, software, etc.
   c. Indicate warning devices, signs etc. and demonstrate emergency shut-down procedures.
4. Provide a demonstration of all owner level maintenance using the O&M manual.
   a. Indicate frequency of maintenance.
   b. Provide and review all spare parts, special tools, and special materials.
5. Provide and review all spare parts, special tools, special materials, or attic stock as applicable.
6. While conducting D&T sessions:
   a. Allow hands on training whenever practical.
   b. Answer questions promptly
   c. Repeat demonstrations and procedures as necessary.

B. Within two (2) working days of completing the D&T session the contractor responsible for the session shall turn-in any documentation generated including the sign in roster to the GC.

C. The GC shall turn over all training documentation to the PA and CPM upon completion of D&T sessions.

D. Re-schedule any training that has been determined to be inadequate or inappropriate for any reason including but not limited to any of the following;
   1. Unqualified instructor
   2. System installation incomplete or untested to the specifications
   3. Equipment failure during demonstration
   4. Un-expected cancellation

3.6. CLOSEOUT PROCEDURE

A. Prior to receiving the 90% Progress payment the GC shall:
   1. Verify with the PA and CPM that each Demonstration and Training Session was conducted properly and according to the submitted plan.
   2. Any required “Off Season” equipment testing, balancing, and Demonstration and Training Sessions have been tentatively scheduled with the GC, necessary sub-contractors, instructors and Owner/Owner Representatives as necessary.

END OF SECTION

SECTION 01 81 13
SUSTAINABLE DESIGN REQUIREMENTS – LEED FOR NEW CONSTRUCTION V3

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Comply with Wisconsin Commercial Building Codes/International Building Code (IBC).

C. Comply with Americans with Disabilities Architectural Guidelines, and ICC/ANSI A117.1-Latest Edition.

D. Comply with USGBC LEED prerequisites and credits needed for Project to obtain "LEED Silver certification based on USGBC's LEED 2009 for New Construction and Major Renovations".

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain "LEED Silver certification based on USGBC's LEED-NC (New Construction and Major Renovations)" Version 3.0.

1. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
3. A copy of the LEED Project checklist is attached at the end of this Section for information only.
4. Specific requirements for LEED are included in greater detail in other Sections.

B. Related Sections: Divisions 01 through 32 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

1.3 DEFINITIONS

A. Albedo (a.k.a. solar reflectance): The ratio of the reflected electromagnetic energy to the incoming electromagnetic energy.

B. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

C. Emissivity (a.k.a. infrared emittance): A parameter between 0 and 1 that indicates the ability of a material to shed infrared radiation.

D. LEED: Leadership in Energy and Environmental Design. Green Building Rating System representing the US Green Building Council's effort to provide a national standard for what constitutes a "green building". The standard requires quantitative and technical documentation to demonstrate compliance with goals described in the US Green Building Council's Green Building Rating System, Version 3.0.

E. Hydrofluorocarbons (HFCs): Refrigerants used in building equipment that do not deplete the stratospheric ozone layer.

F. Locally-Manufactured (for LEED™ Materials Credit 5): Refers to the final assembly of components into the building product that is furnished and installed by the trades people. For example, if the hardware comes from Seoul, South Korea, the lumber from Vancouver, British Columbia, and the joist is assembled in Kent Washington, then the location of the final assembly is Kent, Washington.

G. Post-Consumer Recycled Content: The percentage of waste material by weight available from consumer use incorporated into a building material.

H. Pre-consumer (aka Post-Industrial Recycled) Content: The percentage of waste material by weight available from industrial use incorporated into a building material. Post-industrial recyclable materials are different from industrial scrap, a by-product of industrial processes that can easily be reused as a feedstock.

I. Potable Water: Water that is suitable for drinking and is supplied from wells or municipal water systems.

J. Recycling: The collection, reprocessing, marketing and use of materials that were recovered or diverted from the solid waste stream. Note that LEED uses the term "pre-consumer" rather than "post-industrial." Also note that when manufacturers and trade associations use the term "post- industrial" it often includes spills, scraps, and damaged and surplus materials that are fed back into the same manufacturing process and that these materials are not considered recycled content by the LEED rating systems.

K. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

L. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.

M. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

N. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

O. Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles from Project site. Manufacturing refers to the final assembly of components into the building product that is installed at Project site.

P. Regionally Extracted and Manufactured Materials: Regionally manufactured materials made from raw materials that are extracted, harvested, or recovered within a radius of 500 miles from Project site.

Q. Solar Reflectance: See "Albedo."

R. Sustainable Forestry: The practice of managing forest resources to meet the long-term product needs of humans while maintaining the biodiversity of forested landscapes. The primary goal is to restore, enhance, and sustain a full range of forest values, both economic and ecological.

S. Type A Finishes: Material and finishes with potential for short-term levels of off gassing from chemicals inherent in their manufacturing process, or which are applied in form requiring vehicles or carriers for spreading which release high level of particulate matter in process of installation and/or curing. Including, but not limited to:

1. Composite wood products, specifically including particleboard from which millwork, wood paneling, doors, or furniture may be fabricated.
2. Adhesives, sealants, and glazing compounds, specifically those with petrochemical vehicles or carriers.
3. Wood preservatives, finishes, and paint.

4. Control and/or expansion joint fillers.
5. Hard finishes requiring adhesive installation.
6. Gypsum board and associated finish processes.

T. Type B Finishes: Fuzzy material and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals off-gassed by Type A finishes or may be adversely affected by particulates. These materials become "sink" for deleterious substances which may be released much later, or collectors of contaminants that may promote subsequent bacterial growth. Including, but not limited to:
1. Carpeting and padding.
2. Fabric wallcovering.
3. Insulation exposed to air stream.
4. Acoustic ceiling materials.
5. Fabric covered acoustic wall panels.
6. Upholstered furnishings.
7. Materials that can be categorized as both Type A and Type B.

U. Ventilation: The process of supplying and removing air to and from interior spaces by natural or mechanical means.

V. Volatile organic compounds (VOCs): Chemical compounds based on carbon and hydrogen structures that are vaporized at room temperatures. VOCs are one type of indoor air contaminant.

W. Waste Materials: Large and small pieces of materials indicated which are excess to contract requirements and generally include materials salvaged from existing construction and items of trimmings, cuttings, and damaged goods resulting from new installations which cannot be effectively used in Work.

X. LEED Project Administrator: LEED Certified Professional hired by the project owner to review LEED submittals.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

1.5 ACTION SUBMITTALS

A. General: Submit additional LEED submittals required by other Specification Sections.

B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

C. LEED Submittals: Submit LEED related information under a separate Tab within each product submittal. The LEED submittal shall include:
1. Summary Sheet: A summary, on General Contractors letterhead, of all LEED information requested in specifications shall include:
   a. Project name.
   b. LEED Submittal List: A list of all materials being submitted. For products com- posed of multiple materials the submittal shall include a list of all materials composing the product.
   c. For Products in Divisions 2 - 10, include the following information:
      i. Material costs, for each material on the LEED submittal list, excluding labor costs, delivery cost, cost of installation, as well as profit and overhead.
      ii. The preconsumer and post-consumer recycled content of each material on the LEED submittal list.
      iii. List of all material manufacturing locations.
      iv. Provide distance between manufacturing and construction site.
   d. All other LEED information required in specification.
2. Manufacturer's literature with information highlighted that confirm the figures used in the summary report.
   a. If a range is used in the manufacturer's literature, the summary report shall use the lowest number in the range.
   b. For VOC Submissions: Submit MSDS sheets or manufacturer's literature with VOC figure highlighted.

D. Project Material Costs Data: Provide a statement, on Contractor's letterhead, documenting the total material for the project. Include a spreadsheet tallying the material cost for all materials specified in Divisions 2 - 32. The

total in the material cost data will be used in the LEED Online template to be completed by the Contractor as the actual material cost of the project.

E. LEED Action Plan: Provide preliminary submittal within 30 days of Notice to Proceed that contains:
   1. Example spreadsheets for each construction credit identified in this section.
   2. Contact information for Contractor's LEED coordinators.
   3. Brief description of how the following requirements will be met.
      a. Credit SS Prerequisite 1: Construction Activities Pollution Prevention complying with Section 31 25 00, Erosion Control.
      b. Credit MR c2: Construction Waste Management complying with Section 01 74 19 Construction Waste Management and Disposal. Include a sample spreadsheet showing how the tipping information is going to be recorded to comply with LEED requirements.
      c. Credit MR c4: Recycled content information including methods of collection and recording.
      d. Credit MR c5: Manufacturing location information including methods of collection and recording.
      e. Credit MR c6: Rapidly renewable materials information including methods of collection recording.
      f. Credit MR c7: Certified wood product incorporated into the construction of the facility and a description of how certified wood information, including the chain-of-custody letters are going to be collected and recorded.
      g. EQ c4.1 – 4.4: VOC information including methods of collection and recording required LEED information.
   4. After CPM approval of the Preliminary Action Plan the Contractor shall update the plan monthly with LEED information collected to date and be submitted as part of a monthly progress report.

F. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing the actual construction and purchasing activities with LEED requirements for the following:
   1. Credit SS Prerequisite 1: Construction Activities Pollution Prevention.
   2. Credit MR c2: Construction Waste Management.
   3. Credit MR c4: Recycled content for materials specified in Divisions 2 - 32.
   4. Credit MR c5 Regional Materials: Distance to manufacturing for materials specified in Divisions 2 - 32.
   5. Credit MR c6: Rapidly Renewable Materials: Content and cost for materials specified in Divisions 2- 32.
   6. Credit MR c7: Certified wood products including the chain-of-custody letters identifying the forest of origin.
   7. IEQ c4.1 – 4.4: VOC information.

G. LEED Documentation Online Submittals: The Contractor shall be responsible for completing the following LEED submissions using the LEED online tool for credit submission to USGBC. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.
   1. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over a period of time of not less than one year of post-construction occupancy.
   2. Credit MR 2: Comply with Division 1 Section "Construction Waste Management and Disposal."
   3. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for each product having recycled content.
   4. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
   5. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
   6. Credit IEQ 3.1:
      1. Construction indoor-air-quality management plan.
      2. Product data for temporary filtration media.
      3. Product data for filtration media used during occupancy.
      4. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
   7. Credit IEQ 3.2: Construction IAQ Plan: Before Occupancy.
      1. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.

2. Report from testing and inspecting agency indicating results of indoor-air- quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
8. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subject D (EPA Method 24).
9. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subject D (EPA Method 24).
10. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.
B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
1. Furniture.
2. Plumbing.
3. Mechanical.
4. Electrical.
5. Specialty items such as elevators and equipment.
6. Wood-based construction materials.
C. LEED Action Plans: Provide preliminary submittals within 30 days of date established for the Notice of Award indicating how the following requirements will be met:
1. Credit MR 2: Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."
2. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post- consumer recycled content, and pre-consumer recycled content for each product having recycled content.
3. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
4. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
5. Credit IEQ 3.1: Construction indoor-air-quality management plan.
D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
1. Credit MR 2: Waste reduction progress reports complying with Section 01 74 19 "Construction Waste Management and Disposal."
2. Credit MR 4: Recycled content.
3. Credit MR 5: Regional materials.
4. Credit MR 7: Certified wood products.

1.7 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

1.8 CONTRACTOR RESPONSIBILITIES

A. This project has been registered with USGBC. The Contractor shall provide all necessary documentation for LEED v3.0 certification in accordance with the specifications. Format and content of all construction documentation must be in accordance with the LEED Reference Guide requirements for supporting data required in event of USGBC audit of the particular credit. Con- tractor is required to coordinate all requirements to assure assembled data is acceptable to USGBC and respond to USGBC requests for additional construction data in the course of preparing the project for certification.

PART 2 – PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.2 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4.1: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of [10] percent of cost of materials used for Project.

1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-comsumer recycled comtent plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
2. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
3. Do not include plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

2.3 REGIONAL MATERIALS

A. Credit MR 5: Provide a minimum of 10 percent of building materials (by cost) that are regional materials.

2.4 RAPIDLY RENEWABLE MATERIALS

A. Credit MR 6: Provide a minimum of 2.5 percent of the building materials (by cost) that are rapidly renewable materials.

2.5 CERTIFIED WOOD

A. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
   a. Rough carpentry.
   b. Miscellaneous carpentry.
   c. Finish carpentry.
   d. Architectural woodwork.

2.6 LOW-EMITTING MATERIALS

A. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, use adhesives and sealants shall comply with the following limits for VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Metal to Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Plastic Foam Adhesives: 50 g/L.
5. Carpet Adhesives: 50 g/L.
6. Carpet Pad Adhesives: 50 g/L.
7. VCT and Asphalt Tile Adhesives: 50 g/L.
8. Cove Base Adhesives: 50 g/L.
9. Gypsum Board and Panel Adhesives: 50 g/L.
10. Rubber Floor Adhesives: 60 g/L.
11. Ceramic Tile Adhesives: 65 g/L.
12. Multipurpose Construction Adhesives: 70 g/L.
13. Contact Adhesive: 80 g/L.
14. Structural Wood Member Adhesive: 140 g/L.
15. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
16. Top and Trim Adhesive: 250 g/L.
17. ABS Welding Compounds: 325 g/L.
18. CPVC Welding Compounds: 490 g/L.
19. PVC Welding Compounds: 510 g/L.

20. Adhesive Primer for Plastic: 550 g/L.
21. Plastic Cement Welding Compounds: 350 g/L.
22. ABS Welding Compounds: 400 g/L.
23. CPVC Welding Compounds: 490 g/L.
24. PVC Welding Compounds: 510 g/L.
25. Adhesive Primer for Plastic: 650 g/L.
26. Sheet Applied Rubber Lining Adhesive: 850 g/L.
27. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
28. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
29. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
30. Other Adhesives: 250 g/L.
31. Architectural Sealants: 250 g/L.
32. Non-membrane Roof Sealants: 300 g/L.
33. Single-Ply Roof Membrane Sealants: 450 g/L.
34. Other Sealants: 420 g/L.
35. Sealant Primers for Nonporous Substrates: 250 g/L.
36. Sealant Primers for Porous Substrates: 775 g/L.
37. Modified Bituminous Sealant Primers: 500 g/L.
38. Other Sealant Primers: 750 g/L.

B. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59 (EPA method 24):

1. Flat Paints and Coatings: VOC not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC not more than 150 g/L.
3. Dry-Fog Coatings: VOC not more than 400 g/L.
4. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
7. Pretreatment Wash Primers: VOC not more than 420 g/L.
8. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
9. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
10. Floor Coatings: VOC not more than 100 g/L.
11. Shellacs, Clear: VOC not more than 730 g/L.
12. Shellacs, Pigmented: VOC not more than 550 g/L.
13. Stains: VOC not more than 250 g/L.

C. Credit IEQc4.3: All flooring must comply with the following as applicable to the project scope:

1. All carpet and carpet cushion must meet the requirements of the Carpet and Rug Institute Green Label Program.
2. All carpet adhesive must have VOC limit of 50 g/L.
3. All hard surface flooring must meet the requirements of the FloorScore Standard.
4. Concrete, wood, bamboo and cork floor finishes and tile setting adhesives must meet the requirements of South Coast Air Quality Management District (SCAQMD) Rules 1113 and 1168.

D. Credit IEQc4.4: Do not use composite wood, agrifiber products or adhesives that contain urea- formaldehyde resin. FF & E are not included. Products include:

1. Panel substrates
2. Door cores
3. Strawboard
4. Wheatboard
5. Plywood
6. Medium density fiberboard (MDF)
7. Particleboard

PART 3 – EXECUTION

3.1 CONSTRUCTION ACTIVITIES POLLUTION PREVENTION

A. SS Prerequisite 1 Construction Activities Pollution Prevention:
   1. Follow LEED instructions in LEED NCv3.0 Reference Guide and complying with Section 31 25 00, Erosion Control.
   2. Contractor is responsible for completing the LEED online credit template and attaching the following information to the template:
      a. Provide record of compliance with Erosion and Sediment Control Plan:
         i. Monthly photographs of barriers and containment.
         ii. Monthly photographs of dust control measures
         iii. Records of inspections by agency in charge of overseeing compliance.
   3. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Credit MRc2: Comply with Division 1 Section "Construction Waste Management and Disposal".
   1. Contractor is responsible for completing the LEED online credit template. Attached documentation in support of the credit shall include:
      a. Monthly photographs of waste recycling sorting area including:
         i. Debris control fencing.
         ii. Signage clearly identifying the containers content.
      b. Spreadsheet containing the following information:
         i. Diverted materials description.
         ii. Diverted materials/waste hauler name.
         iii. Date of each haul.
         iv. Quantity of material in each haul.
      c. Copies of recycling vender and waste hauler tipping receipts.
   2. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.

3.3 RECYCLED CONTENT OF BUILDING MATERIALS

A. Credit MRc4: Recycled Content:
   1. Follow LEED instructions in LEED NCv3.0 Reference Guide.
   2. Provide record showing the preconsumer and post-consumer recycled content of all materials specified in Divisions 2 - 32.
   3. Contractor is responsible for completing the LEED online credit template and attaching the following information to the template:
      a. Spreadsheet containing the following information:
         i. The description of each materials in each product specified in Divisions 2 - 32.
         ii. Material manufacturer's name.
         iii. Material cost.
         iv. Percent preconsumer recycled content of each material.
         v. Percent post-consumer recycled content of each material.
         vi. Recycled content information source.
      b. Copies of vendors literatures or a statement from vendors on vendor's letterhead confirming the figures used in the spreadsheet.
   4. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.

3.4 REGIONAL MATERIALS

A. Credit MRc5: Regional Materials:
   1. Follow LEED instructions in LEED NCv3.0 Reference Guide.
   2. Provide record showing the manufacturing location for all materials specified in Divisions 2 - 32.
   3. Contractor is responsible for completing the LEED online credit application and attaching the following information to the application:
      a. Copies of vendors literatures or a statement from vendors on vendor's letterhead confirming the figures used in the spreadsheet.
   4. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.

3.5 RAPIDLY RENEWABLE MATERIALS

A. Credit MRc6: Rapidly Renewable Materials:
   1. Follow LEED instructions in LEED NCv3.0 Reference Guide.
   2. Provide record showing the cost for all rapidly renewable materials specified in Divisions 2 - 32.
   3. Contractor is responsible for completing the LEED online credit application and attaching the following information to the application:
      a. Spreadsheet containing the following information:
         i. The description of each materials in each product specified in Divisions 2 - 32.
         ii. Material manufacturer's name.
         iii. Material cost.
         iv. Percent rapidly renewable.
      b. Copies of vendors literatures or a statement from vendors on vendor's letterhead confirming the figures used in the spreadsheet.
   4. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.

3.6 CERTIFIED WOOD

A. Credit MRc7 Certified Wood:
   1. Follow LEED instructions in LEED NCv3.0 Reference Guide to comply with Credit MRc7 requirements for certified wood installed in construction.
   2. Contractor is responsible for completing the LEED online credit template and attaching the following information to the template:
      a. Copies of vendors literatures or a statement from vendors on vendor's letterhead confirming the figures used in the LEED Online Certified Wood Materials Calculator spreadsheet.
      b. Copies of the chain-of-custody documentation received from vendors on vendors.
   3. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.

3.7 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Credit IEQc3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
   1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 1 Section "Temporary Facilities and Controls", install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
   2. Replace all air filters immediately prior to occupancy.
   3. Provide record of compliance with Indoor Air Quality Management Plan:
      a. Monthly photographs of equipment and ductwork protection.
      b. Monthly photographs of filters used to protect air distribution and equipment.
      c. Contractor's report documenting that MERV 8 filters were used to protect equipment during construction and MERV 13 filters were installed prior to occupancy.

B. Credit IEQc3.2: Indoor Air Quality management Plan – Before Occupancy:
   1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
   2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three (3) hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.
   3. Air-Quality Testing: If the Contractor chooses to test for compliance with LEED Credit IEQc3.2 the following is required:
      a. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air

Pollutants in Indoor Air," and as additionally detailed in the USGBC's "Green Building Design and Construction Reference Guide".

b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
   i. Formaldehyde: 27 ppb.
   ii. Particulates (PM10): 50 micrograms/cu. m.
   iii. Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
   iv. 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
   v. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.

c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, samples are to be taken from the same locations as the first test.

d. Air-sample testing shall be conducted as follows:
   i. All measurements shall be conducted prior to occupancy but during normal occupied hours and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
   ii. Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Non-fixed furnishings such as workstations and partitions are encouraged, but not required to be in place for the testing.
   iii. Number of sampling locations will vary depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
   iv. Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four- hour period.

4. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.

3.8 LOW EMITTING MATERIALS

A. Credit IEQc4.1 through Credit MRc4.4: Low Emitting Materials:
   1. Follow LEED instructions in LEED NCv3.0 Reference Guide.
   2. Contractor is responsible for completing the LEED online credit template and attaching the following information to the template:
      a. Copies of vendor's literature or MSDS sheets confirming the figures used in the spreadsheet.
   3. The LEED Project Administrator will determine if the information prepared by the Contractor is satisfactory for USGBC submission.

3.9 INDOOR CHAMICAL AND POLLUTANT SOURCE CONTROL

A. Credit IEQc5: Indoor Chemical and Pollutant Source Control:
   1. Install new air filtration media, with a MERV 13 Rating, in regularly occupied areas prior to occupancy.

3.10 SUPPLEMENT

A. The supplements listed below, following "End of Section," is a part of this Specification:
   1. LEED for New Construction v3.0 Registered Project Checklist.
   2. LEED Materials Documentation Submittal Cover Sheet

END OF SECTION

1

LEED v3 for New Construction and Major Renovations
Project Checklist 03-10-17

23	**0**	**0**	**3**		**Sustainable Sites**		Possible	**26**
Y	?Y	?N	N	d/C				
Y				C	Prereq 1	Construction Activity Pollution Prevention		
1				d	Credit 1	Site Selection		1
5				d	Credit 2	Development Density and Community Connectivity		5
			1	d	Credit 3	Brownfield Redevelopment		1
6				d	Credit 4.1	Alternative Transportation—Public Transportation Access		6
1				d	Credit 4.2	Alt Transportation—Bike Storage and Changing Rooms		1
2			**1**	d	Credit 4.3	Alternative Transportation—L.E. and Efficient Vehicles		3
1			**1**	d	Credit 4.4	Alternative Transportation—Parking Capacity		2
1				C	Credit 5.1	Site Development—Protect or Restore Habitat		1
1				d	Credit 5.2	Site Development—Maximize Open Space		1
1				d	Credit 6.1	Stormwater Design—Quantity Control		1
1				d	Credit 6.2	Stormwater Design—Quality Control		1
1				C	Credit 7.1	Heat Island Effect—Non-roof		1
1				d	Credit 7.2	Heat Island Effect—Roof		1
1				d	Credit 8	Light Pollution Reduction		1
6	**0**	**0**	**4**		**Water Efficiency**		Possible Points:	**10**
Y	?Y	?N	N	d/C				
Y				d	Prereq 1	Water Use Reduction—20% Reduction		
4				d	Credit 1	Water Efficient Landscaping		2 to 4
						Reduce by 50%		2
						4 No Potable Water Use for Irrigation		4
			2	d	Credit 2	Innovative Wastewater Technologies		2
2			**2**	d	Credit 3	Water Use Reduction		2 to 4
						2 Reduce by 30%		2
						Reduce by 35%		3
						Reduce by 40%		4
29	**0**	**0**	**6**		**Energy and Atmosphere**		Possible Points:	**35**
Y	?Y	?N	N	d/C				
Y				C	Prereq 1	Fundamental Commissioning of Building Energy Systems		
Y				d	Prereq 2	Minimum Energy Performance		
Y				d	Prereq 3	Fundamental Refrigerant Management		
15			**4**	d	Credit 1	Optimize Energy Performance		1 to 19
						Improve by 12% for New Buildings		1

							Improve by 14% for New Buildings	2
							Improve by 16% for New Buildings	3
							Improve by 18% for New Buildings	4
							Improve by 20% for New Buildings	5
							Improve by 22% for New Buildings	6
							Improve by 24% for New Buildings	7
							Improve by 26% for New Buildings	8
							Improve by 28% for New Buildings	9
							Improve by 30% for New Buildings	10
							Improve by 32% for New Buildings	11
							Improve by 34% for New Buildings	12
							Improve by 36% for New Buildings	13
							Improve by 38% for New Buildings	14
						15	Improve by 40% for New Buildings	15
							Improve by 42% for New Buildings	16
							Improve by 44% for New Buildings	17
							Improve by 46% for New Buildings	18
							Improve by 48%+ for New Buildings	19
7				d	Credit 2	On-Site Renewable Energy		1 to 7
							1% Renewable Energy	1
							3% Renewable Energy	2
							5% Renewable Energy	3
							7% Renewable Energy	4
							9% Renewable Energy	5
							11% Renewable Energy	6
						7	13% Renewable Energy	7
2				C	Credit 3	Enhanced Commissioning		2
2				d	Credit 4	Enhanced Refrigerant Management		2
3				C	Credit 5	Measurement and Verification		3
			2	C	Credit 6	Green Power		2
6	**0**	**0**	**8**	d/C	**Materials and Resources**		Possible Points:	**14**
Y	?Y	?N	N					
Y				d	Prereq 1	Storage and Collection of Recyclables		
			3	C	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof		1 to 3
							Reuse 55%	1
							Reuse 75%	2
							Reuse 95%	3
			1	C	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural		1
2				C	Credit 2	Construction Waste Management		1 to 2
							50% Recycled or Salvaged	1

						2	75% Recycled or Salvaged	2
			2	C	Credit 3	Materials Reuse		1 to 2
						1	Reuse 5%	1
						1	Reuse 10%	2
2				C	Credit 4	Recycled Content		1 to 2
						1	10% of Content	1
						1	20% of Content	2
2				C	Credit 5	Regional Materials		1 to 2
						1	10% of Materials	1
						1	20% of Materials	2
			1	C	Credit 6	Rapidly Renewable Materials		1
			1	C	Credit 7	Certified Wood		1
13	**0**	**0**	**2**		**Indoor Environmental Quality**		Possible Points:	**15**
Y	?Y	?N	N	d/C				
Y				d	Prereq 1	Minimum Indoor Air Quality Performance		
Y				d	Prereq 2	Environmental Tobacco Smoke (ETS) Control		
1				d	Credit 1	Outdoor Air Delivery Monitoring		1
			1	d	Credit 2	Increased Ventilation		1
1				C	Credit 3.1	Construction IAQ Management Plan—During Construction		1
1				C	Credit 3.2	Construction IAQ Management Plan—Before Occupancy		1
1				C	Credit 4.1	Low-Emitting Materials—Adhesives and Sealants		1
1				C	Credit 4.2	Low-Emitting Materials—Paints and Coatings		1
1				C	Credit 4.3	Low-Emitting Materials—Flooring Systems		1
1				C	Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber		1
1				d	Credit 5	Indoor Chemical and Pollutant Source Control		1
			1	d	Credit 6.1	Controllability of Systems—Lighting		1
1				d	Credit 6.2	Controllability of Systems—Thermal Comfort		1
1				d	Credit 7.1	Thermal Comfort—Design		1
1				d	Credit 7.2	Thermal Comfort—Verification		1
1				d	Credit 8.1	Daylight and Views—Daylight		1
1				d	Credit 8.2	Daylight and Views—Views		1
5	**0**	**0**	**1**		**Innovation and Design Process**		Possible Points:	**6**
Y	?Y	?N	N					
1				d	Credit 1.1	'Innovation in Design: Low Mercury Lighting Plan		1
1				C	Credit 1.2	'Innovation in Design: Green Cleaning		1
1				C	Credit 1.3	Innovation in Design: MRc5: 30% Regional Materials		1
1				d	Credit 1.4	Innovation in Design: Building Education Program		1
			1	d	Credit 1.5	Innovation in Design: EAc1 (50% or better)		1
1				d	Credit 2	LEED Accredited Professional		1

4	**0**	**0**	**0**		**Regional Priority Credits**		Possible Points:	**4**
Y	?Y	?N	N	d/C				
1				d	Credit 1.1	Regional Priority: SSc2		1
1				d	Credit 1.2	Regional Priority: SSc4.2		1
1				d	Credit 1.3	Regional Priority: WEc3 (30%)		1
1				d	Credit 1.4	Regional Priority: EAc2 (1%)		1
86	0	0	24		**Total**		Possible Points:	**110**
Y	?Y	?N	N					

1

LEED MATERIALS DOCUMENTATION SUBMITTAL COVER SHEET
USGBC LEED BD+C v3 RATING SYSTEM

OPN ARCHITECTS

***Instructions to Contractor/Sub-Contractors*:** For each product / material included in your contract, please complete the following information. Use additional submittal sheets as needed. The General Contractor should use the information provided on this sheet in conjunction with the LEED Materials Tracking Excel Spreadsheet (provided by OPN Architects, Inc.) to document all of the materials and products selected and installed in the project.

Project Name: _____ Company: _____

Signed by (print): _____ Signature: _____ Date: _____

Estimated total cost of all products and materials included in your contract: _____

PART ONE

LEED Materials Breakdown (Divisions 3 – 12 and 31 – 33)

Please list the estimated material cost to be charged to the client (excluding any equipment rental, or installation labor costs but including all delivery/shipping costs to the jobsite) for all products / materials included in your contract. The total of all items listed in the chart below must equal the estimated total cost of all products and materials listed above. Attach additional copies of the Cover Sheet if you need more space than provided in the chart below. All information requested in Part One of this Cover Sheet must be received by the architect before your initial pay application will be processed.

Spec. Section	Product / Material	Manufacturer / Vendor	Product Model #	Prod. / Mat. Cost
Total				

1

LEED MATERIALS DOCUMENTATION SUBMITTAL COVER SHEET
USGBC LEED BD+C v3 RATING SYSTEM

OPN ARCHITECTS

Instructions to Contractors/Vendors/Material Suppliers/Installers: For each product or material, please complete the following information in all applicable categories. Use a separate Submittal Cover Sheet for each product or material supplied. Attach cut sheets, letters from manufacturers, and/or other supporting information and **submit with Shop Drawing submittal for review and approval**. The General Contractor should use the information provided on this sheet in conjunction with the Materials Tracking Excel Spreadsheet (provided by OPN Architects, Inc.) to document all of the materials and products selected and installed in the project.

Project Name: _____ Company: _____

Signed by (print): _____ Signature: _____ Date: _____

Product Name: _____ Manufacturer: _____ Division: _____

PART TWO

LEED MR credit 4: Recycled Content (Divisions 3 – 12 and 31 – 33)

Does the material / product contain pre-consumer or post-consumer content? Yes / No / NA

(The information below must correspond with data provided in Part One of this Cover Sheet)

Product / Material Description	Percent pre-consumer	Percent post-consumer

If only select components of a product contain recycled content, see LEED BD+C v.3 Reference Guide for instructions to calculate total product recycled content (based on relative material weights).

❑ *I confirm that appropriate backup documentation has been provided and attached to this Cover Sheet*

LEED MR credit 5: Locally Harvested/Extracted Materials (Divisions 3 – 12 and 31 – 33)

Were the raw materials extracted/harvested and the final product manufactured within 500 miles of the site?

(The information below must correspond with data provided in Part One of this Cover Sheet)

Product / Material	Location of extraction	Distance	Location of manufacture	Distance

If you wish, you may use http://indo.com/distance/ to confirm linear distance (as-a-crow flies) from the project site.

❑ *I confirm that appropriate backup documentation has been provided and attached to this Cover Sheet*

LEED MR credit 7: FSC Certified Wood (Divisions 3 – 12 and 31 – 33)

Does the material/product contain Forest Stewardship Council (FSC) certified wood? Yes / No / NA

(The information below must correspond with data provided in Part One of this Cover Sheet)

Component	% of Material	Chain-of-Custody Certificate #	Cost

❑ *I confirm that appropriate backup documentation has been provided and attached to this Cover Sheet*

LEED EQ credit 4.1: Low-Emitting Materials - Adhesives and Sealants (Anywhere w/in moisture barrier)

Do the adhesives and sealants comply with the LEED BD+C v3 VOC limits? Yes / No / NA

(The information below must correspond with data provided in Part One of this Cover Sheet)

Product Name	Manufacturer	VOC Content (grams / liter)

VOC limits can be found at http://www.usgbc.org/ShowFile.aspx?DocumentID=5546 pages 66 & 67.

❑ *I confirm that appropriate backup documentation has been provided and attached to this Cover Sheet*

LEED EQ credit 4.2: Low-Emitting Materials - Paints and Coatings (Anywhere w/in moisture barrier)

Do the paints and coatings comply with the LEED BD+C v3 VOC limits? Yes / No / NA

(The information below must correspond with data provided in Part One of this Cover Sheet)

Product Name	Manufacturer	VOC Content (grams / liter)

VOC limits can be found at http://www.usgbc.org/ShowFile.aspx?DocumentID=5546 pages 68.

❑ *I confirm that appropriate backup documentation has been provided and attached to this Cover Sheet*

LEED EQ credit 4.3: Low-Emitting Materials – Flooring Systems

Does the carpet meet the Carpet and Rug Institute's Green Label Plus IAQ testing requirements? Yes / No / NA

Does the cushion meet the Green Label IAQ testing requirements? Yes / No / NA

Are carpet adhesives free of VOCs? Yes / No / NA

Do all time setting adhesives and grout meet 2005 SCAQMD VOC limits? Yes / No / NA

Do all concrete, wood, bamboo and cork floor finishes such as sealer, stain and finish met the 2004 SCAQMD requirements? Yes / No / NA

Are all hard-surface flooring products certified as compliant with the FloorScore Standard? Yes / No / NA

(The information below must correspond with data provided in Part One of this Cover Sheet)

Product Name	Manufacturer	CRI Green Label Plus Certification Number	Adhesive VOC Content

❑ *I confirm that appropriate backup documentation has been provided and attached to this Cover Sheet*

VOC limits can be found at http://www.usgbc.org/ShowFile.aspx?DocumentID=5546 pages 69 & 70.

LEED EQ credit 4.4: Low-Emitting Materials - Composite Wood and Agrifiber

Does the material/product contain any added urea-formaldehyde resins? Yes / No / NA

(The information below must correspond with data provided in Part One of this Cover Sheet)

Product/Manufacturer	Yes or No?

❑ *I confirm that appropriate backup documentation has been provided and attached to this Cover Sheet*

VOC limits can be found at http://www.usgbc.org/ShowFile.aspx?DocumentID=5546 pages 71.

SECTION 01 91 00
GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.01. RELATED DOCUMENTS

A. Owner Program Requirements and Basis of Design

1.02. GENERAL DESCRIPTION

A. Commissioning is the process of verifying and validating that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective to operate and meet the Owner's operational needs; that the installation is adequately documented; and that Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.

B. Commissioning Provider shall work with the Contractor and the Engineer to direct and oversee the Commissioning process.

1. Utilize Autodesk BIM-360 collaboration software to maintain an observation log, equipment installation and start-up status.
2. Contractors and subcontractors shall interface with the Cx process using BIM-360 web interface and/or an Apple iPad.
3. Generate a commissioning plan including schedule.
4. Integrate commissioning activities into the general construction schedule.
5. Provide commissioning specifications
6. Lead commissioning kick-off and coordination meetings.
7. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer's recommendation, and industry accepted minimum standards and that they receive adequate operational checkout by the installing contractors.
8. Verify and document test, adjust and balance is complete and accurate.
9. Verify and document proper performance of equipment and systems.

10. Verify that operation and maintenance documentation left onsite is complete.
11. Verify that the owner's operating personnel are adequately trained.
12. Provide a Final Commissioning report.

C. The Commissioning Plan details the commissioning process.

D. The Commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functional product as defined in the plans and specifications.

E. This Section and other Sections of the specifications detail the Contractor's responsibilities relative to the Commissioning process. It expands on the Commissioning Plan, which covers the roles and responsibilities of all Parties. It also indicates the details of the Functional Performance Testing in which the Contractor must participate.

1.03. SUMMARY

A. Section includes:
1. General requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Specific Equipment/systems to be utilized is “to be determined” (TBD) at this time. At minimum, the following general equipment/systems shall be commissioned:
1. HVAC system and controls.
2. Lighting control system.
3. Domestic hot water system.
4. Metering.

C. References:
1. ASHRAE Standard 202-2013, “The Commissioning Process for Building and Systems”
2. ASHRAE Guideline 0-2013, “The Commissioning Process”
3. ASHRAE Guideline 1.1-2007, " HVAC & R Technical Requirements for the Commissioning Process"
4. ASHRAE Guideline 4-2008, “Preparation of Operating and Maintenance Documentation for HVAC&R Systems”
5. American Society for Testing and Materials (ASTM)
6. BCA - Building Commissioning Association
7. Electronics Industry Association/Telecommunications Industry Association (EIA/TIA)
8. International Building Code (IBC)
9. Illuminating Engineering Society (IES)
10. Institute of Electrical and Electronics Engineers (IEEE)
11. International Electrical Testing Association (NETA)
12. National Electrical Manufacturers Associates (NEMA)
13. National Fire Protection Association (NFPA)
14. NEBB - Procedural Standards for Building Systems Commissioning
15. National Electric Code (NEC)
16. NETA-ATS, Testing Standards
17. Underwriters Laboratory, Inc. (UL)
18. U.S. Green Building Council (USGBC)
19. Washington State Energy Code (WSEC)
20. Washington Sustainable Schools Protocol (WSSP) Fundamental Commissioning
21. WSSP Enhanced Commissioning

D. Related Sections:
1. Section 23 05 93 "Testing, Adjusting and Balancing".
2. Section 23 09 00 " Controls "

1.04. DEFINITIONS

1. Acceptance Phase: This is the phase of the project when the facility and its systems and equipment are inspected, tested, verified, and documented; and when most of the Functional Performance Testing and formal training occurs. This will generally occur after the Construction Phase is complete (start-up and checks have been accomplished). The Acceptance Phase typically begins with Substantial Completion and ends with Functional Completion.
2. A/E: General reference to the Architect/Engineer lead-design entity.
3. Building Automation System (BAS): The computer-based heating, ventilation and air-conditioning (HVAC) control or automation system.

4. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
5. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
6. Commissioning Authority (CA): The Party retained by the Owner who will oversee the Commissioning process as well as develop and stipulate many of the Commissioning requirements. They will also manage the Commissioning process, and ensure and validate that systems and equipment are designed, installed and tested to meet the Owner's requirements.
7. Commissioning Coordinator (CxC): This refers to the Individual within each of the various Parties that is designated the point of contact for that Party relative to Commissioning activities.
8. Commissioning Portal: This is an internet hub for the collaboration on Commissioning information. This portal will act as a hub for posting electronic information.
9. Commissioning Plan: The Commissioning Plan is a part of the Contract Documents and outlines many of responsibilities, procedures and tasks throughout the Commissioning process. It also describes the Functional Performance Tests that will be performed during the Acceptance Phase. The Contractor must have an understanding of commissioning process and the Contractor requirements within the plan.
10. Commissioning Team (CxT): The group of Parties involved in the commissioning process for any given system. The Commissioning Team will include a core group involved with all systems. This core group will typically include the CA, the Construction Manager's Commissioning Coordinator (CM-CxC), the Owner's Commissioning Coordinator (O/O-CxC) and the General Contractor's Commissioning Coordinator (GC-CxC). On any given system, the Commissioning Team will also include the Commissioning Coordinator for the Contractor(s) responsible for the system or equipment.
11. Contractor: As used herein, 'Contractor' is a general reference to the installing Party and can therefore refer to the General Contractor, subcontractors, or vendors as inferred by its usage. The contractor generally refers to the person or entity who has agreed with the owner to perform work. Whereas the subcontractor is any person other than the contractor who agrees to furnish or furnishes any supplies, material, equipment, or services of any kind in connection with the work.
12. Construction Manager (CM): The Party retained by the Owner to represent the Owner and make decisions on the Owner's behalf throughout the design and construction process.
13. Construction Phase: Phase of the project during which the facility is constructed and/or systems and equipment are installed and started. Contractor and subcontractors complete the installation, complete start-up documentation, submit operation and maintenance information, establish trends, and perform any other applicable requirements to get systems started. Contractor and Vendors may also conduct equipment specific training. The Construction Phase will generally end upon completed start-up and test, adjust and balance of systems and equipment.
14. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).
15. Engineer: Licensed Professional Engineer that designed and stamped the project reflecting his or her specific area of certification and expertise.
16. Factory Authorized Representative: An individual fully trained on the equipment and certified by the manufacturer to start-up equipment, perform the respective task, and make reports.
17. Factory Testing: Testing of equipment off-site at the manufacturer's facility. The testing may be witnessed by the members of the project team.
18. Factory Start-Up: Start-up of equipment by a Factory Authorized Representative.
19. Functional Performance Testing (FPT): The detailed and thorough testing of building systems and their interactions with building components and other building systems.
20. IAQ: Indoor Air Quality.
21. Installation, Operation and Maintenance (I,O&M) Documentation: This refers to Contractor-developed documentation designed to address the needs of facilities personnel and customized for the context of the specific facility and installation. The foundation of I,O&M Documentation is manufacturer's literature (including 'installation and operational and maintenance manual', parts lists, troubleshooting guides, etc.) as well as Contractor-developed instructions for start-up and shut-down, sequences, and other installation-specific information. I,O&M Documentation content is a subset of the Facility Manual, so it is common for only one or the other to be specified. All documentation shall be submitted to Owner in electronic format. See Division 1, Section 01785 for additional information.

22. Measurement and Verification (M&V): Period after commissioning where systems are trended and analyzed for proper operations and for hitting energy savings requirements. This is a separate service apart from commissioning.
23. Observation Log: This is a list that is maintained and updated by the commissioning provider that includes all Observation Items that relate to Commissioning activities and site observations requiring contractor action or response.
24. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
25. Opposite Season: The season opposite that when the majority of the testing occurs.
26. Installation verification: Preliminary testing accomplished during a scheduled system outage to verify system functionality prior to placing the system/equipment into preliminary service.
27. Start-Up: Refers to the quality control process whereby the Contractor verifies the proper installation of a device or piece of equipment, executes the manufacturer's starting procedures, completes the Start-Up Checklist, energizes the device, verifies that it is in proper working order and ready for dynamic testing, including Start-Up Tests.
28. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.
29. TAB: Can refer to the test, adjust, and balance process or the Testing, Adjusting, and Balancing Contractor.
30. Transition Period: Time period after FPT completed to operate systems to purge the building and stabilize equipment operations. Time is also used by the CA to test system performance.
31. Trending: Monitoring and recording a history of parameters typically using the BAS.
32. Warranty Phase: Includes the early occupancy of the building and can continue through the Warranty Period and at least into the opposite season from when it was initially tested.

1.05. COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CA.

B. Members Appointed by Owner:
   1. CA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CA under a separate contract.
   2. Representatives of the facility user and operation and maintenance personnel.
   3. Architect and engineering design professionals.

1.06. OWNER RESPONSIBILITIES

A. Provide the OPR documentation to the CA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and Engineer and approved by Owner, to the CA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.07. COORDINATION MANAGEMENT PROTOCOL

A. Coordination responsibilities and management protocols relative to Commissioning are initially defined below but will be refined and documented in the Commissioning Plan. Contractor shall have input in the protocols and all parties will commit to scheduled obligations. The CA will record and distribute.
   1. Submittals and Shop Drawings: CM shall distribute the submittal log to the CA. CA shall review the submittal log and communicate which submittals need to be forwarded.
   2. CA Review Comments for Shop Drawings: An email reply is sent directly to the CM, A/E, and Owner by the CA. The Owner and A/E will consider and incorporate at their discretion.
   3. Deficiencies Identified by the Commissioning Provider: When the CA identifies a deficiency the CA shall make a good faith assessment of responsible parties. Those parties, as well as the Owner and CM shall be notified of the perceived deficiency. This communication is FOR INFORMATION ONLY and is not a direction to resolve the deficiency or to take any action. Contractor may elect to accept responsibility and resolve the deficiency. If the contractor contests either the deficiency or responsibility for that deficiency, Contractor shall respond to that deficiency indicating disagreement. If responsibility is not

agreed to via the Commissioning dialogue, CM shall issue a work directive or RFI via the normal contractual channels to resolve the issue.

4. Requests for Meetings: In general request by the contractor for a meeting with the CA shall be routed through Owner and CM who will then determine the validity. Note that every attempt should be made to deal with Commissioning issues at regularly scheduled Commissioning Meetings.
5. Control Sequence Modifications: CA shall review the sequences during the design and submittal phases and address any known issues prior to the submittal approval. However, CA and the contractor may incorporate minor changes to the sequence during testing when it is apparent that it improves the control of the equipment but does not fundamentally change the sequence, subject to the approval of the Owner and Engineer. Any and all changes must be thoroughly documented in the record documents.
6. Notification of Completion Milestones: Contractor shall notify the CA, Owner and CM at least one week prior to any anticipated commissioning activity or commissioning milestone (such as FPT). The Owner or CM (as applicable) shall then coordinate the scheduling of the activity between all required parties. Notification shall be via email.
7. Observation Log: CA maintains a categorized Observation Log which tracks the Commissioning related action items. Any party that is copied on an email resulting from an Observation Item posting may respond to it and contribute to the dialogue. CA normally distributes a copy of the current open items on the action list with each site visit report.
8. Start-Up Checklist and Test Documents: Minimum start-up and documentation requirements are listed in the respective sections of the specifications for controls and mechanical commissioning. The Contractor then performs the reviewed and approved Start-Up procedures, completes the documentation and signs, and submits it. CA subsequently spot checks the procedures and documentation during the FPT. They are then included in the Commissioning Record.
9. Functional Performance Test Documents: FPTs are witnessed and documented by the CA but performed by the contractor. They are developed during the construction phase generally after completed submittals. CA drafts and forwards the FPT procedures to the CM to be subsequently distributed to the subcontractors for review by the CM. Contractors review and comment on the procedures. Throughout the Commissioning process, CA maintains a current record of the testing procedures and keeps the documentation up to date and accessible for all to access the current progress. Upon request, the CA will provide an electronic copy of completed functional test procedures at any significant stage of Cx.

B. Coordination Between Testing Parties

1. Factory Start-Ups: For many systems and equipment, Factory Start-Ups are specified. The Contractor is responsible for providing onsite support for the Factory representatives. These Factory Start-Ups will be reviewed and checked during FPT. All costs associated with the Factory Start-Ups are included with the bid unless otherwise noted. Contractor shall make notification of when Factory Start-Ups are occurring and coordinate these with witnessing Parties. The CA and CxT members may witness Factory Start-Ups at their discretion. Aspects of FPT accomplished during the Factory Start-Ups may be accomplished and approved by the CA if they meet the intent of the FPT. It is assumed that the Factory representatives budget the appropriate numbers of trips to support initial start-up, resolving equipment issues, TAB and training.
2. Independent Testing Agencies and Special Inspectors: For systems where contractor's independent testing agencies or special inspectors are specified, the cost of this testing is included with the bid unless otherwise noted. Much of the testing performed by these independent agencies or special inspectors will cover aspects required in the Start-Up Procedures and FPTs.
3. Contractor, testing agencies, and special inspectors shall coordinate with the CA so that the CA can support the testing (when necessary), witness the testing, and approve the applicable aspects of the FPTs. The Contractor should not start up equipment or systems without CA approval.
4. The CA may independently spot-check work of the testing agencies or special inspector if the tests were not witnessed. However, it is not the intent for the CA to re-accomplish testing by others that is specified in the construction specifications.
5. Contractor is responsible for coordinating the efforts of testing agency or special inspector with that of the Cx process. Documentation shall be contiguous and seamless and duplication will be avoided. Testing agencies or special inspectors shall complete the documentation of the Cx process as required.

1.08. CONTRACTOR RESPONSIBILITIES

A. Construction Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Construction Phase.

1. Include Commissioning requirements in price and plan for work.

2. Designate a CxC from each major subcontractor with activities related to commissioning. These CxCs are to be the primary contacts for Commissioning activities.
3. Attend Construction Phase Commissioning Kick Off Meeting. The CxC and Project Manager from each major subcontractor shall attend at a minimum.
4. The CxC shall attend all Commissioning progress meetings unless otherwise agreed to by the CA.
5. Remedy any deficiencies identified throughout construction.
6. Submit Start-Up Procedures along with the manufacturer's application, installation and start-up information to the CA for review prior to implementation.
7. TAB shall submit Project specific TAB Plan and sample balancing forms for approval prior to starting work.
8. Contractor shall incorporate the Commissioning process into the construction schedule outlining generic Commissioning tasks with precedents or prerequisites to each task. These tasks will apply to many systems and the Contractor shall incorporate as such. Examples of enumerated tasks include:
    a. Contractor preparation of the Training Plan.
    b. Independent Testing Agency activities.
    c. Contractor documentation of pipe pressure testing, flushing, and cleaning of applicable systems.
    d. Documentation of the Start-Up Procedures for equipment and systems
    e. TAB of applicable system
    f. Training Events
    g. Preparation of the O&M Manual content
    h. FPT and Acceptance
    i. Observation Period and System Optimization
    j. Occupant or other Regulatory Agency testing or approval process
9. Coordinate the work of subcontractors, vendors, manufacturers, Testing Agencies and Special Inspectors provided with the bid, and ensure that they are informed of and are adhering to the requirements of the Commissioning process specified throughout the contract documents. Particular reference is made to providing the required O&M Documentation; submittal of training materials and documentation of that training; collaboration with the overall start-up and testing process; developing comprehensive integrated procedures for scheduling and task notification and documenting them in a common format; and electronic delivery requirements if applicable.
10. Provide assistance to the CA in preparation for the specific FPT procedures. Contractors, subcontractors and vendors shall review the FPTs to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures that is the result of malfunctioning equipment or contract deficiencies, shall be the responsibility of the Contractor.
11. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this section. The Contractor (and subcontractors) shall record, in the form of photographs, compliance to and/or deviation from IAQ standards.
12. Contractor shall notify the CA at least 7 days in advance of any tests, start-ups, or training. CA shall witness selected tests and start-ups. Notification shall be accompanied by a schedule showing the coordinated start date and task duration and all open prerequisites
13. Start-up, TAB of systems and equipment prior to verification and FPT by the CA. Start-up procedures shall be in accordance with Contract Documents, reference or industry standards, and Commissioning specs. Provide skilled technicians who are qualified to do the work required. Provide factory trained/authorized technicians where required by the contract documents and stated in the applicable technical section. Generally start-up and testing shall proceed from device checkout, to component checkout, to system checkout, to inter-system checkout.
14. Record start-up and testing procedures on start-up forms or checklists and certify that the systems and equipment have been started and/or tested in accordance with the requirements specified above. Each task or item shall be indicated with the party actually performing the task or procedure.
15. Demonstrate the operation of all systems as specified.
16. Certify that systems have been installed and are operating per Contract Documents and OEM prior to FPT and acceptance.
17. Support/Assist in the building flush-out per Construction Indoor Air Quality, Section 01561. If the flush-out is not performed or is incomplete then the Contractor shall coordinate an air quality test from an approved Industrial Hygienist after construction is complete to verify the chemical air contaminants are below the specified limits.
18. Maintain an updated set of Record Documentation as required by the Contract Documents.

19. Conduct and document Equipment and Systems Training events as required by this Section and by applicable sections of the Specifications pertaining to each piece of equipment or system and general training requirements.
20. Operate systems under direction of the CA during FPT's and other acceptance testing.

B. Acceptance Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Acceptance Phase.
1. Will work in conjunction with CA in FPT and will generally include the following:
   a. Operate and Manipulate systems and equipment to facilitate testing (as dictated in this section, relevant technical sections and the Commissioning Plan).
   b. Operate and Manipulate BAS and other control systems to facilitate FPT (as dictated in this section, relevant technical sections and the Commissioning Plan).
   c. Provide Point to Point and Devise Calibration reports prior to coordination to facilitate FPT.
2. Correct any work not in accordance with Contract Documents.
3. Maintain record documentation and update and resubmit it after Functional Completion.
4. Compensate the Owner for additional CA fees and expenses incurred to retest equipment and systems following testing failures.
5. Monitor systems, equipment and areas throughout the Acceptance Phase. Log and diagnose all alarms during this period. Maintain trends and logs of all parameters. Forward the logs and trends on a weekly basis throughout the Acceptance Phase.

C. Warranty Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Warranty Phase.
1. Provide warranty service.
2. Conduct BAS Sequence Training.
3. Respond to and document Warranty issues.
4. Participate as required in the opposite season testing.
5. Correct any deficiencies identified throughout the Warranty Phase.
6. Update record documentation to reflect any changes made throughout the Warranty Phase and resubmit final Record Drawings and data records at the close of the Warranty period.

1.09. DESIGN REVIEW

A. The A/E provides the CA a design development (DD) set for review; the drawing set should be near 100% complete. The CA reviews the design set for inconsistencies, misses, OPR & BOD compliance, and opportunities for improvement. The CA documents their comments and provides them to the A/E for incorporation into the design set.

B. The A/E provides a Construction Document (CD) set that is near 50% and/or 90% complete to the CA for review. The CA reviews the set to verify previous comments have been addressed and to identify any further misses or opportunities. The CA documents their comments and provides them to the A/E for incorporation into the construction set.

1.10. COMMISSIONING PLAN

A. The CA will develop the Commissioning Plan and its elements shall be included in the project schedule when approved by the owner or construction manager. The following provides an overview of the Commissioning tasks discussed in the Commissioning Plan.
1. Commissioning program overview - Goals & Objectives, general project information, system to be commissioned
2. Commissioning team - Team members, roles & responsibilities, communications & protocols, meetings and management
3. Commissioning process activities - Document owner's project requirements, review the basis of designs, review submittals, development of system functional performance testing, verify system performance, report deficiencies & the resolution process, accepting the building system and training
4. Commissioning schedule - A commissioning schedule will typically include start and end dates for the following.
   a. Design set review
   b. CD set review
   c. Bid packages released
   d. Distributed power available
   e. Distributed water available
   f. Start-up tests

g. Point to Point
h. TAB
i. Functional performance testing
j. Training

1.11. OBSERVATION LOG

A. CA shall maintain an Observation Log (required information, identified deficiencies, work required, etc.) that relates to Commissioning. Each item shall be tracked with the initiator, the parties responsible, due date, the date of closure, and a description of the resolution. Each item shall be categorized for sorting and tracking and for documentation on applicable forms.

B. CA will disseminate this list as appropriate to keep all parties informed.

C. All parties indicated as responsible for an action item shall respond. The preferred response method is via e-mail. Response with a plan of action (either repair or plan to resolve) is expected within 48 hours.

1.12. SUBMITTAL

A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Provider. All documentation requested by the CA will be included by the Subs in their O&M manual contributions.

B. The Commissioning Provider will review and provide comment on submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning Provider will notify the CM, Owner Representative, or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

C. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

E. Contractor's responsibility for deviations in submittals from requirements of the Contract Documents is not relieved by the Commissioning Provider's review.

PART 2 - PRODUCTS

2.01. INSTRUMENTATION

A. All test instruments described in this section shall be acceptable for any portion of the commissioning process herein described. All instruments shall conform to the standards specified in the most recent edition of “NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems” in regard to accuracy and calibration status. Current calibration certificates must be available to the CA as requested.

B. Test instrument accuracy and resolution must match or exceed that of the system component being verified or calibrated.

C. Test instruments must be used within guidelines as recommended by instrument manufacturer. All measuring methods must be appropriate to the instrument application and measurements must be repeatable under equivalent conditions.

D. Standard Testing Instrumentation: Standard instrumentation normally used for performance assessment and diagnosis will be provided by Cx/Contractor. These include:

1. Electronic Manometer (for Air and Flow Hood)
2. Electronic Manometer (for Water)
3. Temperature Instruments
4. Humidity Instruments
5. CO2 Instrument
6. Sound Meter

7. Electronic Multimeter
8. Tachometer
9. Ultrasonic Flow Meter
10. Thermal Infrared Camera
11. Others as required

PART 3 - EXECUTION

3.01. INSTALLATION VERIFICATION

A. All equipment, components, and devices applicable to installation verification must be installed, and the installation verification must be documented and approved. This includes installation, identification labeling, insulation, and all other requirements for placing systems into dynamic operation.

B. Required submittal documentation shall be present and located convenient to testing area. Validate that all required documentation has been submitted and is per the contract requirements.

C. Contractor shall provide the completed installation verification procedures at the time of testing. CA shall review the installation verification procedure documentation and spot-check at the beginning of Start-Up.

D. Contractor shall demonstrate that access is sufficient to perform required maintenance.

E. System and equipment configurations shall be compared against the contract documents.

3.02. START-UP CHECKS

A. All equipment, components, and devices applicable to the FPT must be started, and the Start-Up must be documented and approved. This includes completion of Start-Up Procedures, pressure testing (of equipment, duct and piping), flushing/cleaning, identification labeling, insulation, and all other requirements for placing systems into dynamic operation.

B. Unless specifically agreed to by the Owner and CA, all support systems shall be complete prior to FPT. For instance, an air handler will require that:
   1. The electrical system serving it is completed and tested.
   2. The hydronic systems serving it have been pressure tested, flushed, and functional performance tested.
   3. Balancing has been completed.
   4. The control systems have been started and calibrated.
   5. The CA shall determine the optimal sequence of testing.

C. Required submittal documentation shall be present and located convenient to testing area. Validate that all required documentation has been submitted and is per the contract requirements.

D. Contractor shall provide the completed Start-Up Procedures at the time of testing. CA shall review the Start-Up Procedure documentation and spot-check at the beginning of FPT.

E. Contractor shall demonstrate that access is sufficient to perform required maintenance.

F. BAS trends shall have been established as required in the documents. These shall generally be reviewed prior to or during FPT.

G. Capacities and adjusted/balanced conditions as applicable shall be subject to review.

H. Sequencing Verification: For applicable systems and equipment, all modes of operation shall be verified for proper sequencing.

I. System and equipment configurations shall be compared against the contract documents.

J. Verify Modes (such as heating and cooling) are coordinated and do not overlap or 'fight'.

K. All adjusted, balanced, controlled systems shall be assessed to determine the optimal setting for the system as applicable. The optimal settings should be determined to establish reliable, efficient, safe and stable operation.

L. BAS or Local Panel Dynamic Graphics: The graphic displays for all components, systems, and areas required to be represented by a graphic shall be checked for adequacy and accuracy. Furthermore, when setpoints or other parameters are required to be adjustable, CA shall verify that they can be adjusted directly from the graphic screen.

3.03. START-UP PROCEDURE

A. Purpose: The Commissioning process requires that the normal quality control processes involved with preparing systems and equipment for operation are performed to a high standard of care and are thoroughly documented. The required commissioning-related Start-Up Procedures involve nothing additional over that which would be done for a proper installation. These procedures shall be performed on all installed systems and equipment and no sampling strategy is used for the start-up process. The Commissioning process requires all Parties to collaborate to establish the optimal standard of care for starting systems and equipment. After the procedures

are established, the Contractor performs them and documents them with the Start-up Procedures that are developed by the Contractor.

B. Start-Up Procedures: The content of these Start-Up Procedures shall provide the minimally acceptable content in accordance with the OEM field quality control requirements. These procedures and protocols will normally be common across different manufacturers.

C. Content of Start-Up Procedures: Start-Up Procedures shall generally include the following for each item of equipment or system (as applicable):
   1. Project-specific designation, location and service.
   2. Indication of the Party performing and documenting the Start-Up Procedure.
   3. Clear explanation of the inspection, test, measurement, and outcome with a Pass/Fail indication and a record of measure parameters.
   4. A Start-up Checklist item indicating that proper maintenance clearances have been maintained.

D. Recording and Documentation of Factory Start-Up: Manufacturer's start-up protocols shall be executed and forms shall be completed by a qualified/authorized technician.

E. Recording and Documentation of non-Factory Start-Up: The start-up tests and checklists shall be completed by a qualified technician.

F. Commissioning Provider Review: CA will review and spot-check procedures during FPT.

G. Documentation Completion: The individual executing the start-up must complete the start-up and pre-functional documentation for any given equipment and acknowledge acceptability with the indication of who did the associated task.

H. Sampling and Final Submission: All (100% of) systems are started and documented per the approved procedures and NO sampling strategy is used. Completed Start-up and pre-functional checklists for all pieces of equipment associated with independent systems shall be submitted to CA prior to any associated FPT. Any outstanding item shall be clearly indicated and an associated Action Item must be entered to track resolution.

I. Owner Access: Contractor shall allow access by Owner representatives to inspect the equipment and ensure its proper operation.

3.04 POINT TO POINT VERIFICATION

A. A documented, comprehensive point to point and basic function testing in the field is required on all installations. Factory calibration and bench tests are not acceptable alternates to onsite field-testing.

B. Point-to-point (or calibration verification) scope of work consists of testing from all end field devices (any device that provides an input signal to, or receives an output signal from the control hardware) through proper input/output to the graphic and operator interface. Testing must be complete, detailed and documented on approved point to point verification forms. Point-to-point should be performed with a separate device from the installation sensor - “ringing out a sensor” alone is not an acceptable level point-to-point testing. Point-to-point testing forms will include all point database requirements (i.e. alarm priority, paging, email, device range, etc.).

C. Submittal of the control provider's forms for approval must take place 3 weeks prior to commencement of field testing. The point-to-point report summary documentation must include the signature of the test technicians and date completed. The technician's signature certifies that the system has been tested and is fully ready for the commissioning lead's performance verification testing.

D. The CA will select up to 10% of the readings from the BAS Reports and spot check them, as part of the time allocations for the various systems. If subsequent failures are found, the Controls contractor will be required to justify noted failures or re-verify and re-document the system.

E. The maximum failure rate for this sample is 10%. The readings selected by the CA may include air temperature, fluid temperature, air flow rate, liquid flow rate, differential pressure, gage pressure, relative humidity, CO concentration, CO2 concentration, and refrigerant monitoring.

F. For all readings a deviation of more than the below between the verification reading and reported data shall be considered as failing the FPT

Sensor Application	**Accepted BAS Tolerance**
Airflow (Pressurized Spaces)	± 3 %
Airflow (Measuring Stations)	± 5 %
Airflow (Terminal)	± 10 %
Air Pressure Differential (Space)	± .001 in wg
Air Pressure (Ducts)	± .01 in wg

Air Relative Humidity	± 2 % RH
Air Temperature (Ducted)	± 1 deg F
Air Temperature (Room, AC unit, TU, etc.)	± 1 deg F
Air Temperature (Outside)	± 2 deg F
Air Wet Bulb Temperature Outdoor (Dew point)	± 2 deg F
Air Wet Bulb Temperature Indoor (Dew point)	± 1 deg F
Air Temperature Differential	± .25 deg F
Carbon Dioxide Monitor	± 50 PPM (of mid-range)
Carbon Monoxide Monitor	± 5 % (of mid-range)
Oxygen Monitor	± 5 %
Refrigerant Monitor	± 5 % (at 50 PPM)
Fluid Flow	± 5 %
Fluid Pressure	± 2 % (of full-scale)
Fluid Temperature	± 1 deg F
Electrical	± 5 %
Thermal Energy	± 5 %
Steam Flow	± 5 %
Steam Temperature	± 2 deg F
Vibration	± 5 %

■Notes:
Accepted calibration tolerances will vary according to measured medium and application of sensors. The tolerances listed are standard accepted criteria.
Not all sensors listed above may be in the project.

3.05 TEST, ADJUST, AND BALANCE

A. CA shall review TAB Plan, Draft / Final TAB reports.

B. The CA will select up to 10% of the readings from the Balancing Reports and spot check them, as part of the time allocations for the various systems. If subsequent failures are found, the TAB contractor will be required to justify noted failures or rebalance and re-document the system.

C. The maximum failure rate for this sample is 10%. The readings selected by the CA may include supply air diffuser readings (both minimum and maximum readings for variable air volume boxes), main and branch supply duct traverse readings, outside/return air flow readings, exhaust air flow readings, water flow readings, amp readings, and water pressure drop readings through coils, heat exchangers, and other hydronic elements.

D. For all readings a deviation of more than 10% between the verification reading and reported data shall be considered as failing the FPT.

3.06 FUNCTIONAL PERFORMANCE TESTING

A. Objectives and Scope:

1. The objective of FPT is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, thus improving the function and operation of the systems.
2. Each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, normal [and emergency power], fire alarm, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, no flow, equipment failure, etc. shall also be tested.

B. Development of Test Procedures:

1. CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Prior to execution, the CA shall provide a copy of the test procedures to

the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection, and scope. The CA will also submit the tests to Owner for Review.

2. Contractor shall review the FPTs in detail and submit edits and comments to the CA for possible incorporation.
3. The purpose of any given specific FPT is to verify and document compliance with the stated criteria of acceptance, modes of operation and performance.

C. Scheduling: After Contractors' notification that systems are ready for testing and submittal and review of all the required submittals has occurred, CM shall schedule the testing. To the extent practical, tests shall be scheduled to allow efficient and contiguous testing of inter-related systems and equipment.

D. Phasing: Non-interdependent segments of the project testing can be phased. Phasing of this project will be determined as the project progresses.

E. Participation: CA will direct, witness and document FPTs performed by the contractor after Start-Up Procedure documentation of systems and equipment has been reviewed and accepted. CA will orchestrate the execution of the FPTs unless otherwise specified. Contractor shall perform the FPTs as described in section 3.6 with manipulation of the systems or equipment, provision of supporting equipment or materials (lifts, ladders, specialty test equipment, safety equipment), and on-the-spot remediation of minor identified deficiencies whenever possible.

1. Required participating Parties shall be indicated in the individual FPT. Typically, multiple Parties are required for any given test, yet participation for any given Party is only required for the respective portion of the test for which the Party is responsible.
2. Frequently, on multiple samples where a given party does not directly perform the test, the participation of that party will only be required for an initial quantity of systems/equipment. Whenever practical and at the discretion of the CA with the contractor's full approval, the CA will continue with the remaining portion of the sample without assistance from the Contractor(s) not directly performing the test. However, the Contractor is allowed to be present for any or all FPTs conducted.
3. The required parties shall be available on-site throughout the testing of any given system for which they are required participants. Therefore, time for which they are not directly involved can be spent performing other work (typically addressing identified punch list items or failed tests).
4. No party involved with the project is prohibited from participation in or witnessing of any tests. Any Contractor may elect to witness all tests on their systems even if their involvement is not directly required (for instance, BAS Vendor involvement is sometimes required on the first few of a sample and not on the entire sample).
5. CA will endeavor to coordinate effectively with the individual Contractors throughout FPT and minimize their required involvement.

F. Completeness: All systems must be completed and ready for FPT. All start up, factory authorized field testing, independent testing agency tests, and TAB procedures must be complete and the control systems must be tested and started for the respective system or component.

G. Test Documentation: CA will witness and document the tests. CA will record all test results on the forms developed for the testing. CA will 'Pass' or 'Fail' the testing and record the date and time of the test. Deficiencies shall clearly be indicated when the test is failed. When all related testing is completed successfully, CA shall recommend acceptance of the system or component. In the case of specialized testing, witness (at CA's discretion) and review the testing reports prepared by the Contractor.

H. After functional testing is completed all settings adjusted to test the equipment/system will be returned to normal.

I. FPT Acceptance:

1. The Acceptance Criteria shall be as follows unless specifically indicated within applicable individual specification sections or test procedures. CA may exercise professional judgment to relax requirements and pass tests and recommend approval by the Owner and Engineer when appropriate.
2. Accuracy/repeatability on sensing devices will be as specified for the device. CA and TAB will use calibrated gages for independent validation and use judgment in passing or failing the devices. In many cases, the coordination of multiple related sensors is more important than absolute accuracy.
3. HVAC sequence-related criteria will be as explicitly specified in the documents and as interpreted by the CA.
4. Testing may be deferred due to seasonal or operational constraints. In either situation the testing will be coordinated and be governed by the specifications for the project.

J. FPT Deficiencies:

1. Non-Conformance: Non-conformance deficiencies identified during FPT shall be resolved as follows:

a. The CA will record the results of the functional test. All deficiencies or non-conformance issues shall be noted as Observation Log Items and reported to the Owner and CM.
b. Corrections of identified minor deficiencies may be made during the tests at the discretion of the CA. In such cases the deficiency will be noted on the FPT documents.
c. Every effort will be made by the CA to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
d. As tests progress and deficiencies are identified, the CA will discuss the issue with the executing Contractor.
e. When there is no dispute on the deficiency and the Contractor accepts responsibility to correct it:
    i. The CA shall document the deficiency along with the Contractor's response and intentions, and they go on to another test or sequence. A copy/email of the deficiency shall be generated and provided to the Contractor and CA. The Contractor corrects the deficiency, completes the Action Item response certifying that the issue is resolved and/or the equipment is ready to be retested, and sends it back to the CA.
    ii. The CA reschedules the test and the test is repeated.
f. If there is a dispute about a deficiency, regarding whether it is a deficiency and/or who is responsible:
    i. The deficiency shall be documented as an Observation Log Item with the Contractor's response and the Owner and CM will be notified. The CM will track this issue under the construction contract dispute resolution provisions.
    ii. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner and CM.
    iii. The CA documents the resolution to the Observation Log Item.
    iv. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, and responds to the Action Item indicating completion. The CA reschedules the test and the test is repeated until satisfactory performance is achieved. CA then closes the Action Item.

K. Max Failure Limit and Sample Percentages: A Maximum Failure Limit is indicated along with the Sampling Percentages. The Max Failure Limit indicates the maximum percentage of the tested devices that may have any test that fails before an entirely new sample must be tested. This is based on the concept that if many failures occur, it is a result of inadequate start-up by the Contractor. When the maximum number of failures is reached, testing on that sample will be terminated and re-testing will be scheduled.
    1. If no Max Failure Limit is indicated, all tested samples must pass (Max Failure Limit 0%).
    2. Where sample tests involve multiple systems (i.e., checking strainers on different hydronic systems) the Maximum Failure Limit will apply per system.
    3. The responsible Contractors shall reimburse the Owner for the CA's cost of that sample test, and redo the start-up and TAB for the applicable devices/systems.
    4. All work necessitated by sample failures shall be at no cost to the Owner.
L. Failure Due to Manufacturer's Defects: If 10% of identical pieces of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, all identical units may be considered unacceptable by the CM. (For the purposes of defining 'identical equipment' for this Section, size or capacity alone does not constitute a difference.) In case of failure due to manufacturer's defects, the Contractor shall provide the Owner with the following:
    1. Manufacturer's response in writing as to the cause of the failure and proposed resolution.
    2. Manufacturer shall implement their proposed resolution on a representative sample of the product.
    3. The CM will determine whether a replacement of all identical units or a repair is acceptable.
    4. Upon acceptance, the manufacturer shall replace or repair all identical items at their expense and shall extend the warranty accordingly (if the original equipment warranty had begun).
    5. Manufacturer shall pay the costs of all retesting necessitated by the failure.

3.07 ACCEPTANCE

A. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the CM, if necessary. The CA recommends acceptance of each test to the CM using a standard form. The CM gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.08 CLOSEOUT

A. Commissioning Report:

1. A final summary report (about four to six pages, not including backup documentation) by the CA will be provided to the CM, focusing on evaluating commissioning process issues and identifying areas where the process could be improved.
2. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.
3. Installation verification, Start Up checklists, TAB, functional tests and monitoring reports will not be part of the final report, but will be stored in the Commissioning Record in the I,O&M manuals.
4. Off season testing and additional factory start-ups shall clearly be identified and the designated test period noted for contractor and owner coordination. See Warranty Period.

B. Code Required Reports:
1. Provide Contractor with all commissioning reports required by state and local authorities for compliance with governing energy code and mechanical code.

3.09 TRAINING

A. The CM shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.
1. A training plan shall be generated and include the following elements:
a. Equipment
b. Intended audience
c. Location of training
d. Objectives
e. Subject covered (description, duration of discussion and special methods)
f. Instructor for each subject
g. Method of instruction (classroom lecture, manufacturer video, site walk through, actual operational demonstration, written handouts)
2. The controls contractor shall attend any training in which their system interfaces (minimally mechanical)
3. Recommended training
a. Use printed installed ad O&M manuals
b. Review of O&M - include start-up, all modes of operation, shutdown, seasonal changes, and emergency operations (emphasis should be given on safety and proper operations).
c. Health and safety issues
d. Warranties and guarantees
e. Common troubleshooting
f. Peculiarities
g. Overrides

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.

3.10 INSTALLATION, OPERATION AND MAINTENANCE

A. Prior to substantial completion, the CA shall review the I,O&M manuals, documentation and redline as-builds for systems that were commissioned to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the CM or A/E, as requested.

B. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the CM or A/E.

C. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the I,O&M manuals according to the A/E's contract.

3.11 WARRANTY REVIEW

A. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the I,O&M manuals and as-builds due to the testing will be made.

END OF SECTION

SECTION 01 95 00
MEASUREMENT AND VERIFICATION

PART 1 – GENERAL

1.01. OVERVIEW

A. This Measurement and Verification (M&V) plan is based on Option D: Calibrated Simulation of the *International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April, 2003.* The plan is intended to verify the cost savings associated with energy efficiency measures incorporated into the design, and to provide a recalibrated energy model that will serve as a tool for building operators in identifying and remedying causes of underperformance.

1.02. SCOPE OF WORK

A. McKinstry is primarily responsible for the M&V Plan's development, coordination and implementation. The project owner and building operations staff will support implementation of the plan

B. A comprehensive measurement and verification plan will be developed which will detail the project milestones listed below:

Baseline energy model
Recalibrate baseline energy model to reflect as-built and post-occupancy conditions
Identification of ECMs for inclusion in the M&V plan
Development of M&V plan
Compilation of all occupancy, controls, BAS data, and scheduling information during the M&V period
Spot metering during M&V period
Installation of required sub-metering equipment
M&V Report
Corrective Action Plan (if necessary)

1.03. MEASUREMENT & VERIFICATION TEAM

A. The measurement & verification team as referred to in all sections will consist of the job-specific group responsible for performing M&V duties throughout the project lifecycle. The primary point of contract is the project's performance assurance specialist at McKinstry.

B. Additional parties crucial to the process but not directly responsible for Measurement & Verification in the capacity of those listed above are:

1. Mechanical Contractor Project Manager
2. Mechanical Field Foremen
3. Mechanical Design Engineer
4. Control Contractor Representative
5. Control Field Engineers / Technicians
6. General Contractor Representative
7. Electrical Contractor Representative

C. The nature of the process requires a significant amount of communication between and participation of all members listed above.

1.04 MEASUREMENT & VERIFICATION PLAN

A. Prior to project commencement the McKinstry team shall develop a comprehensive measurement & verification plan which will address the following:

1.05 INSTRUMENTATION

A. All test instruments described in this section shall be acceptable for any portion of the measurement & verification process herein described. All instruments shall conform to the standards specified in the most recent edition of "International Performance Measurement and Verification Protocol (IPMVP)" regarding accuracy and calibration status. Current calibration certificates must be available.

B. Test instrument accuracy and resolution must match or exceed that of the system component being verified or calibrated.

C. Test instruments must be used within guidelines as recommended by instrument manufacturer. All measuring methods must be appropriate to the instrument application and measurements must be repeatable under equivalent conditions.

D. The M&V team shall assume full responsibility for safekeeping of all instrumentation during the course of work.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.01. PRE-CONSTRUCTION

A. During the pre-construction phase, the measurement & verification team shall be available to all concerned parties in a consulting capacity. The role of the team in the construction phase affords them with practical knowledge that can be applied during the design and construction scheduling processes. Pre-construction input is intended to reduce or eliminate issues that have historically hindered timely project completion or have caused unanticipated project cost impact. Examples include:

1. Engineering design issues.
2. Manufacturer-specific equipment performance.
3. System control strategies.
4. Subcontractor performance.
5. Project scheduling conflicts.
6. Owner / contractor expectations.

3.02. POST-INSTALLATION EQUIPMENT MONITORING

A. Following installation and before occupancy, commissioning activities were used to verify the proper fundamental operations of the building systems. Should a component of an ECM fail to work in the designed manner, maintenance will be performed to restore the equipment to its designed operation. Permanent and spot metering will be used to measure electrical consumption. Operation staff will use metered trend data and spot checks to identify underperforming systems so that corrective action can be taken.

B. The method of metering will be through sealed electronic sub meters, these meters will record the electrical loads indicated within this plan. These meters are intended to validate the anticipated energy savings previously indicated in LEED EAc1 and as indicated below. Recalibration of the meters can be done by sending these meters back to the factory, contacts with these vendors have indicated that this is typically done every five years. The table below shows the metering strategy that will be used to monitor electrical loads.

3.03. M&V PERIOD VERIFICATION ACTIVITIES

A. On a monthly basis, operations staff shall record the energy consumption of loads associated with ECMs. Also record any significant O&M activities performed on the systems during that time period, including any associated costs. At the end of the one-year M&V period, summarize the electrical consumption data for comparison with the recalibrated baseline and expected consumption. The metered equipment shall be inspected at the conclusion of the M&V period and as needed to verify proper operation. All collected information and comparison results will be included in the M&V report.

B. All efforts will be made to prevent the omission or loss of metered data. In the event that data is missing or lost, existing data from before and after the missing portion will be used to extrapolate if appropriate. Extension of the M&V period is also an option for mitigating the effect of lost data.

3.04 BUILDING AUTOMATION SYSTEM LOGGING/TRENDING

A. The schedule of point trends will be developed by McKinstry and shared with the project team upon project execution and DDC system selection.

B. The BAS includes data logging functions that will also be used to provide ongoing measurement and verification data pertaining to certain mechanical systems. BAS data will be used in conjunction with metered electricity to track equipment performance, identify underperforming systems. This data will also be used to assist the baseline energy model recalibration. The table below shows the metering strategy that will be used to monitor mechanical systems that use electricity.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.

B. This section includes the design, construction and treatment of formwork and related accessories to confine and shape concrete to the required dimensions.

C. This section also includes the installation of embedded items such as flashing reglets, shelf angles, and PVC weeps.

D. Structural notes indicated on the drawings regarding concrete formwork shall be considered a part of this specification.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified.

1. ACI 117 – Standard Specification for Tolerances for Concrete Construction and Materials.
2. ACI 301 – Standard Specification for Structural Concrete.
3. ACI 318 – Building Code Requirements for Structural Concrete.
4. ASTM C31 – Standard Specification for Making and Curing Concrete Test Specimens in the Field.
5. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Test Specimens.

B. Where provisions of the pertinent Codes and Standards conflict with this specification, the more stringent provision shall govern.

C. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship.”

1. Non-rented temporary concrete formwork.

1.3 SUBMITTALS

A. Formwork Release Agent: Submit data on the formwork release agent proposed for use with each form surface to be used for acceptance unless otherwise specified in the Contract Documents. Include certification that agent is compatible with finish.

B. Testing for Formwork Removal: When methods other than cylinder tests are proposed for determining time for formwork removal, submit data on methods for approval.

C. LEED Certification: Submit manufacturer’s certification for formwork including the following:

1. LEED Credit MRc 4.1/4.2 – Recycled content including percentage of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer’s name and product cost.

2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

3. LEED Credit MRc 7 – Chain-of-custody certificates certifying that wood used for formwork complies with forest certification requirements. Include evidence that manufacturer is certified for chain-of-custody by an FSC-accredited certification body.

a. Include statement indicating costs for each certified wood product.

1.4 DESIGN REQUIREMENTS

A. Design and Engineering of formwork is the responsibility of the Contractor. Design and construct formwork, shoring and bracing to conform to Contract Documents and building code requirements. Design for construction loads, lateral pressure, and requirements of the applicable building code.

B. Drawings show the design requirements and dimensions for structural strength, but structural drawings do not show all detail dimensions to fit intricate Architectural and mechanical detail. Contractor shall so construct the concrete work that it will conform to the clearance required by the Architectural, Mechanical and Electrical design.

C. Maximum deflection of facing materials forming concrete surfaces exposed to view shall be 1/240 of the center-to-center span between structural members of the formwork.

PART 2 - PRODUCTS

2.1 MATERIALS AND ACCESSORIES

A. Formwork Accessories: Use commercially manufactured accessories for formwork accessories that are partially or completely embedded in concrete, including ties and hangers.

B. Formwork Release Agent: Use commercially manufactured form release agents that will prevent formwork absorption of moisture, prevent bond with concrete, and will not stain the concrete surface. Formwork release agent shall be compatible with paint or any other finish applied to the concrete; submit data indicating compatibility.

C. Form Material:

1. No aluminum shall be allowed in the concrete work unless coated to prevent aluminum-concrete reaction.

2. Concrete form materials must be used in a manner so as to provide the surface finish specified.

3. Design formwork in accordance with the provisions of the building code or the following standards if not covered in the building code:

a. Wood - AF & PA "National Design Specification".
b. Plywood - American Plywood Association "Plywood Design Specification".
c. Steel - AISC "Manual of Steel Construction - Allowable Stress Design".
d. Cold-formed Steel - AISI "Cold-Formed Steel Design Manual".
e. Aluminum - Aluminum Association "Aluminum Construction Manual".
f. Concrete - ACI 318.
g. Other materials - as directed by manufacturer.

D. Chamfer Strips:

1. Chamfer strips shall be 3/4 inch by 3/4 inch strips. Verify material finish with Architect.

2.2 FORM FINISHES

A. Rough Form Finish:

1. Concrete surfaces not exposed to view in the finished work shall have a rough-form finish. No form-facing material is specified for rough-form finish.

2. Set and maintain forms so finished concrete dimensions shall conform to the tolerances. Rough form finish is Designated Surface Finish-1.0 from ACI 301, except that surface tolerance Class C is required as specified in ACI 117.

B. Smooth Form Finish:

1. Concrete surfaces exposed to view in the finished work or surfaces to receive finishes of any type (paint, textured paint, etc.) shall have a smooth form finish. Form-facing material shall be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper, or other acceptable material capable of producing the desired finish. Form-facing material shall produce a smooth, uniform texture on the concrete. Do not use form facing material with raised grain, torn surfaces, worn edges, patches, dents, or other defects that might impair the texture of the concrete surfaces.

2. Set and maintain forms so finished concrete dimensions shall conform to the tolerances. Smooth form finish is Designated Surface Finish-3.0 from ACI 301, including surface tolerance Class A as specified in ACI 117.

C. Patching and repairing concrete finishes are specified under Section 03 30 00.

2.3 FABRICATION AND MANUFACTURE

A. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.

2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 CONSTRUCTION OF TEMPORARY FORMWORK

A. Design, erect, shore, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. At construction joints, lap contact surface of the form sheathing for flush surfaces exposed to view over the hardened concrete in the previous placement by not more than 1 inch. Ensure formwork is held firmly against hardened concrete to prevent offsets or loss of mortar at construction joints and to maintain a true surface.

C. Unless specified in the Contract Documents, construct formwork so concrete surfaces conform to tolerance limits. The class of surface for offset between adjacent pieces of formwork facing material shall be Class C, unless specified otherwise.

D. Provide positive means of adjustment (wedges or jacks) of shores and struts. Do not make adjustments in the formwork after concrete has taken its initial set. Brace formwork securely against lateral deflection and lateral instability.

E. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete. Formwork camber calculations are the responsibility of the formwork designer. Set formwork and intermediate screed strips for slabs accurately to produce designated elevations and contours of the finished surface prior to removal of formwork. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds when the finish specified requires the use of such equipment.

F. When formwork is cambered, set screeds to a like camber to maintain required concrete thickness.

G. Fasten form wedges in place after final adjustment of forms and prior to concrete placement.

H. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movement of the formwork system during concrete placement.

I. Securely brace and shore forms to prevent displacement and to safely support construction loads.

J. Construct formwork for wall openings to facilitate removal and to counteract swelling of wood formwork. Keep wood forms wet as necessary to prevent shrinkage.

K. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Chamfer wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

L. Do not use rust-stained steel form-facing material.

M. Provide temporary openings at the base of column and wall formwork and at other points where necessary to facilitate cleaning and inspection.

N. Unless noted otherwise, all footings shall be centered under walls, piers or columns.

O. Provide runways for moving equipment and support runways directly on formwork or structural member without resting on the reinforcing steel.

P. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for support of adjoining work prior to concrete placement.

Q. Position and support expansion joint material and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.

R. Projecting corners of walls and columns shall be formed with a 3/4 inch chamfer. Unless noted otherwise on Architectural drawings.

S. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign material before concrete is placed.

T. Cover surfaces of formwork with acceptable formwork release agent. Apply form release agent before placing reinforcing steel and concrete according to manufacturer's written instructions. Do not allow formwork release agent to puddle in forms. Do not allow formwork release agent to contact reinforcing steel or hardened concrete against which fresh concrete is to be placed

U. Clean and inspect formwork immediately before concrete is placed.

V. Provide forms for concrete work adjacent to earth banks including sides of footings, except where footing excavation is vertical rock cut.

W. Construct forms plumb and straight to conform to slopes, lines and dimensions shown.

X. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

3.2 COORDINATION

A. Install all required pipe sleeves, cavities or slots. Notify appropriate trades in due time so that they may furnish information and make necessary installations. Check sizes, location and alignment of all openings, frames and other work, which are to be built-in including electrical boxes and conduit.

B. Layout the run of partitions and establish location of openings so that other trades may properly locate their work.

C. Core drilling concrete is not permitted unless noted otherwise or approved in writing by the Architect. Notify the Architect in advance of conditions not shown on the drawings.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Built-In Items:

1. Confirm with Architect that all materials to be embedded are suitable for embedment in concrete.

2. Build in anchors, inserts, and other devices indicated or required for various portions of work.

3. Build in sleeves, thimbles, and other items furnished or set in place by other trades.

4. Accurately position and support all embedded items prior to concrete placement. Secure embedded items against displacement during concrete placement operations.

5. Fill voids with readily removable material to prevent entry of concrete into voids.

6. Mechanical and electrical shall provide and set required sleeves.

7. Coordinate setting of all embedded items.

3.4 REMOVAL OF FORMS

A. When removal of formwork is based on concrete reaching a specified compressive strength, concrete will be presumed to have reached this strength when either of the following requirements has been met:

1. Test cylinders, molded and cured under the same conditions for moisture and temperature as used for the concrete they represent, have reached the specified compressive strength.

2. Concrete has been cured in accordance with the specifications for the same length of time as laboratory-cured cylinders, which have reached the specified strength. Determine the length of time concrete has been cured in the structure by the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50 degrees and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

B. Forms shall remain in place for the following periods of time. These periods represent cumulative number days or hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50 F:

1. Walls, piers, and footings: 50% specified compressive strength or minimum 24 hours.

C. When finishing is required, remove forms as soon as removal operations will not damage concrete.

D. Loosen wood formwork for wall openings when this can be accomplished without causing damage to concrete.

E. Do not allow removal of formwork to damage the fresh concrete for columns, walls, sides of beams, and other parts supporting the weight of the concrete. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing.

3.5 FASTENER REMOVAL

A. Remove all protruding fasteners left as a result of securing inserts to forms by Contractor responsible for insert.

B. Cutting flush with surface is not acceptable.

C. Patch exposed concrete surfaces if damaged during fastener removal process.

3.6 REMOVING AND REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.

B. This section includes the fabrication and placement of reinforcing steel for concrete, and all related accessories.

C. Reinforcing steel for use in bond beams, masonry columns, and lintels is specified in Division 4 and is not a part of the work in this section.

D. Structural notes indicated on the drawings regarding concrete reinforcement shall be considered a part of this specification.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified.

1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Standard Specification for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 315 - Details and Detailing of Concrete Reinforcement.
5. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
6. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
7. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
8. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
9. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.
10. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
11. CRSI - Manual of Standard Practice.

B. Where provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1.3 SUBMITTALS

A. Placing Drawings: Submit placing drawings showing fabrication dimensions and locations for placement of reinforcement and reinforcement accessories. Indicate bar sizes, spacing, locations, and quantities of reinforcing steel, bending and cutting diagrams, and supporting and spacing devices. Dowels shall be shown in placing drawings for the element that is to be placed first. Reinforcing steel descriptions or shop drawings shall be inch-pound sizes.

B. Product Data: Submit product data sheets for all specified products.

1. Fibrous concrete reinforcing material.

a. Application rate per cubic yard of concrete.
b. Manufacturer's printed batching and mixing instructions.
c. Letter of Certification that materials supplied meets or exceeds ASTM C1116.

C. Manufacturer's Certificate: Submit mill certifications at time of delivery.

D. Splices: Submit request for splices not indicated in the Contract Documents. Request shall indicate locations, types, and lengths of splices for approval.

E. Field Bending: Submit requests and procedure for field bending or straightening of reinforcement partially embedded in concrete not described in the Contract Documents.

F. Reinforcement Relocation: Submit requests to adjust reinforcement spacing necessitated by conflicts with other reinforcement, conduits, etc. for approval.

G. LEED Certification: Submit manufacturer's certification for reinforcement including the following:

1. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer's name, product cost, and steel processing furnace type.

2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

1.4 COORDINATION

A. Coordinate reinforcement installation with the placement of formwork and other embedded items such as inserts, conduit, pipe sleeves, drains, metal supports, anchor rods, etc.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to the jobsite in bundles sorted and labeled with durable tags indicating bar size, length, and shop drawing mark.

B. Store elevated clear of ground and protect at all times from contamination and deterioration.

C. Prevent bending, coating with earth, oil, or other material, or otherwise damaging the reinforcement.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bar Deformations: Bars used for reinforcement shall be deformed except welded wire reinforcement, which may be plain.

B. Reinforcing Steel: Reinforcing steel shall conform to the ASTM standard and grade indicated in the General Notes on the Drawings.

C. Synthetic Macro Fiber Reinforcing: Shall meet the requirements of ASTM C116, Type III, be approved by UL for use in a two-hour rated floor assembly, and be specifically manufactured for use as concrete secondary reinforcement.

1. Fiber Length: 1-1/2" to 2".

2. Aspect Ratio: Between 70 and 100.

3. Specific Gravity: Between 0.90 and 0.93.

4. Mix proprietary materials in accordance with manufacturer's instructions, product data and technical bulletins.

5. Application Rate: Per drawings.

a. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include:

1) STRUX 90/40; Grace Construction Products.
2) Fibermesh 650; Propex Concrete Systems.
3) TUF-STRAND SF; Euclid Chemical Company.

D. Welded Wire Reinforcement: Welded wire reinforcement shall conform to the ASTM standard indicated in the General Notes on the Drawings.

E. Joint Dowel Bars: Plain-steel bars. Cut bars true to length with square ends and free of burrs.

F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

2. Concrete cast against earth: Bars may be supported by precast concrete bricks or approved prefabricated wire bar supports with footpads large enough to support the weight of the bars and construction traffic without being pushed into underlying grade. Precast concrete blocks shall have a minimum compressive strength of 6,000 psi.

G. Epoxy Anchoring System: Epoxy anchoring shall consist of a reinforcing dowel and the epoxy adhesive cartridge.

1. Reinforcing shall be as specified earlier in this Section.

2. Epoxy injection gel shall consist of a two-component structural epoxy adhesive applied in a dual cartridge dispensing system, which properly mixes the components at the point of application. Refer to General Notes for acceptable epoxy anchoring systems.

2.2 FABRICATION

A. Fabrication Tolerances: Reinforcing steel shall be shop fabricated within tolerances to conform in size, shape, quantity, dimensions, etc. to the Construction Drawings and approved Shop Drawings.

B. Bar Condition: Bars shall be free from mill scale, excessive rust and other coatings, which would reduce or destroy the bond with the concrete.

C. Bars Bending: Bars shall be bent cold, and no method of fabrication shall be used which would be injurious to the material. Heating of bars for bending is not permitted.

D. Identification: After fabrication, bars shall be sorted, bundled and tagged with metal tags bearing the bar mark before delivery to the jobsite.

E. Corner Bars: Provide corner bars to make reinforcing continuous at all times, including intersections at footings, walls, beams or caps. Such bars shall be the same size and spacing as the horizontal reinforcing and each leg shall have a length of at least 30 inches.

F. Reinforcing for continuous footings shall extend into spread footings a minimum of 2'-0".

G. Dowels between footings and walls or columns shall be the same grade, size and spacing or number as the vertical reinforcing respectively, unless noted otherwise.

2.3 LEED CREDIT

A. LEED Credit MRc 4.1/4.2:

1. Provide steel products made using an Electric Arc Furnace having a minimum recycled content of 80%, including at least 40% post-consumer recycled content and 30% post-industrial recycled content.

2. Provide steel products made using a Basic Oxygen Furnace having a minimum recycled content of 25%, including at least 20% post-consumer recycled content and 5% post-industrial recycled content.

B. LEED Credit MRc 5.1/5.2:

1. Steel products shall be manufactured within 500 miles of project site. Recycled steel products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 PLACING

A. Reinforcement Relocation: When necessary to move reinforcement beyond the specified spacing to avoid interference with other reinforcement, or embedded items, submit resulting arrangement of reinforcement to Engineer for approval.

B. Reinforcement Cutting: Cutting of reinforcement which conflicts with embedded objects is not acceptable.

C. Welded Wire Reinforcement: Extend welded wire reinforcement to within 1 inch of the concrete edge. Lap edges and ends of fabric sheets a minimum of one full mesh square plus 2". Support welded wire reinforcement during placing of concrete to assure required positioning in the slab. Do not place wire reinforcement on grade or metal deck and raise into position in freshly-placed concrete.

D. Wire Tie Orientation: Set wire ties so that ends are directed away from concrete surface.

E. Slab on Grade Reinforcement Placement: Place shrinkage and temperature reinforcement 2 inches from the top surface of the slabs on grade unless noted otherwise on the Drawings.

F. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

G. Support for Reinforcement: Unless noted otherwise, supports for reinforcement shall have Class 2 protection as defined in the CRSI Manual of Standard Practice. Submit data on supports indicating class of protection at all different locations for approval.

H. Fibrous Reinforcement: Add fibrous reinforcement to concrete materials at the time concrete is batched in amounts indicated on the approved submittals for each type of concrete required.

1. Mix concrete for uniform and complete distribution of fibrous reinforcement.

I. Support for Bars in Concrete Cast on Ground: Bar supports for slabs on grade, grade beams, footings, and all other concrete cast directly onto grade shall be supported at an average spacing of 4 feet or less in each direction.

J. Securing Reinforcing Bars: All bars must be placed, spaced, secured and supported prior to casting concrete. Bars embedded in hardened or partially hardened concrete shall not be bent unless approved in writing prior to placement by the Engineer of Record.

K. Foot Traffic: Restrict foot traffic over the slab on grade reinforcing after it has been properly positioned.

L. Reinforcement at Expansion Joints: Do not continue reinforcement or other embedded metal items bonded to concrete through expansion joints. Dowels bonded on only one side of a joint and waterstops may extend through joint.

M. Pumping Concrete: When using a pump to place concrete, pump hose shall be supported directly on forms. Do not allow hose to rest on reinforcing bars if doing so could cause displacement of bars.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.

B. The work includes all items required for executing and completing the cast-in-place concrete work and related work shown on the drawings or specified herein. Work shall include installation of items furnished in other sections of these specifications.

C. Concrete paving, walks, and curbs are specified in Division 3 or 32.

D. Structural notes indicated on the drawings regarding Cast-In-Place concrete shall be considered a part of this specification.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified herein:

1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Standard Specifications for Structural Concrete
3. ACI 305.1 - Specification for Hot Weather Concreting
4. ACI 306.1 - Standard Specification for Cold-Weather Concrete
5. ACI 318 - Building Code Requirements for Reinforced Concrete.
6. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
7. ASTM C33 - Standard Specification for Concrete Aggregates.
8. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
9. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
10. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
11. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
12. ASTM C150 - Standard Specification for Portland Cement.
13. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
14. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
15. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.

16. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

17. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

18. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

19. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

20. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

21. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

22. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

23. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

24. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

25. ASTM D1751 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

26. ASTM E154 - Standard Test Method for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

27. ASTM E329 –Standard Specification for Agencies Engaged in Testing and/or Inspection of Material Used in Construction

28. Concrete Reinforcing Steel Institute (CRSI) - Manual of Standard Practice.

B. Comply with all local building code requirements which are more stringent than those listed above. All referenced codes or standards shall be the most currently adopted as of the date for Receipt of Proposal.

C. Where any provision of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

D. Maintain records verifying materials used are of the specified and accepted types and sizes and are in conformance with the requirements of the Contract Documents.

E. Use of testing services will not relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

1.3 TESTING AND INSPECTION

A. Inspection and Testing:

1. The Contractor shall employ an Inspection Agency to perform the duties and responsibilities specified below.

2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.

3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Inspection Agency:

   a. Perform all testing and inspection required per the Testing and Inspection Schedule indicated below.

   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.

   c. Submit a final signed report stating whether the work requiring Inspection was, to the best of the Inspection Agency's knowledge in conformance with the approved plans and specifications.

5. Structural Component Testing and Inspection Schedule for Section 03 30 00 is as follows:

Concrete and Concrete Placement	Continuous	Periodic	Referenced Standard
Review of proposed mix design and supporting test results		X	
Inspect bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased or where strength design is used.	X		ACI 318: 8.1.3, 21.2.8
Inspection of anchors installed in hardened concrete.		X	ACI 318: 3.8.6, 8.1.3, 21.1.8
Verifying use of required design mix		X	ACI 318: Ch. 4, 5.2-5.4
At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X		ASTM C172, ASTM C31, ACI 318: 5.6, 5.8
Inspection of concrete placement for proper application techniques	X		ACI 318: 5.9, 5.10
Inspection for maintenance of specified curing temperature and techniques.		X	ACI 318: 5.11 - 5.13
Verification of in-situ concrete strength, prior to removal of shores and forms from beams and structural slabs		X	ACI 318: 6.2

B. Sampling and testing requirements:

1. Take samples of fresh concrete at the job site for each mix design placed each day. Sampling and testing shall be done after the final addition and proper mixing of any water or admixtures that are added on site.

   a. Personnel and testing equipment shall meet the requirements of ASTM E329.

b. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or 5,000 sq. ft. of surface area, whichever is less or fraction thereof of each concrete mixture placed each day.

1) On a given project, if the total volume of concrete is such that the frequency of testing required above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

c. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.

2. For each sample of fresh concrete, perform the following duties:

a. Measure and record slump in accordance with ASTM C143.

b. Measure and record temperature in accordance with ASTM C1064.

1) Provide one test hourly when air temperature is 40°F (4.4°C) and below and when 80°F (27°C) and above, and one test for each composite sample.

c. Measure and record air content by volume in accordance with either ASTM C231 or ASTM C173.

d. Mold three cylinders (laboratory cylinders) in accordance with ASTM C31 to be laboratory-cured. Protect from moisture loss and maintain at 60°F to 80°F for 24 to 48 hours before moving. Deliver cylinders to testing laboratory for curing and testing.

e. Mold one cylinder (field cylinder) in accordance with ASTM C31 to be field-cured. Field cylinder shall be placed as near as possible to the in-place concrete from which it was taken, protected, and cured in the same manner. Deliver field-cured cylinder to testing laboratory, and measure and record compressive strength in accordance with ASTM C39. Field cylinder shall be used to determine if concrete footings, walls, or piers have reached the required compressive strength for steel erection to begin.

3. Measure and record compressive strength in accordance with ASTM C39 for laboratory cylinders. Test one laboratory cylinder at 7 days and all other cylinders at 28 days. Acceptance is based on the average of the two laboratory cured 28-day tests. Notify Architect in the event strength levels do not meet the acceptance requirements of ACI 318.

a. Any additional cylinders molded for Contractor to have a compressive strength test done before seven days shall be at the Contractor's expense.

4. Prepare and submit test reports to the Architect, Engineer, Contractor, and Supplier. Reports shall be completed and furnished within 48 hours of testing. Refer to description in Submittals.

5. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

1.4 SUBMITTALS

A. Concrete Materials: Submit information on concrete materials as listed below.

1. Cementitious materials: Submit type, class, producer name, and certification not more than 90 days old of compliance with applicable ASTM standard.

2. Aggregates: Submit type, pit or quarry location, producer name, gradations, specific gravity, water content, and certification not more than 90 days old.

3. Admixtures: Submit product data sheet. Product data shall include: dosages and performance data, brand names, producers, chloride ion concentrations, and certifications of compliance with applicable ASTM standard. Certifications shall not be more than 90 days old.

4. Water: Submit name of source.

B. Product Data: Prepare and submit product and performance data for materials and accessories, including patching compounds, joint systems, curing compounds, finish materials and other concrete related items.

C. Testing Agency Qualifications: When requested, the proposed testing agencies shall submit data on qualifications for acceptance.

D. Concrete Mix Design:

1. Concrete mix design submittals shall be submitted at least 14 days prior to placing concrete.

2. Submit concrete mixture proportions and characteristics for each concrete mix. Include standard deviation analysis or trial batch data with mix design. Submit historical field test data to demonstrate the average compressive strength for approval. Concrete mix proportions, materials, and handling methods for field test data or trial batches shall be the same as used for the work. Include the following information for each mix design:

   a. Water/cementitious materials ratio.
   b. Slump per ASTM C143
   c. Air content per ASTM C231 or ASTM C173
   d. Unit weight of concrete per ASTM C138
   e. Compressive strength at 28 days per ASTM C39

3. If trial batches are used, submit representative samples of each proposed ingredient to independent testing laboratory for use in preparation of mix design.

4. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mix water to be withheld for later addition at Project site.

5. Provide a record copy of the final mix designs and test results to the testing agency prior to commencement of the concrete work.

E. LEED Certification: Submit manufacturer's certification for each concrete product including the following:

1. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage by weight of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer's name and product cost.

2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

F. Concrete Finish Shop Drawings: Submit drawings indicating type of finish to be used at each location.

G. Slab-on-Grade Joint Layout: Submit drawings for proposed slab-on-grade control joint and construction joint layout for approval.

H. Test Reports: Submit laboratory test reports for concrete materials, mix design, compressive strength, slump, air content, and temperature. Each report shall indicate date of sampling, date of test, mix design, and location of concrete in structure.

I. Repair Methods: When stains, rust, efflorescence, and surface deposits must be removed, submit the proposed method of removal.

J. Certificates: Submit written certification regarding the design mix from the ready-mix supplier and the admixture manufacturer stating all concrete and admixtures do not contain chloride ions in excess of concentrations specified herein.

K. Placement Notification: Notify the Architect at least 24 hours in advance of concrete placement.

L. Adjustments: Submit any adjustments to mixture proportions or changes in materials, suppliers, or sources along with supporting documentation during the course of the work.

M. Cold Weather Procedure Submittal: Refer to Cold Weather Concreting article in Part 3 for more information.

1.5 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. Cementitious materials: Store cementitious materials in dry weather tight buildings, bins, or silos that exclude contaminants.

B. Aggregates: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other materials or other sizes of aggregates. Store aggregates so as to drain freely.

C. Admixtures: Protect stored admixtures against contamination, evaporation, or damage. Protect liquid admixtures from freezing and temperature changes, which would adversely affect their performance. Handle chemical admixtures in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: Portland cement shall conform to ASTM C150, Type I Normal, and be a standard brand of Portland cement. Use one brand of cement throughout project, unless approved in writing by the Engineer. Cement, which conforms to ASTM C150 Type II, may be used if it also meets the requirements of ASTM C150 Type I. Cement used in concrete shall be of the same brand and type as the cement used in the concrete represented by the submitted field test data or used in the trial mixtures. Maintain consistent cement color throughout project unless directed otherwise by architectural requirements.

1. Total replacement of Portland cement by supplementary cementitious materials in design mixture shall not exceed 50% (by weight).

B. Supplementary Cementitious Materials

1. Fly Ash: Fly ash shall conform to ASTM C618, Class C or Class F. Replacement of Portland cement by fly ash shall not exceed the following (percentages are by weight):

   a. Concrete Flatwork: 20 percent.
   b. Mass Concrete (more than two feet thick): 50 percent.
   c. All other concrete: 25 percent.
   d. Concrete to be placed in cold weather as defined herein: No fly ash allowed unless the cold weather procedure submitted has compensated for the increased setting time and decreased rate of strength gain due to cold weather and fly ash.

2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

   a. Ground Granulated Blast-Furnace Slab Limit: 50% by weight of total cementitious materials.

b. In mass concrete more than 2 feet thick, the usage rate may be 80% by weight of total cementitious materials.

3. Combined Fly Ash and Ground Granulated Blast-Furnace Slag:

a. Supplementary Cementitious Materials Limit: 50% with fly ash not exceeding 25% by weight of total cementitious materials.

b. In mass concrete more than 2 feet thick: 80% with fly ash not exceeding 50% by weight of total cementitious materials.

C. Blended Hydraulic Cements

1. Portland Blast-Furnace Slag Cement: ASTM C 595, Type IS.

a. Blast-Furnace Slag Content: 25% to 50% by weight of total cementitious materials.

2. Portland-Pozzolan Cement: ASTM C 595, Type IP.

a. Pozzolan Content: 15% to 40% by weight of Pozzolan total cementitious materials.

3. Pozzolan-Modified Portland Cement: ASTM C 595, Type I (PM).

a. Pozzolan Content: 0% to 15% by weight of total cementitious materials.

4. Slag-Modified Portland Cement: ASTM C 595, Type I (SM.

a. Blast-Furnace Slag Content: 0% to 25% by weight of total cementitious materials.

D. Coarse Aggregate for Normal Weight Concrete: Comply with ASTM C33. Provide coarse aggregate from a single source for exposed concrete. Gradations shall be similar to that described in the following table:

COARSE AGGREGATE GRADATIONS							
SIEVE SIZE - PERCENT PASSING							
Grade No.	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 16
4	90-100 Note 1	20-55	0-15	---	0-5		---
57	100	95-100	---	25-60	0-10	0-10	---
67		100	90-100	---	20-55	0-10	---
89	---	---	---	100	90-100	20-55	0-10

1. Shall be 100 percent passing the 2" sieve.

2. A maximum of 30% of coarse aggregate may be recycled aggregate for footing concrete.

E. Fine Aggregate for Normal Weight Concrete: Comply with ASTM C33. Provide fine aggregate from a single source for exposed concrete. Fine aggregate shall consist of washed sand. Gradations shall be similar to that described in the following table:

FINE AGGREGATE GRADATIONS							
SIEVE SIZE - PERCENT PASSING							
Grade No.	3/8	No. 4	No. 8	No. 16	No. 50	No. 80	No. 100
FA	100	95-100	80-100	50-85	5-30	---	0-10

1. A maximum of 10% of fine aggregate may be recycled aggregate for footing concrete.

F. Do not use aggregates containing deleterious substances that could cause spalling on any exterior exposed surface. These include, but are not limited to the following:

1. Organic impurities.
2. Ferrous metals.
3. Soluble salts.
4. Coal, lignite, or other lightweight materials.
5. Soft particles.
6. Clay lumps and friable particles.
7. Cherts of less than 2.40 specific gravity.

G. Water: Mixing water for concrete shall meet the requirements of ASTM C94. Water shall be clean and free from injurious amounts of acids, alkalies, organic materials, chloride ions and oils deleterious to concrete or reinforcing steel.

H. Testing agency shall be given access to plants and stockpiles to obtain samples for testing for compliance with the Contract Documents.

2.2 ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures. Calcium chloride thiocyanates or admixtures containing more than 0.05 percent chloride ions by weight are not permitted.

B. Water Reducing Admixture: Material shall comply with ASTM C494, Type A. Acceptable manufacturers and products include:

1. Euclid Chemical Company - Eucon WR Series.
2. Sika Chemical Corp. - Plastocrete 161.
3. GRT – Polychem 400 NC.
4. Grace Construction Products - WRDA 82.

C. High Range Water Reducing Admixture (superplasticizer): Material shall comply with ASTM C494, Type F or Type G. Acceptable manufacturers and products include:

1. Euclid Chemical Company - Eucon 37 or Plastol Series.
2. Sika – ViscoCrete 2100.
3. GRT – Melchem.
4. Grace Construction Products - Mira 110.

D. High Range Water Reducing, Slump Retaining Admixture: Material shall comply with ASTM C494, Type F or Type G. Acceptable manufacturers and products include:

1. Euclid Chemical Company - Eucon 537, Eucon 1037, or Plastol Series.
2. Sika – Sikament 686.
3. GRT – Melchem – M.
4. Grace Construction Products – ADVA FLEX.

E. Non-Chloride Accelerator: Material shall comply with ASTM C494, Type C or Type E, and not contain a higher chloride ion concentration than municipal drinking water. Acceptable manufacturers and products include:

1. Euclid Chemical Company - Accelguard Series.
2. Sika Chemical Corp. - Sika Rapid-1.
3. GRT – Polychem HE.
4. Grace Construction Products – Lubricon NCA.

F. Air Entraining Admixture: Air entraining admixture shall comply with ASTM C260, and be certified by the manufacturer to be compatible with other admixtures to be used. Acceptable manufacturers and products include:

1. Euclid Chemical Company - Air-Mix or AEA Series.
2. Sika Chemical Corporation - Sika-Aer.
3. GRT – Polychem VR.
4. Grace Construction Products - Darex II or Daravair 1000.

G. Admixtures used in concrete shall be the same brand, type, and dosage used in concrete represented by field test data or used in trial mixes.

2.3 CURING PRODUCTS

A. Moisture Retaining Cover

1. Plastic Film: Use 6 mil polyethylene film sheet materials that meet the requirements of ASTM C171.

2. White burlap-polyethylene sheet meeting ASTM C171.

3. Reinforced Curing Paper complying with ASTM C171.

4. Moisture Retaining Fabric: A naturally colored, non-woven, polypropylene fabric with a 4-mil, non-perforated reflective (white) polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention. Acceptable manufacturers and products include:

   a. PNA Construction Technologies, Inc.: Hydracure M15.
   b. Reef Industries Incorporated: Transguard 4000.

B. Dissipating Resin Curing Compound: Clear, waterborne, membrane-forming curing compound complying with ASTM C309, Type 1, Class B shall be composed of hydrocarbon resins and dissipating agents that begin to break down upon exposure to ultraviolet light and traffic approximately 4 to 6 weeks after application, providing a film that is removable with standard degreasing agents, and mechanized scrubbing actions so as to not impair the later addition of applied finishes.

1. Curing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.

C. Non-dissipating Curing Compound: Clear, membrane-forming curing compound complying with ASTM C309, Type 1, Class B.

1. Curing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.

D. Curing and Sealing Compound: Clear, membrane-forming curing and sealing compound complying with ASTM C309, Type 1, and ASTM C1315, Type 1, Class A. Compound shall dry to a clear finish, resist yellowing due to ultraviolet degradation and provide a long lasting finish that has high resistance to chemicals, oil, grease, deicing salts, and abrasion.

1. Curing and sealing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.

2.4 MISCELLANEOUS MATERIALS

A. Patching Mortar: Non-shrink, non-slump, non-metallic, quick setting. Acceptable manufacturers and products:

1. Euclid Chemical Company - Eucospeed.
2. BASF - Thorite.
3. Adhesive Technologies. - Hard Rok Vertipatch.
4. W.R. Meadows - Speed Crete (Red Line).
5. Dayton Superior – Re-Crete 20 minute.
6. SpecChem - Precast Patch.

B. Expansion Joint Material: Preformed, resilient, non-extruding asphalt impregnated resilient fiber conforming to ASTM D1751. Thickness of expansion joint material shall be 1/2" unless noted otherwise on the drawings.

C. Magnesium phosphate patching cement specially designed for cold weather grouting and anchoring. Acceptable Manufacturer:

1. BASF - MasterEmaco T545.
2. Euclid Chemical Company - Eucospeed MP.

D. Vapor Retarder: ASTM E 1745, Class A, not less than 10 mils (0.25 mm) thick. Acceptable manufacturers and products:

1. Stego Industries, LLC - Stego Wrap.
2. W.R. Meadows, Inc. - Perminator.
3. Raven Industries - Vapor Block
4. Insulation Solutions - Viper VaporCheck II.

E. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces. Acceptable manufacturers and products:

1. Conspec Marketing & Manufacturing Co., Inc. - Intraseal
2. Curecrete Chemical Co., Inc. - Ashford Formula
3. Dayton Superior Corporation - Day-Chem Sure Hard (J-17)
4. Euclid Chemical Company - Eucosil
5. L&M Construction Chemicals, Inc. - Seal Hard
6. Vexcon Chemicals, Inc - Vexcon Starseal PS
7. SpecChem - SpecHard

F. Control Joint Filler: Flexible, single-component polyurethane sealant with backer rod compliant with ASTM C 920, Type S, Grade P, Class 25. Apply sealant per manufacturers written recommendations. Acceptable manufacturers and products:

1. Dayton Superior – Perma 230 SL.
2. Euclid Chemical Company – Eucolastic I.
3. Sonneborn – Sonolastic SL 1.

2.5 STRENGTH AND PROPERTIES

A. Concrete Mix Designs: Refer to Drawings for specified compressive strength. Proportion concrete mixes according to the properties in the following tables. The concrete supplier may produce a mix at a lower water-cement ratio to allow for adjustment of slump at the site by adding water. The addition of site water shall be in accordance with ASTM C94, and the total water-cement ratio shall not exceed the value specified below.

Class	Coarse Aggregate Gradation	Fine Aggregate Gradation	Range of Slump	Max. w/c	Air Content	Other Requirements
A	57 or 67	FA	1" to 4"	0.40	5% to 8%	
B	57 or 67	FA	1" to 4"	0.45	5% to 8%	
C	57 or 67	FA	1" to 4"	0.50	—	
D	57 or 67	FA	4" to 6"	0.50	—	Use water reducing admixture to achieve slump specified
E	4 or 57	FA	1" to 4"	0.50	—	
F	4 or 57	FA	5" to 8"	0.50	—	Use retarder
H	89	FA	5" to 8"	0.50	—	
J	Lightweight	FA	5” max	0.5	4% to 7%	Maximum 107-116 pcf dry density

Note: w/c = water-cementitious materials ratio.

B. Schedule of Concrete Classes: Provide concrete of the specified class according to the following schedule.

1. Footings: Class E
2. Exterior foundation walls and piers: Class B
3. Interior slabs on grade: Class D
4. Floor topping: Class H
5. Unless noted otherwise: Class B

C. Slump of Superplasticized Concrete: Concrete containing high-range water reducing admixtures (superplasticizer) shall have 8" maximum slump, unless otherwise approved by Structural Engineer. Concrete shall arrive at job site with 2" to 3" slump, be verified, then high range water reducing admixture added to increase slump to approved level.

D. Accelerators: Add non-chloride accelerator to all concrete slabs placed at air temperatures below 50°F.

E. Water Reducer: Add water reducing admixture or high range water reducing admixtures (superplasticizers) as follows:

1. All pumped concrete.
2. Fiber reinforced concrete.
3. As required for placement or workability.
4. As required by high temperatures, low humidity, or other adverse placement conditions.
5. Concrete with water-cementitious materials ratio below 0.50.

F. No other admixtures shall be used unless approved by Structural Engineer of record.

G. Chlorides: Admixtures or other ingredients including aggregates containing calcium chloride or more than 0.05% chloride ions by weight shall not be used.

H. Workability: Concrete shall have a workability such that it will fill the forms without voids, honeycombs, or rock pockets with proper vibration without permitting materials to separate or excess water to collect on the surface.

I. Concrete Temperatures: Minimum concrete temperature of fresh concrete varies in relation to average air temperature over a 24-hour period as follows:

1.	Air temperature below 0°F	Concrete temperature 70°F min.
2.	Air temperature 0°F to 30°F	Concrete temperature 65°F min.
3.	Air temperature 30°F to 50°F	Concrete temperature 50°F min.
4.	Air temperature above 50°F	No minimum temperature

The maximum temperature of concrete at the time of delivery shall be 90°F. When concrete temperature exceeds 90°F, concrete supplier shall attempt to reduce temperature by shading aggregates and cement and cooling mix water. When these methods fail to reduce concrete temperature below 90°F, supplier shall use ice in the water to reduce the concrete temperature.

2.6 LEED CREDITS

A. LEED Credit MRc 4.1/4.2 –Concrete flatwork shall contain at least 15% recycled cement (slag cement and fly ash). Concrete footings and drilled piers shall contain at least 50% recycled content. All other concrete shall contain at least 25% recycled cement.

B. LEED Credit MRc 5.1/5.2 – Concrete shall be manufactured within 500 miles of the project site. Aggregate, sand and water shall be procured form within 500 miles of the project site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not place concrete until data on materials and mix designs have been approved, Architect has been notified, and all other affected trades have coordinated their work.

B. Remove snow, ice, frost, water, mud, and other foreign material from surfaces, reinforcing bars and embedded items against which concrete will be placed.

C. Do not allow form release agent to contact reinforcing bars.

3.2 SLABS

A. Slab on Grade:

1. All interior slabs on grades shall have a polyethylene vapor retarder conforming to ASTM E1745. Lap all joints minimum 6” and seal edges with adhesive tape. Fit vapor retarder around utilities and seal with adhesive tape as required. Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

2. Refer to Drawings and Section 31 23 00 for required sub-grade preparation beneath slabs on grade.

3. Where vapor retarder is not used below slab on grade, wet sub-grade below slab prior to placing concrete. Subgrade shall be moist with no free water and no muddy or soft spots.

4. Saw cut control joints: Cut with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Control joints shall be located along column lines, with intermediate joints spaced at a maximum distance of 36 times the slab thickness, unless noted otherwise. Control Joints shall be continuous, not staggered or offset. Slab panels shall have a maximum length to width ratio of 1.5 to 1. Provide additional control joints at all reentrant or isolated corners formed in the slab on grade. Refer to Drawings for typical control joint detail.

5. Provide isolation joints around each column and along foundation walls. Form isolation joints with 1/2" expansion joint material. Extend isolation joint material full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

6. Depress slabs as required for mats architectural finishes. Obtain layout and locations from Architect.

7. Verify completion of all under slab work with mechanical and electrical trades before placing slabs.

8. Slope slabs as indicated on Drawings and to provide positive drainage. Slope slab keeping bottom level and varying top. Maintain minimum thickness of concrete as indicated on Drawings. Refer to floor finishes for tolerances.

B. All slabs not on grade (all supported slabs), including slabs-on-steel decking and cast-in-place concrete slabs:

1. Supported slabs have deflections that may cause areas of concrete to have thicknesses greater than indicated on the Drawings. Contractor is expected to provide that volume as needed to finish the floor at the specified elevation. If specified floor finish tolerances are not achieved during the concrete floor construction, the Contractor shall install, at no cost to the project, a self-leveling cementitious underlayment (Master Builders Mastertop 110 Underlayment or approved equal) to correct the floor flatness and levelness.

C. Embedded Items:

1. The outside diameter of embedded conduit or pipe shall not exceed one-third of the slab thickness in structural slabs, including at crossovers, and shall be placed between the top and bottom reinforcing with a minimum 3” clear cover. Conduit or pipe running parallel to each other shall be spaced at least 8” apart and no more than 2 runs stacked vertically in the slab. Conduit or pipe shall not be embedded in any supported slab less than 6” thick. No embedded conduit or pipe is allowed in any concrete slab-on-steel deck.

3.3 CONSTRUCTION JOINTS

A. Construction Sequence Submittal: Contractor shall submit a construction sequence indicating construction joints and the pour sequence.

B. Vertical: Locate vertical construction joints in walls not farther than a maximum of 100 feet on center. Coordinate joint locations with architectural design.

C. Horizontal: Locate horizontal joints in walls, piers and columns at underside of slabs and at the top of slabs and footings unless otherwise indicated. At least 24 hours shall elapse between placing concrete in a wall or column and placing concrete in an area supported by the walls or columns, unless approved in writing by Structural Engineer.

D. Reinforcing: Stop all welded wire reinforcement and/or reinforcing at construction joint in slabs on grade and provide dowel bars as detailed. Provide reinforcement at other construction joints as detailed. Roughen and thoroughly clean the surface of the concrete, remove all laitance, and wet the surface before placing new concrete against the joint. Slush vertical joints with a neat cement grout before placing new concrete.

3.4 CONCRETE PLACEMENT

A. Place concrete as continuously as possible until placement is complete. Do not place against concrete that has attained initial set, except at authorized joints. If, for any reason, concrete pour is delayed for more than 45 minutes, bulkhead off pour at last acceptable construction joint. Immediately remove excess concrete and clean forms.

B. Do not begin to place concrete during periods of rain, sleet or snow unless adequate protection is provided.

C. No concrete shall be cast onto or against sub-grades containing free water, frost, ice or snow.

D. Notify the architect in advance if concrete is to be pumped.

E. Do not place concrete until all reinforcement is in place, forms have been thoroughly cleaned and approval has been given.

F. Do not accept concrete delivered to the job site more than 90 minutes after initial mixing.

G. Concrete from its point of release to mixers, hoppers, or conveyances, shall not be permitted to drop more than 5 feet (10 feet for concrete containing high range water reducers). Deposit concrete directly into conveyances and directly from conveyances to final points of deposit. Sufficient transportation equipment in good working order shall be on hand before work begins. All conveying equipment must be clean and kept clean during concreting operations. Take every possible precaution to prevent segregation or loss of ingredients.

H. Deposit concrete in wall forms in layers not greater than 12 inches in depth, each layer being compacted by internal vibration before succeeding layer is placed.

I. Place concrete as near as possible to its final position to prevent segregation. Do not use vibrators to transport concrete within forms. Consolidate concrete in walls, columns, beams and slabs or joist construction thicker than 8" with internal vibrators (8,000 to 12,000 V.P.M.). Slabs less than 8" thick may be consolidated with internal vibrators (9,000 to 13,500 V.P.M.) or vibrating screeds supported on forms, boards or rails, approved by Structural Engineer, supplement vibration by forking or spading by hand along surfaces adjacent to forms and construction joints.

J. Re-tempering of concrete will not be permitted. Concrete that has obtained its initial set shall be discarded.

K. Exercise care in placing concrete over waterproof membranes, rigid insulation and/or protection boards to avoid damaging those materials. Report damage immediately, and do not proceed until damage is repaired.

L. Remove loose debris from surfaces, thoroughly wet and slush with a neat cement grout immediately before placing new concrete, or apply bonding compound to surface and let dry before placing new concrete.

M. Protect existing concrete work to be exposed to view and other finished materials from damage and staining resulting from concreting operations. Handle concrete carefully to avoid dripping and spillage. Remove spilled concrete from existing surfaces immediately. Covering sills, ledges, and other surfaces with protective coverings may be necessary to protect the work.

N. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

O. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.5 CONCRETE FINISHES AND TOLERANCES

A. Exposed Smooth Formed Surfaces: Remove forms and perform necessary repairs and patch to produce surface finish-3.0 as specified in ACI 301. Apply the following to smooth-formed finished concrete exposed to view in the finished work. Confirm finishes with architect prior to concrete placement by submitting shop drawings indicating locations of all types of finishes.

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.6 CONCRETE SLAB FINISHES AND TOLERANCES

A. Trowel Finish:

1. Screed concrete to an even plane, float, then power trowel the surface.

2. Hand trowel the surface smooth and free of trowel marks. Continue hand troweling until a ringing sound is produced as the floor is troweled.

3. Provide trowel finish as indicated on the Drawings and at the following locations:

   a. Concrete floors exposed in finished work unless otherwise indicated.
   b. Slabs to receive curing compounds and sealers.
   c. Slabs to receive resilient flooring or carpet.

B. Fine Broom Finish:

1. Screed concrete to an even plane, float, then power trowel the surface. Provide fine hair broom finish perpendicular to slope, free of loose particles, ridges, projections, voids and concrete droppings.

2. Provide fine broom finish as indicated on the Drawings and at the following locations:

   a. Stoop slabs.
   b. Raised curbs and walkway areas.
   c. Slabs to receive thin set ceramic tile.

C. Broom Finish:

1. Screed concrete to an even plane and then float. Immediately after concrete has received a floated finish, give the concrete surface a coarse transverse scored texture by drawing a coarse broom across the surface.

2. Provide as indicated on the Drawings and at the following locations:

   a. ADA ramp slabs.
   b. Exterior walkway slabs.

D. Float Finish:

1. Screed concrete to an even plane then float.

2. Provide as indicated on the Drawings and at the following locations:

   a. Slabs to directly receive concrete topping.
   b. Roof slabs to receive loose laid roof insulation.

E. Floor Finish Tolerances: Floor finish tolerances shall be measured by placing a freestanding (unleveled) 10 foot straightedge anywhere on the slab and allowing it to rest upon two high spots within 72 hours after placement of slab and removal of shoring (if present). The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed:

1. Slab on Grade: 1/4”

F. Slab Drainage: Finish all concrete slabs to proper elevations to insure that all surface moisture will drain freely to floor drains, and that no puddle areas exist. Contractor shall bear the cost of corrections to provide positive drainage.

G. Special Tolerances for Concrete Slabs: No abrupt change in vertical elevation of 1/4" or more is acceptable at the interface between slabs and within areas where pedestrian traffic is expected:

3.7 CONCRETE CURING

A. Freshly placed concrete shall be protected from premature drying and excessively hot temperatures.

B. Concrete other than high-early strength shall be maintained above 50°F and in a moist condition for at least the first 7 days after placement, except when special curing is used. Special curing procedures shall not be used without written permission from the Structural Engineer of Record.

C. Formed surfaces shall be cured by leaving the formwork in place during the curing period.

D. Protect concrete from excessive changes in temperature during the curing period and at the termination of the curing process. Changes in the temperature of the concrete shall be as uniform as possible and shall not exceed 5°F in any one hour or 50°F in any 24 hour period.

E. Protect concrete from injury from the elements until full strength is developed. Protect from mechanical injury.

F. During cold weather construction, all footings shall be protected from frost penetration until the building is enclosed and temporary heat is provided.

3.8 SLAB CURING

A. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface. Use one of the methods described below.

B. Moisture-Retaining-Cover Curing for Concrete Floors not Exposed in Final Condition: Cover concrete surface with waterproof sheet material as soon as finishing operations are complete and the concrete is sufficiently hard to be undamaged by covering. The cover shall be placed flat on the concrete surface, avoiding wrinkles. Sprinkle concrete with water as necessary during application of covering. Place in widest practicable width, with sides and ends lapped at least 12 inches, and seal with waterproof tape or adhesive. Verify that the concrete is continuously wet under the sheets; otherwise, add water through soaker hoses under the sheets. Weight down covering to prevent displacement. Immediately repair any holes or tears during the curing period using polyethylene sheet and waterproof tape. Curing process shall be maintained for a minimum of 7 days.

C. Moisture-Retaining-Fabric Curing for Concrete Floors to Remain Exposed: Cover concrete surface with moisture retaining fabric as soon as finishing operations are complete and the concrete is sufficiently hard to be undamaged by covering. The cover shall be installed in accordance with manufacturer's written recommendations, in largest practical widths. Wet the slab to rejection, then thoroughly wet fabric side of cover and install with poly side up. Lap over adjacent covers a minimum of 18". Wet all laps and outside edges to prevent displacement and to ensure intimate contact with concrete and adjacent covers. Rewet as necessary and protect covers from damage during curing process.

1. After minimum 7-day cure, remove moisture retaining fabric in sections.

2. A maximum of 3,500 square feet of concrete curing cover may be removed at any one time. At no time shall the exposed area be permitted to dry prior to completion of the floor scrubbing process.

3. Using a high powered floor scrubber capable of a minimum 80 pounds head pressure, and a mild citrus-based detergent that does not damage or mar the surface in any way, scrub the floor to remove any minerals or soluble salts that may have accumulated at the floor surface. Rinse area thoroughly with clean fresh water. Remove water and allow floor to dry. If whitening occurs during drying, repeat scrubbing process before floor dries until no whitening occurs during drying.

4. All areas of the floor shall remain wet during floor scrubbing process. Expose only the amount of floor surface that can be cleaned before any drying occurs without exceeding the maximum allowable exposed area.

D. Curing Compound: Apply uniformly in continuous operation by low pressure spray equipment or roller as soon as finishing operations are complete, free water on the surface has disappeared and no water sheen can be seen. Follow the manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Verify compatibility of the curing compound with paint, finishes, or toppings that require positive bond to the concrete. If curing compound is not compatible with paint finishes or toppings, utilize a dissipating curing compound and remove in accordance with the manufacturer's recommendations.

3.9 PENETRATING LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

B. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs in accordance with manufacturer's written instructions.

C. Do not apply to concrete that is less than seven days old.

D. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.10 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Do not fill joints until construction traffic has permanently ceased.

C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

D. Install semi-rigid joint filler in saw-cut joints and in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11 APPLICATION OF FLOOR SEALER - FINISH COAT

A. Give concrete floors as indicated in Room Finish Schedule and where exposed in finished Work, second coat of curing and sealing compound immediately prior to Substantial Completion.

B. Clean floors and apply sealer strictly according to manufacturer's instructions. Dilution and coverage shall be as recommended by the manufacturer. Apply sealer evenly.

3.12 COLD WEATHER CONCRETING

A. Definition: Cold weather shall be defined as a period when for more than three successive days the average daily outdoor temperature drops below 40°F. The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50°F occur during more than half of any 24 hour duration, the period shall not be regarded as cold weather.

B. All cast-in-place concrete work occurring during cold weather shall conform to all requirements of ACI 306.1, "Standard Specification for Cold Weather Concreting", published by the American Concrete Institute, Detroit, Michigan, except as modified by the contract documents or this specification.

C. Planning: The General Contractor, concrete contractor, concrete supplier and the architect shall have a pre-construction conference to outline the cold weather concreting operations concerning the placing, finishing, curing and protection of the concrete during cold weather. Pre-construction conference shall occur before cold weather is expected to occur.

D. Detailed procedure submittal: Concrete contractor shall prepare and submit for review detailed procedures for the production, transportation placement, protection, curing and temperature monitoring of concrete during cold weather. Include procedures to be implemented upon abrupt changes in weather conditions. Do not begin cold weather concreting until these procedures have been reviewed and approved.

E. Mixing: Concrete flatwork poured in cold weather shall be proportioned to obtain a lower slump to minimize the amount of bleed water during finishing. All bleed water should be skimmed off flatwork prior to troweling. Concrete that will be exposed to cycles of freezing and thawing while saturated should be properly air entrained as outlined in this specification.

F. Protection of Concrete: Cure and protect concrete against damage from freezing for a minimum period of 72 hours, unless approved by the structural engineer. The protection period may be reduced according to ACI 306.1 requirements. Concrete contractor shall submit a letter of request to reduce the protection period, by outlining the method used to achieve the reduction per ACI 306.1.

1. When practical for the construction schedule, formwork shall be insulated and remain in place for at least the required protection period.

G. Concrete Temperatures: The minimum temperature of concrete immediately after placement shall be as specified in the following table.

Section Size	Minimum temperature of concrete as placed and maintained during the protection period	Maximum gradual decrease in surface temperature during any 24 hours after the end of the protection.	Mixing Temperatures		
			Above 30°F	0 to 30°F	Below 0°F
< 12 in	55°F	50°F	60°F	65°F	70°F
12-36 in	50°F	40°F	55°F	60°F	65°F
36-72 in	50°F	30°F	50°F	55°F	60°F
> 72 in	50°F	20°F	45°F	50°F	55°F

H. Mixing Temperatures: As the ambient air temperature decreases the concrete mixing temperature shall be increased to compensate for the heat lost in the period between mixing and placement. The concrete supplier shall use one or both of the following methods for increasing the concrete temperature.

1. Heating the mixing water to a temperature necessary to offset the temperature losses during transport. Supplier shall not heat water to temperatures in excess of 140°F, without taking special precautions as outlined in ACI 306.

2. Heating the aggregate with a circulated steam piping system.

I. Temperature measurements: The Contractor shall be responsible for monitoring and recording the concrete temperatures during placement and throughout the protection period.

1. Inspection personnel shall keep a record of the date, time, outside air temperature, temperature of concrete as placed, and weather conditions.

2. Temperature of the concrete and the outside air shall be recorded at regular intervals but not less than twice in a 24 hour period. The record shall include temperatures at several points within the enclosure and on the concrete surface of sufficient frequency to determine a range of temperatures.

3. Inspection agency shall submit the temperature logs to the Architect for permanent job records.

3.13 HOT WEATHER PROTECTION

A. Definition: Hot weather shall be defined as any combination of high ambient temperature, low relative humidity, high winds and intense solar radiation that leads to higher than usual evaporation. The table below defines low relative humidity based on air temperature. For a given air temperature, if the relative humidity is equal to or less than the specified minimum, provisions for hot weather concreting shall be as follows:

Air Temperature	Minimum Relative Humidity
105°F	90%
100°F	80%
95°F	70%
90°F	60%
85°F	50%
80°F	40%
75°F	30%

B. Scheduling: When hot weather is expected, adjust concrete placement schedules to avoid placing or finishing during the period from noon until 3:00 pm. When possible, slab pours should be delayed until the building is enclosed to protect the concrete from wind and direct sunlight, Construction schedule shall account for 7 day moist curing period.

C. Mixing: Concrete supplier shall adjust mix designs and admixtures to minimize slump loss. Concrete shall be mixed at a water-cement, which is lower than the specified maximum to allow for the adjustment of slump by addition of water in the field. Water reduction shall be accomplished without reducing initial slump by increasing dosage of water reducing admixture.

D. Preparation: Do not order concrete earlier than is required to avoid delays. Cool forms, subgrades and reinforcing bars with water spray from fog nozzle prior to concrete placement.

E. Delivery: Site traffic shall be coordinated and delivery times scheduled to minimize waiting times for concrete trucks.

F. Placement: Preparations shall be made to place and consolidate the concrete at the fastest possible rate. Maintain a continuous flow of concrete to the job site to avoid development of cold joints, during placement of slabs, apply fog spray to prevent moisture loss without causing surplus water to stand on concrete surface.

G. Finishing: Finish concrete as fast as practical. Continue fogging concrete during finishing. Where fogging is not possible, apply sprayable moisture-retaining film between finishing passes.

H. Curing: Formed concrete shall be covered with a waterproof material to retain moisture. Flat work shall be moisture cured as described in this specification. Moist curing shall continue for at least 7 days.

3.14 FIELD QUALITY ASSURANCE

A. Independent Testing Agency and Inspector shall each perform their prescribed inspection, sampling, and testing services as described in Part 1 of this specification section.

B. In cases where samples have not been taken or tests conducted as specified or strength of laboratory test cylinders for a particular portion of the structure fails to meet requirements of ACI 301, for evaluation of concrete strength, Structural Engineer shall have the right to order compressive or flexural test specimens or both be taken from the hardened concrete according to ASTM C42, load tests according to ACI 318, or such other tests as may be necessary to clearly establish the strength of the in situ concrete, and such tests shall be paid for by the Contractor.

3.15 REPAIR OF DEFECTIVE AREAS

A. All repair of defective areas shall be made, with prior approval of Architect, as to method and procedure, in accordance with Section 5 of ACI 301, except specified bonding compound must be used.

B. Patch form tie holes at the following locations:

1. Unfinished exposed concrete (not scheduled for painting, plus at board formed concrete finish).

2. All other areas: Prime voids with bonding compound and fill with patching mortar. Strike flush without overlap, float to uniform texture to match adjacent surfaces.

3. Exposed areas scheduled for spray texture:

   a. Remove projections and protrusions: 1/16" or larger.
   b. Remove continuous ridges 1/32" or larger.
   c. Fill voids and pin holes.

4. Exposed areas scheduled for paint or epoxy:

   a. Remove projections, ridges, and other protrusions 1/32" or larger.
   b. Fill voids and pin holes 1/16" or larger.

5. Exposed areas not scheduled for paint or other finishes:

   a. Remove projections, ridges and other protrusions not conforming to requirements specified under Section 03 10 00.
   b. Fill voids and pin holes not conforming to requirements specified under Section 03 10 00.

C. All structural repairs shall be made, with prior approval of the Architect/Engineer, as to method and procedure, using the specified epoxy adhesive and/or epoxy mortar.

D. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

3.16 CLEANING

A. Clean exposed concrete to remove laitance, efflorescence and stains.

END OF SECTION

SECTION 03 33 00

CAST-IN-PLACE BOARD FORM CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mock-up(s)

B. Concrete formwork

C. Concrete for cast-in-place architectural board form concrete site walls

D. Concrete curing and protection

1.2 RELATED REQUIREMENTS

A. Section 01 43 39 - Mockups

B. Section 03 20 00 - Concrete Reinforcement

1.3 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; 2016.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

E. ACI 305R - Guide to Hot Weather Concreting; 2010.

F. ACI 306R - Cold Weather Concreting; 2010.

G. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).

H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).

I. ACI 347R - Guide to Formwork for Concrete; 2014.

J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.

K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2016b.

L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.

M. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.

N. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.

O. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

P. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.

Q. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

R. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

S. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2016.

U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

V. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

W. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2015.

1.4 SUBMITTALS

A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

B. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
   2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

C. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

D. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used; use LEED New Product Content Form.

E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

1.6 MOCK-UP

A. Pre-construction mock-up(s) shall be required to test specific concrete mix, slump, placement rates, form pressures, vibration methods, form stripping, and overall aesthetic.

B. The mock-up(s) must duplicate the materials, methods, workmanship, placement rates, and form pressures that will actually be used on the job.

C. Mock-up Requirments
   1. Size: Full exposed height x 6' minimum length
   2. Include all finish details including, but not limited to:
      a. Vertical board-form aesthetic
      b. Toe Kick
      c. Drainage channel
      d. Form tie pattern (if applicable)
      e. Chamfer
      f. Top of wall slope and finish
   3. Quantity: Minimum of 1, maximum of 3

D. Accepted mock-up is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.

E. Mock-up may not remain as part of the Work.

1.7 WARRANTY

A. See Section 01 78 36 - Warranties, for additional warranty requirements

PART 2 PRODUCTS

2.1 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Framing and Support Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

C. Form Facing Materials: The below options should each be represented in the contractor's initial mock-up for review and selection by Owner and Architect. Additional mock-ups; if necessary, will proceed with the preferred option.
   1. Form Facing for Exposed Board-Form Architectural Concrete
      a. Option I: Douglas Fir Species
         1) Boards shall have minimal naturally occuring blemishes such as knots and zero knot holes

2) Boards clear of damage such as dents, splinters, splits and checks
3) Varying board widths ranging between 2 1/2" - 5 1/2", arranged randomly
4) Boards placed in a vertical orientation

b. Option II: Spruce, Pine, or Fir Species
1) Meeting all requirements of Option I in addition to the below
2) Board surface lightly sandblasted to enhance natural grain pattern of wood

c. Option III: Formliner
1) Manufacturer: Fitzgerald Formliners, 1500 E. Chestnut Ave., Santa Ana, CA 92701; www.formliners.com; 800-547-7760
2) Pattern #16020, Rough Sawn Plank
3) Vertical board pattern orientation

2. Boards at outside corners shall be mitered rather than overlapped

D. Special attention shall be taken in the construction of Formwork to assure all formwork is plumb and straight

E. Screws rather than nails shall be used in the construction of formwork to prevent movement and to aid in form striping after curing

F. Form Coating: Release agent that will not adversely affect concrete.

G. Form Ties: If necessary, Fiberglass at exposed wall surfaces

2.2 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
1. Acquire cement for all board-form architectural concrete from the same source.

B. Fine and Coarse Aggregates: ASTM C 33.
1. Acquire aggregates for all board-form architectural concrete from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Calcined Pozzolan: ASTM C618, Class N.

E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

F. Water: Clean and not detrimental to concrete.

2.4 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. Plasticizers for Flowing Concrete: ASTM C1017

D. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

E. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

2.5 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch.
2. Total Air Content: 6 percent plus or minus 1.5 percent, determined in accordance with ASTM C173/C173M.

3. Maximum Slump: 6 inches.

2.6 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Notify Architect not less than 24 hours prior to commencement of placement operations.

C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

D. Ensure reinforcement and embedded parts will not be disturbed during concrete placement.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.4 CONCRETE FINISHING

A. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

B. Exposed Board-From Finish: Prior to any surface repair, review with Architect to determine which raised fins, bug holes, and/or areas of honeycombing should be repaired - if any - and to discuss methods and expected results from repairs.

C. Top of Wall Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

3.5 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than 7 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

3.6 FIELD QUALITY CONTROL

A. The Contractor shall employ an Inspection Agency to perform the duties and responsibilities specified in Section 03 30 00 Cast-in-Place-Concrete, Part 1.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.7 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

END OF SECTION

SECTION 03 35 11

CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.4 SUBMITTALS

A. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

B. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.5 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, , and Owner's Representative of scheduled meeting dates.

1.6 QUALITY ASSURANCE

A. Polisher Qualifications:
   1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
   2. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.8 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

PART 2 PRODUCTS

2.1 DENSIFIERS AND HARDENERS

A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set or as otherwise recommended by manufacturer.
   1. Composition: Lithium silicate.
   2. Products:
      a. ProSoCo; Consolideck LS.
      b. W.R. Meadows, Inc; Liqui-Hard Ultra: www.wrmeadows.com/sle.

2.2 COATINGS

A. Enhancing Sealer: High-gloss, enhancing sealer for hardened concrete.
   1. Products:
      a. ProSoCo; Consolideck LS Guard.
      b. W.R. Meadows, Inc.; Bellatrix.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

C. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Alkalinity:
   1. Test Method: Measure pH according to method indicated in ASTM F 710.
   2. Acceptable Results: pH between 8 and 10.

B. Moisture Vapor Transmission Rate:
   1. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
   2. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.

C. Relative Humidity:
   1. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
   2. Acceptable Results: Not more than 75 percent.

3.3 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.4 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion. Remove if present. Clean in accordance with concrete floor finish manufacturer's written instructions.

B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

C. At concrete surfaces indicated to be sealed, but not polished, provide the following:
   1. Confirm that concrete slab is acceptable to concrete floor finish manufacturer for application of hardener. Apply hardener/densifier in accordance with manufacturer's instructions. Allow to dry per manufacturer's instructions prior to applying enhancing sealer.
   2. Apply two coats of enhancing sealer after hardener/densifier has dried per manufacturer's instructions.
   3. Once enhancing sealer is dry, brunish after each coat using a high speed burnisher in accordance with manufacturer's instructions.
   4. At Substantial Completion, apply and burnish two additional coats of enhancing sealer to all sealed floor areas.

3.5 PROTECTION

A. Cover floors with masonite during construction. Remove at Substantial Completion.

3.6 FINAL APPLICATION

A. At Substantial Completion, apply two coats of enhancing sealer to concrete surfaces receiving hardener/densifier.

END OF SECTION

SECTION 03 41 00
STRUCTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.

B. This section includes engineering, fabrication and erection of structural precast concrete units. Work shall include, but not be limited to, the following items:

1. Precast Hollow Core Slab Sections

C. Work shall also include headers for openings, connections, anchor bolts, templates, installation instructions and grouting of precast units. Anchor bolts shall be installed by other contractor.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified.

1. ACI 301 - Standard Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Reinforced Concrete.
3. ASTM A36 – Standard Specification for Carbon Structural Steel.
4. ASTM A82 - Standard Specification for Steel Wire, Plain for Concrete Reinforcement.
5. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcing, Plain for Concrete Reinforcement.
6. ASTM A416 - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
7. ASTM A615 - Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
8. ASTM C33 - Standard Specification for Concrete Aggregates.
9. ASTM C150 - Standard Specification for Portland Cement.
10. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
11. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
12. ASTM C618 - Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
13. ASTM C1240 - Standard Specification for Silica Fume for use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout.
14. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength, Inch Dimensions.

15. AWS D1.1 - Structural Welding Code - Steel.

16. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

17. CRSI - Manual of Standard Practice.

18. PCI MNL-120 - PCI Design Handbook – Precast and Prestressed Concrete.

19. PCI MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

20. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

21. PCI MNL-123 - Manual on Design of Connections for Precast Prestressed Concrete.

22. PCI MNL-124 - Manual on Design for Fire Resistance of Precast Prestressed Concrete.

23. PCI MNL-126 - Manual for the Design of Hollow Core Slabs.

24. PCI MNL-127 - Recommended Practice for Erection of Precast Concrete.

25. PCI MNL-135 - Tolerance Manual for Pre-cast and Prestressed Concrete Construction.

26. UL - Underwriter's Laboratories.

B. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

C. Qualifications:

1. Fabricate and perform testing of precast units in accordance with PCI MNL-116 Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

2. The engineer preparing design calculations, shop drawings, and other structural data for the precast concrete units shall be a registered engineer in the state where the project is located, with not less than three (3) years of continuous experience in design work of similar scope to that shown on the drawings.

3. The precast concrete manufacturer shall not have less than five (5) years of continuous experience in the manufacture of precast concrete units.

4. The precast concrete manufacturer shall have production capacity to produce required units without causing delay in work.

5. The precast concrete erector shall not have less than five (5) years of continuous experience in the erection of structural precast concrete units.

6. All welding of structural steel shall be performed by operators who have been qualified within the past one year as prescribed in "Qualification Procedures" of the American Welding Society (AWS).

1.3 DESIGN REQUIREMENTS

A. Precast units and their connections shall be designed by a licensed, qualified engineer licensed in the State were the project is located, to withstand the loadings and criteria indicated on the drawings and contained within this section.

B. Precast units shall be designed to meet the project fire ratings as specified by the Architect.

C. Precast hollow core slabs shall not be designed as composite sections with the concrete topping slab indicated on the drawings.

D. Fire-Test-Response Characteristics: Provide precast concrete units that comply with the following requirements:

1. UL, ITS or another testing and inspecting agency acceptable to authorities having jurisdiction has performed fire-response testing on each assembly.

2. Material and construction of fire-resistance-rated assemblies, as listed by UL's "Fire Resistance Directory," ITS's "Directory of Listed Products," or the listings of another testing and inspection agency, are identical to those tested per ASTM E119.

3. Products are identified with appropriate markings of applicable testing and inspecting agency.

1.4 SUBMITTALS

A. Shop Drawings:

1. Prepare and submit complete erection and detailed shop drawings for Engineer's approval, including but not limited to the following:

a. Member piece marks and completely dimensioned size, shape and type of each member.

b. Plans and/or elevations locating and defining all products furnished by the manufacturer. Indicate separate face and backup mix locations plus thicknesses and indicate the limits of each finish.

c. Indicate locations and extent and treatment of dry joints if two-stage casting is proposed.

d. Sections and details showing connections, cast-in items and their relation to the structure.

e. Methods of connecting, anchoring, fastening, bracing and attaching work of other trades.

f. Indicate welded connections by AWS standard symbols.

g. Indicate size and location of openings, either saw-cut or formed, to be coordinated with other trades.

h. Joints and openings in units and between units and the structure.

i. Description of all loose, cast-in and field hardware.

j. Headers required for openings.

2. Manufacturer shall submit the shop drawings showing floor member and roof member layout to the Mechanical Contractor for review of openings and inserts required by mechanical components.

B. Product Data:

1. Products: Prepare and submit product data for Engineer's approval for shop applied primers, fasteners, grout and other miscellaneous materials.

C. LEED Submittals:

1. LEED Certification: Submit manufacturer's certification for each concrete product including the following:

a. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage by weight of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer's name and product cost.

b. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

D. Qualification Data:

1. When requested by the Architect, provide lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Design Calculations:

1. Prepare and submit one complete set of signed and sealed structural calculations to the Owner for approval of each unique and distinct precast member and precast connection prepared and certified by a Engineer licensed in the state where the project is located. Owner's approval or acceptance of the manufacturer's design calculations shall in no way relieve the manufacturer of the full responsibility for the correctness of the calculations or the structural performance of the completed members or sections.

F. Production Drawings:

1. Be prepared to submit, upon the Owner's request, production drawings indicating the following:

a. Sections and details to indicate quantities, type and position of reinforcing steel, anchors, inserts, etc.

b. Dimensions and finishes.

c. Prestress for strand and concrete strengths.

d. Methods for storage and transportation.

G. Test Reports:

1. Be prepared to submit, upon the Owner's request, test reports showing compliance with the testing provisions contained in PCI MNL-116, Manual for Quality Control for Plants.

H. Certifications:

1. Submit manufacturer's certifications that the precast units have been fabricated to meet the fire ratings specified by the Architect.

2. Submit copies of welding procedures and personnel.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Precast units shall be transported, stored and erected in a manner that will avoid any damage or deformation. Precast units shall be lifted and supported during manufacturing, stock-piling, transporting and erection operations only at the lifting and/or supporting points shown on the approved shop drawings.

B. Store units at the project site in such a manner so as to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Protect edges of precast units from chipping or spalling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Materials:

1. Refer to Section 03 30 00, Concrete, for additional information and requirements for concrete, formwork, materials application, admixtures, accessories, etc.

2. Portland Cement: ASTM C150, Type I or III, gray and white.

3. Normal-Weight Aggregates: ASTM C33

4. Admixtures – As determined by precast manufacturer, but conforming to:

   a. Air-entraining Admixtures: ASTM C260.
   b. Chemical Admixtures: ASTM C494.
   c. Fly Ash: ASTM C618, Class C or F.
   d. Silica Fume: ASTM C1240.

5. Water – Potable and free from foreign materials in amounts harmful to concrete and embedded steel.

B. Reinforcement and Prestressing Strands:

1. Refer to Section 03 20 00, Reinforcement, for additional information and requirements for fabrication, installation, etc.

2. Reinforcing Bars - ASTM A615, Grade 60, deformed.

3. Prestressing Strand - ASTM A416, Grade 250 or 270, uncoated, seven-wire, low-relaxation strand.

4. Plain-Steel Wire - ASTM A82.

5. Plain-Steel Welded Wire Reinforcement- ASTM A185, fabricated from steel wire into flat sheets.

C. Anchors, Inserts and Connection Material:

1. Steel Plates and Shapes - ASTM A36.
2. Anchor Rods - ASTM F1554.
3. Deformed Bar Anchors - ASTM A496.
4. Steel Headed Studs - AWS D1.1, Type B.
5. High-Strength Bolts - ASTM F3125, Grade A325.
6. Welding Electrodes - Comply with AWS standards.

D. Grout:

1. Cement Grout - Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144. Mix at a ratio of 1.0 part cement to 2.5 parts sand, by volume, with minimum water required for placement and hydration. Minimum compressive strength to be 3000 psi.

2. Non-metallic, non-shrink grout - Grout shall be a pre-mixed, non-metallic, non-corrosive, non-staining product, containing selected silica sand, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, and complying with ASTM C1107. Minimum compressive strength to be 7,000 psi at 28 days.

E. Bearing Pads: Manufacturer to choose one of the following.

1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer, minimum tensile strength 2250 psi per ASTM D412.

2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.

3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer.

4. Hardboard: AHA A135.4, Class 1, tempered hardboard strips, smooth on both sides.

5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.2 CONCRETE MIXES

A. Concrete shall achieve a minimum 28-day compressive strength of 5000 psi.

B. Prestressed concrete shall achieve a minimum release strength of 3500 psi.

2.3 FABRICATION AND MANUFACTURE

A. Fabricate precast member in plastic lined or metal forms which are true to line and plane. Form openings of 100 square inches in area.

1. Edge and Corner Treatment: Uniformly chamfered.

B. General Contractor shall identify opening locations to precast manufacturer for coordination and shall provide precaster with cast-in items required by other trades.

C. Manufacture units in compliance with PCI MNL-116. Comply with the tolerances specified in PCI MNL-116.

D. Precast hollow core slabs shall have end bearings lengths as indicated on the structural drawings, but at least 3 inches minimum.

E. Clean reinforcement of loose rust, mill scale, and other materials, which may reduce or destroy bond with concrete.

F. Place reinforcement to obtain at least the minimum coverage for concrete protection as specified by ACI-318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

G. Install welded wire reinforcement in longest lengths practical. Lap adjoining pieces one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

H. Cast in structural inserts, plates and accessories as indicated on the Drawings and as determined by the fabricator for erection and anchorage. Cast in architectural accessories to receive windows, dowels, waterstops, flashings and other similar work.

I. Provide cast-in-place or structural steel headers for openings larger than one slab width according to fabricator's written recommendations.

J. Finishes, unless otherwise indicated on the drawings, provide:

1. Precast hollow core slabs:

a. Standard underside - As resulting from casting against approved forms. Small surface holes, normal color variations, normal joint marks, minor chips and spalls will be tolerated. Major imperfections, honeycombs, structural defects, or other defects will not be tolerated.

b. Standard topside - As resulting from vibrating screed and additional hand finishing at projections. Normal color variations, normal joint marks, minor chips and spalls will be tolerated. Major imperfections, honeycombs, structural defects, or defects which would affect finished floor materials will not be tolerated.

K. Provide permanent markings to identify pick-up points and orientation in structure, complying with the markings indicated on approved shop drawings. Imprint date of casting on each precast unit on a surface, which will not show in the structure.

L. Weight of hollow core precast units shall not exceed the following:

1. 8" hollow-core: 63 psf.

2.4 LEED CREDIT

A. LEED Credit MRc 4.1/4.2 – Precast wall panels, hollowcore, double tees, columns, and beams shall have a maximum recycled content for standard products.

B. LEED Credit MRc 5.1/5.2 – Precast shall be manufactured within 500 miles of project site. Aggregate, sand, water, and reinforcing shall be procured within 500 miles of project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which Work is to be performed and notify the General Contractor in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Do not install precast concrete units until supporting concrete has attained 75% of its design compressive strength.

3.2 ERECTION

A. The General Contractor shall be responsible for:

1. Providing suitable access to the site, proper drainage, and firm, level bearing for the hauling and erection equipment to operate under their own power.

2. At time of delivery, provide area inside and outside the building to allow adequate maneuverability for erection procedures.

3. Placement and accurate alignment of anchor bolts, plates or dowels in footings or foundation walls, ledge angles and other field placed support units.

4. Provide all shoring and bracing required by manufacturer's recommendations and as indicated on the Precast Shop Drawings.

B. Install bearing pads on true, level and uniform bearing surfaces. Maintain the correct position of the pads until precast units are in place.

C. Locate lifting hooks as specified on the shop drawings.

D. Erect units in compliance with PCI MNL-127, Recommended Practices for Erection of Precast Concrete.

E. After precast units are in place, remove lifting hooks and handling inserts, level bottom of slab to correct for unequal camber prior to grouting and perform necessary welding in accordance with AWS D1.1.

F. Shore and brace precast units to maintain location, stability and alignment until permanent connections are established.

G. Precast units shall be properly aligned and leveled as required by the shop drawings.

H. Remove hoisting or shoring devices and fill voids with sand-cement grout to be flush to adjacent surfaces.

I. Repair damaged metal surfaces by cleaning and applying a coat of galvanizing repair paint to galvanized surfaces or repainting damaged surfaces. Damage to those surfaces having special finishes as specified, shall be brought to the attention of the Architect.

J. Required openings less than 100 square inches in area in precast units shall be field cut. No openings shall be cut so as to pass through the leg sections of the prestressed units. Holes cut in slabs not concealed by finished ceiling systems shall be cut through, starting on underside with hand or mechanical chisels or from top only with core type drills. Restrict openings to as small as possible.

K. Use flowable cement grout (minimum compressive strength 5,000 psi) to grout keyways between hollow core slabs as follows:

1. Clean and prepare keyways to be filled. Joints should be free of debris and dust.
2. Seal underside of slab joints to prevent grout leakage.
3. Fill grout keys full and strike flush with top surface.
4. Remove grout that seeps through to ceiling below before grout hardens.

L. Welding: Comply with AWS D1.1 and AWS D1.4

1. Protect precast concrete units and bearing pads from damage by field welding or cutting, and provide noncombustible shields as required.

M. Field touch up:

1. Immediately after erection, field welding and/or final bolting, clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt and stains.

3.3 FIELD QUALITY CONTROL

A. The contractor may choose to employ a separate testing laboratory to evaluate the precast manufacturer's quality control and testing methods. If requested, the precast manufacturer shall allow the Owner's testing company access to the manufacturing facility, and provide samples of material for additional evaluation.

B. Precast units which do not conform to specified requirements, including strength, tolerances, and finishes, or which are damaged during handling and erection, shall be replaced with precast concrete units that meet the requirements of this specification.

C. The contractor shall be responsible for the cost of corrections to other work affected by or resulting from corrections to precast concrete work.

D. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. The contractor shall be responsible for the cost of necessary repair, removal and replacement of rejected units.

E. The precast supplier shall inspect all field cutting, which cuts reinforcing. The precast manufacturer shall issue a letter to the Owner either accepting the system as modified or directing corrective procedures to offset cut reinforcing. The contractor shall be responsible for the cost of any corrective procedures.

F. Clean all exposed surfaces after erection to remove weld marks, other markings, stains and dirt. Wash and rinse according to manufacturer's recommendations. Protect other work from damage or staining during cleaning operations.

END OF SECTION

SECTION 04 20 01

MASONRY VENEER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Calcium silicate masonry units.

B. Mortar and Grout.

C. Reinforcement and Anchorage.

D. Flashings.

E. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry.

1.3 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

H. ASTM C476 - Standard Specification for Grout for Masonry; 2016.

I. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

J. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2005.

K. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

L. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2005.

1.4 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

B. Samples: Submit four samples of calcium silicate masonry units to illustrate color, texture, and extremes of color range.

1.5 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.

1.6 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized __ feet long by ___ feet high; include mortar and accessories and structural backup in mock-up.

B. Locate where directed.

C. Approved mock-up may not remain as part of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.8 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. General Contractor to provide winter protection and heat sources for installation of masonry units, as required to maintain project constructions schedule, at no additional cost to Owner.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 PRODUCTS

2.1 CALCIUM SLICATE MASONRY UNITS

A. Calcium Silicate Masonry Units: to ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; 3-5/8" bed depth; special shapes as indicated; and as follows:
   1. Modular Size: As indicated on Drawings.
   2. Texture: smooth on exposed faces and ends.
   3. Basis-of-Design: Arriscraft, Montecito Renaissance.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

E. Water: Clean and potable.

2.3 REINFORCEMENT AND ANCHORAGE

A. Reinforcement and Anchorage: As specified in section 04 20 00 - Unit Masonry.

B. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.

2.4 FLASHINGS

A. Rubberized Asphalt Flashings with stainless steel drip edges, as specified in Section 07 25 00 - Weather Barriers.

B. Stainless Steel: ASTM A666, Type 304, soft temper; 26 gage, 0.0187 inch thick; finish 2B to 2D.

2.5 ACCESSORIES

A. Cavity Vents: Molded PVC grilles, insect resistant.
   1. Manufacturers:
      a. Dur-O-Wall; Cekk Vents: www.dur-o-wal.com.
      b. Heckmann Building Products Inc.; No. 85 Cell Vent.
      c. Hohmann & Barnard, Inc, Quadro-Vent: www.h-b.com/sle.
      d. WIRE-BOND, Cell Vents: www.wirebond.com.

B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.

1. Provide one of the following:
    a. Full-Height Airspace Maintenance and Drainage Material: Mesh panels, fitted between masonry ties.
        1) Manufacturers:
            (a) CavClear/Archovations, Inc; CavClear Masonry Mat: www.cavclear.com.
    b. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
        1) Manufacturers:
            (a) Advanced Building Products Inc; Mortar Break: www.advancedflashing.com/sle.
            (b) Mortar Net Solutions; MortarNet: www.mortarnet.com.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

D. Compressible Filler: Premolded, closed cell, filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

2.6 MORTAR AND GROUT

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
    1. Masonry below grade and in contact with earth; Type S.
    2. Exterior, non-loadbearing masonry; Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency as required to fill volumes completely for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Verify foundations are constructed with tolerances conforming to the requirements of ACI 117.

E. Verify reinforcing dowels are positioned in accordance with the project drawings.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Cold Weather Procedures:
    1. Heat mortar sand or mixing water to produce mortar temperatures between 40°F and 120°F at the time of mixing. Maintain mortar above freezing until used in masonry.
    2. When the mean daily temperature is between 40°F and 32°F, protect completed masonry from rain or snow by covering.
    3. When the mean daily temperature is between 32°F and 25°F, completely cover completed masonry with a weather resistive membrane for 24 hours after construction.
    4. When ambient temperature is between 25°F and 20°F, use heat sources on both sides of the masonry under construction and install wind breaks when wind velocity is in excess of 15 mph. Completely cover completed masonry with insulating blankets or equal protection for 24 hour period after construction.
    5. When ambient temperature is below 20°F, provide an enclosure for the masonry under construction and use heat sources to maintain temperatures above 32°F within the enclosure 24 hours after construction.

B. Frozen Materials:

1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen work. Do not lay masonry units having a temperature below 20°F.

C. Remove and replace masonry work damaged by frost or freezing

D. Hot Weather Proceedures:
1. Hot weather construction is defined when the ambient air temperature exceeds 100°F or exceeds 90°F with a wind velocity greater than 8 mph. Hot weather procedures include the following:
   a. Maintain sand piles in a damp, loose condition.
   b. Maintain temperature of mortar and grout below 120°F.
   c. Flush mixer, mortar transport container, and mortarboards with cool water before they come in contact with mortar ingredients or mortar.
   d. Maintain mortar consistency by retempering with cool water.
   e. Use mortar within 2 hours of initial mixing.
   f. Fog spray all newly constructed masonry until damp, at least three times a day until the masonry is three days old.
2. Do not spread mortar beds more than 4 feet ahead of masonry. Set masonry within one minute of spreading mortar

3.4 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is requied, cut units with motor-driven saws, provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry produce a uniform blend of colors and textures.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30g/30 sq. in. per minute where tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

D. Comply with tolerances in ACI 530.1/ASCE 6/TMS 620 and with the following:
1. For conspicuous vertical lines, suce as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

3.5 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Calcium Silicate Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.6 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.7 WEEPS/CAVITY VENTS

A. Install cavity vents in veneer walls at 24 inches on center horizontally below shelf angles and lintels, at top of walls, and above through-wall flashing.

3.8 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Cavity Mortar Control Panels: Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.

D. Cavity Mortar Diverter: Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.9 ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors in masonry back-up to bond veneer at maximum 1.77 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 8 inches, minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.11 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/8 inch, plus 3/8 inch.

3.12 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Clean soiled surfaces with cleaning solution.

3.14 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 04 22 00
REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the Work specified in this Section.

B. This section includes the supply and installation of all reinforced concrete unit masonry and accessories as shown on the Drawings and herein specified.

C. This section defines work including: Concrete unit masonry, mortar, grout, reinforcement, anchors, ties, and accessories.

D. Masonry, cavity wall board insulation, loose fill insulation, and foam core insert insulation is specified elsewhere; however, installation shall be a part of the Work of this Section.

E. Notes indicated on the drawings regarding reinforced unit masonry shall be considered part of this specification.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified.

1. ACI 530.1/ASCE 6/TMC 602 - Masonry Standards Joint Committee (MSJC) Code and Specification.
2. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
5. ASTM A951 - Standard Specification for Steel Wire for Masonry Joint Reinforcement.
6. ASTM C90 - Standard Specification for Load-bearing Concrete Masonry Units.
7. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
8. ASTM C387 - Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
9. ASTM C476 - Standard Specification for Grout for Unit Masonry.
10. ASTM C780 - Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
11. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
12. IMIAC - International Masonry Industry All-Weather Council: Recommended Practice and Guide Specification for Cold Weather Masonry Construction.

B. Where any provision of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

C. Mockup:

1. Prior to installation of masonry work, erect sample wall panel to further verify color and texture characteristics of selected masonry units and mortar and to demonstrate the level of workmanship required for the unit masonry.

2. Construct mockup at the site, where directed. Mockup shall be full thickness, including face and back-up wythes, as well as all accessories. Mockup shall indicate the proposed range or color, texture, and quality of workmanship to be expected in the completed work.

3. Obtain Architect's acceptance of visual qualities of the mockup before start of masonry work.

4. Retain mockup during construction as a standard for judging completed masonry work.

5. Construct mockup panels for the following walls:

a. Exterior masonry wall construction.

6. Demolish and remove mockups from site when directed by Architect/Engineer.

1.3 FIRE RESISTANT CONSTRUCTION

A. Whenever a fire resistant classification is indicated for unit masonry construction, provide concrete block units as tested and listed for the particular fire resistant construction.

1.4 QUALIFICATIONS

A. Installation Company: Company shall have not less than five years of documented experience in the construction of masonry projects of similar scope and complexity.

B. For the actual cutting and placing of concrete masonry units, use only skilled masons who are thoroughly experienced with the material and methods specified and thoroughly familiar with the design requirements. Workers shall have not less than three years of documented experience in the construction of masonry walls.

1.5 SUBMITTALS

A. Prepare and submit product data for Engineer's approval. Data should include all horizontal reinforcement, anchoring devices, and all other embedded items herein specified.

B. Prepare and submit shop drawings detailing the fabrication, bending, and placement of reinforcing bars.

C. When requested by the Architect and before any materials are delivered to Worksite, submit for approval one sample of the proposed masonry materials, showing the full range of colors and textures available.

D. Submit a letter of certification from manufacturer of concrete masonry units certifying that all concrete masonry units delivered to the worksite are in strict conformance with the provisions of this specification.

E. Submit concrete unit masonry compressive strength test results demonstrating that the units meet the specified strength. Test must be conducted by a qualified independent testing agency.

F. Submit mortar mix design and test results as follows:

1. Mix designs shall indicate type and proportions of ingredients in compliance with the proportion requirements of ASTM C270.

2. For mix designs not in accordance with the proportion requirements of ASTM C270, the mortar test history must be performed in accordance with ASTM C780 to verify performance with property

requirements of ASTM C270. Tests must meet the type of mortar specified on the drawings. Tests must be done by a qualified independent testing agency.

G. Submit grout mix designs and test results as follows:

1. Mix designs shall indicate type and proportions of the ingredients in compliance with the proportion requirements of ASTM C476.

2. For mix designs not in accordance with the proportion requirements of ASTM C476, the grout test history must be performed in accordance with ASTM C1019 to verify performance with property requirements of ASTM C476. Tests must meet the type of grout specified on the drawings. Test must be done by a qualified independent testing agency.

a. Perform one test prior to construction and perform at least one test during construction for each 5000 square feet of wall.

H. LEED Submittals: Submit product certificates for each masonry product and material including the following:

1. LEED MRc4.1/4.2 – Recycled content, including percentage by weight of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer's name and product cost.

2. LEED Credit MR 5.1/5.2 - Indicate location and distance of manufacturer from project and point of extraction or recovery for each raw material.

a. Include cost for each regional material and the fraction by weight that is considered regional.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All masonry units shall be delivered to worksite and stacked on pallets to allow the circulation of air through all units. Cover with a waterproof covering anchored to prevent displacement during high winds.

B. Masonry accessories, including reinforcing steel, shall be stored clear of the ground to prevent deterioration or damage due to moisture, temperature changes, contaminants, and corrosion.

C. Deliver all materials in sufficient quantity and time to maintain approved construction schedule.

D. Deliver all packaged materials in manufacturer's original containers, with labels and markings intact and legible.

E. Immediately remove all damaged materials or containers from site and replace with new items.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Masonry Units: ASTM C90, as follows:

1. Weight: Normal weight.
2. Compressive Strength: As indicated on the Drawings.
3. Nominal Size: As indicated on the Drawings.
4. Actual Size: 3/8" less than nominal size.
5. Aggregates:
   a. Normal Weight: ASTM C33.

6. Provide special units for 90° corners, lintels jambs, sash, control joints, headers, bond beams, and other special conditions conforming to ASTM C90.
7. All exposed unit masonry shall be free of chips, cracks, and other imperfections.

B. Mortar and Grout:

1. Compressive Strength: As indicated on the drawings.
2. Mortar type for masonry construction shall be as designated in the General Notes of the drawings, conforming to ASTM C270, and grout shall conform to ASTM C476.
3. Portland Cement: ASTM C150, Type I, non-staining, no air entraining, natural color cement.
4. Blended Cement: ASTM C595.
5. Masonry Cement: ASTM C91.
6. Mortar Aggregate: ASTM C144, standard masonry type.
7. Hydrated Lime: ASTM C207.
8. Quicklime: ASTM C5, non-hydraulic type.
9. Premix Mortar: ASTM C387, using gray cement, normal strength.
10. Grout Aggregate: ASTM C404.
11. Grout Fine Aggregate: Sand.
12. Water: Clean and potable.
13. Do not use calcium chloride in mortar or grout.

C. Joint Reinforcement:

1. Provide joint reinforcement formed from galvanized carbon-steel wire in accordance with ASTM A641, Class 1 for interior walls; and ASTM A153, Class B-2, for exterior walls.

2. Provide welded wire units prefabricated with 9 gauge deformed continuous side rods and 9 gauge plain cross rods into straight lengths of not less than 10 feet with matching corner and tee units. Unit widths to be 1-1/2" to 2 inch less than the wall thickness.

D. Ties and Anchors:

1. Structural steel column anchor ties shall be adjustable weld-on 1/4 inch diameter steel rods and minimum 3/16 inch galvanized triangular shaped tie.

2. Adjustable Anchor System: For use with stone/brick veneer and CMU backup.
   a. Single screw veneer tie for CMU backup construction. Fabricated from carbon steel with a premium quality organic polymer coating. A dual diameter barrel wth factory-installed EPDM washer to seal both the face of the insulation and the air/vapor barrier. #14 screw integrated into the dual-diameter barrel. Provide with a projecting eyelet to accept wire ties.
   b. Wire Tie. Wire ties to be 3/16” diameter, Stainless Steel. Length as required.

E. Reinforcement:

1. Use deformed billet bars with unprotected finish conforming to ASTM A615, 60 ksi yield strength.

F. Control and Expansion Joints:

1. Control joint material for unit masonry shall consist of cross-shaped extruded polyvinyl gaskets sized to match wall thickness.

2. Expansion or joint filler material, unless otherwise indicated, shall be 1/2 inch thick asphalt impregnated cellular board.

3. Compressible filler shall be pre-molded filler strips complying ASTM D1056, Type 2, Class A, Grade 1; compressible up to 35 percent of width and thickness indicated.

4. Bond breaker strips shall be asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

G. Flashing:

1. Provide metal flashing at window sills, exterior lintels, base courses of masonry walls, and elsewhere as shown on drawings or specified herein. Flashing shall be prefabricated minimum 18 gauge galvanized pre-finished sheet metal flashing.

H. Breath wicks shall be 3/16 inch diameter cotton sash cord or glass fiber rope. Provide 2 inches of exposure to the outside and space wicks at 18 inches on center along the wall.

I. Insulation Board: Refer to Board Insulation in Division 7.

J. Masonry Cleaners shall be non-acidic and not harmful to masonry worker adjacent materials.

2.2 LEED CREDIT

A. LEED MRc4.1/4.2 - Provide masonry units that contain a percentage of recycled materials.

B. LEED Credit MR 5.1/5.2:

1. Provide masonry units that have been manufactured within 500 miles of project location and from aggregates and cement that have been extracted, recovered, or manufactured, within 500 miles of project site.

2. Provide aggregate for mortar and grout cement, and lime that have been extracted, recovered, or manufactured within 500 miles of the project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

1. Verify foundations are constructed with tolerances conforming to the requirements of ACI 117.

2. Verify reinforcing dowels are positions in accordance with the Project Drawings.

B. Verify items provided by other Sections of work are properly sized and located.

C. Verify that built-in items are in proper location and ready for roughing into masonry work.

D. Beginning of installation means Installer accepts existing conditions.

3.2 PREPARATION

A. Layout walls in advance for accurate spacing of bond patterns, with uniform joint widths and to properly locate openings, expansion joints, and offsets.

B. Direct and coordinate placement of metal anchors supplied to other Sections.

C. The Contractor is responsible to design, provide, and install bracing that will ensure stability of masonry during construction. Maintain in place until building structure provides permanent bracing.

D. Remove laitance, loose aggregate, and anything else that would prevent mortar from bonding to the foundation.

E. Clean all reinforcement by removing mud, oil, or other materials that will adversely affect or reduce bond at the time mortar or grout is placed.

3.3 COLD WEATHER CONSTRUCTION

A. When ambient temperature is below 40ºF (4.5ºC), implement cold weather procedures.

B. Special cold weather requirements for various temperature ranges are as follows:

1. Air temperature 40ºF to 32ºF (4.5ºC to 0ºC): Sand or mixing water shall be heated to produce mortar temperatures between 40ºF to 120ºF (4.5ºC to 49ºC).

2. Air temperature 32ºF to 25ºF (0ºC to -4ºC):

a. Sand and mixing water shall be heated to produce mortar temperatures between 40ºF to 120ºF (4.5ºC to 49ºC). Maintain temperature of mortar on boards above freezing.

b. Grout aggregates and mixing water shall be heated to produce grout temperature between 70ºF to 120ºF (21ºC to 49ºC).

3. Air temperature 25ºF to 20ºF (-4ºC to -7ºC): Comply with requirements for air temperature between 32ºF to 25ºF (0ºC to -4ºC) and the following:

a. Provide heat sources on both sides of the wall under construction to heat masonry surfaces to 40ºF (4.5ºC). Windbreaks shall be used when wind is excess of 15 miles per hour.

b. Heat masonry to a minimum temperature of 40ºF (4.5ºC) prior to grouting.

4. Air temperature 20ºF(-7ºC) and below. Comply with requirements for air temperature between 32ºF to 20ºF (0ºC to -7ºC) and the following:

a. Enclosure and auxiliary heat shall be provided to maintain air temperature above freezing. Do not lay masonry units having a temperature below 20ºF (-7ºC).

C. Cold-Weather Protection:

1. When the mean daily air temperature is 40ºF to 25ºF (4.5ºC to -4ºC), masonry shall be completely covered for 24 hours with weather-resistive membrane.

2. When the mean daily air temperature is 25ºF to 20ºF (-4ºC to -7ºC), masonry shall be completely covered for 24 hours with insulating blankets with a weather-resistive covering. Extend time period to 48 hours for grouted masonry.

3. When the mean daily air temperature is 20ºF (-7ºC) or below, masonry temperature shall be maintained above freezing for 24 hours by enclosure and auxiliary heating. Extend time period to 48 hours for grouted masonry.

D. Do not lay masonry units having either a temperature below 20ºF (-6.7ºC) or containing frozen moisture, visible ice, or snow on their surfaces.

E. Remove visible ice and snow from the top surface of existing foundations and masonry to receive new construction. Heat these surfaces above freezing.

F. Top of all walls not enclosed or sheltered shall be covered with strong weather-resistive material at the end of each day or shutdown.

G. Partially completed walls shall be covered at all times when work is not in progress.

H. Any section of masonry deemed frozen and damaged shall be removed before continuing construction of that section.

I. Masonry units shall be dry at the time of placement. Wet or frozen unit shall not be laid.

J. All cold weather masonry construction shall conform to IMIAC - Recommended Practices and Specification for Cold Weather Masonry Construction.

3.4 HOT WEATHER CONSTRUCTION

A. Hot weather construction is defined when:

1. The ambient air temperature exceeds 100°F or exceeds 90°F with a wind velocity greater than 8 mph.

B. Hot Weather Procedures:

1. Maintain sand piles in a damp, loose condition.

2. Provide necessary conditions and equipment to produce mortar having a temperature below 120°F.

3. Flush mixer, mortar transport container, and mortar boards with cool water before they come in contact with mortar ingredients or mortar.

4. Use mortar within two hours of initial mixing.

5. Fog spray all newly constructed masonry until damp, at least three times a day until the masonry is three days old.

6. Do not spread mortar beds more than 4’ ahead of masonry. Set masonry within one minute of spreading mortar.

3.5 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement. Grouted cells shall be in vertical alignment.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Lay concrete masonry units in bond to match existing at all patch and infill locations.

D. Unless noted otherwise, provide masonry control joints at 30'-0" on center maximum.

E. Unless noted otherwise, build non-bearing interior partitions walls full height to underside of structure.

3.6 PLACING AND BONDING

A. Unless noted otherwise, construct masonry in running bond pattern.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Bed and Head Joints:

1. Unless otherwise required, construct 3/8 inch thick bed and head joints.

2. At foundation, construct bed joint of the starting course a thickness not less than 1/4 inch, and not more than 3/4 inch.

3. Unless otherwise noted, tool joint with a round jointer when the mortar is thumbprint hard.

4. Remove masonry protrusions extending 1/2 inch or more into cells or cavities to be grouted.

D. Collar Joints:

1. Unless otherwise required, solidly fill collar joints less than 3/4 inch wide with mortar as the job progresses.

E. Place hollow units as follows:

1. With face shells of bed joints fully mortared.

2. With webs fully mortared in:

a. All courses of piers columns and pilasters.
b. In the starting course on foundations.
c. When necessary to confine grout or loose fill.
d. When otherwise required.

3. With head joints mortared, a minimum distance from each face equal to the face shell thickness of the unit.

4. Vertical cells to be grouted are aligned and openings are unobstructed.

F. Place solid units as follows:

1. Unless otherwise required, solidly fill bed and head joints with mortar.
2. Do not fill head joints by grouting with mortar.
3. Construct head by shoving mortar tight against the adjoining unit.
4. Do not deeply furrow bed joints.

G. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

H. Remove excess mortar as work progresses.

I. Interlock intersections and external corners.

J. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

K. Perform job site cutting of masonry units with proper tools to provide straight, clean, undamaged edges. Prevent broken masonry unit corners or edges.

L. Isolate masonry partitions from vertical structural framing members with a control joint.

M. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler and pin top of wall with prefabricated partition anchors that allow vertical movement.

3.7 HORIZONTAL REINFORCEMENT AND ANCHORS

A. Install horizontal joint reinforcement as follows:

1. Interior non-load bearing walls - 24 inches on center vertically.
2. Exterior walls and interior load bearing walls - 16 inches on center vertically.
3. Parapet walls - 8 inches on center vertically unless noted otherwise.
4. Foundation walls - 8 inches on center vertically unless noted otherwise.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches. Extend minimum 16 inches each side of openings.

E. Place joint reinforcement so longitudinal wires are embedded in mortar with a minimum cover of 1/2 inch when not exposed to weather or earth, and 5/8 inch when exposed to weather or earth.

F. Anchor masonry to structural members where masonry abuts or faces such members.

G. Wall Ties:

1. Embed the ends of wall ties in mortar joints. Embed wall tie ends at least 1/2" into the outer face shell of hollow units. Embed wire wall ties at least 1-1/2" into the mortar bed of solid masonry units or solid grouted hollow units.

2. Do not bend wall ties after embedded in grout or mortar.

3. Unless otherwise required, install adjustable ties in accordance with the following requirements.

   a. One tie for each 1.77 square feet of wall area.

   b. Do not exceed 16 inches horizontal or vertical spacing.

   c. The maximum misalignment of bed joints from one wythe to the other is 1-1/4".

   d. The maximum clearance between connecting parts of the ties is 1/16".

   e. When pintle legs are used, provide ties with at least two legs made of wire size W2.8.

   f. Install wire ties perpendicular to a vertical line on the face of the wythe from which they protrude. Where one-piece ties or joint reinforcement is used, the bed joints of adjacent wythes shall align.

   g. Unless otherwise required, provide additional unit ties around all openings larger than 16 inches in either dimension. Space ties around perimeter of opening at a maximum of 3 feet on center. Place ties within 12 inches of opening.

H. Veneer Anchors:

1. Embed veneer anchors in mortar joint and extend into the veneer a minimum of 1-1/2 inch at least 5/8 inch cover to the outside face.

2. Install adjustable veneer anchors as follows:

   a. The maximum misalignment of bed joints from one wythe to the other is 1-1/4 inch.

   b. The maximum clearance between connecting parts of the ties is 1/16 inch.

   c. When pintle legs are used, provide anchors with at least two legs made of wire size W2.8.

   d. Provide at least one adjustable two-piece anchor of wire size W1.7 or 22 gauge corrugated sheet metal anchor for each 2.67 square feet of wall area.

3. Install non-adjustable veneer anchors for each 3.5 square feet of wall area.

4. Space anchors at a maximum of 32 inches horizontally and 16 inches vertically.

5. Provide additional anchors around all openings larger than 16 inches in either dimension. Space anchors around the perimeter of opening at a maximum of 3 feet on center. Place anchors within 12 inches of the opening.

3.8 VERTICAL REINFORCEMENT

A. Support and secure reinforcing bars from displacement beyond the tolerances allowed by construction loads or by placement of grout or mortar. Maintain position within 1/2 inch of masonry unit or formed surface, but not less than 1/4 inch (only when fine grout is used).

B. Lap splices minimum 48 bar diameters.

C. Dowels in footings shall be set to align with cores containing reinforcing steel.

D. Place and consolidate grout fill without displacing reinforcing. Completely embed reinforcing bars in grout.

E. All cells containing reinforcing in concrete blocks shall be filled solid with grout.

F. Do not bend reinforcement after it is embedded in grout or mortar.

G. Reinforce masonry unit cores and cavities with vertical reinforcement bars and grout as indicated on drawings. Place reinforcements and ties in grout spaces prior to grouting.

H. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters.

I. Place steel in walls and flexural elements within 1/2 inch of required location.

J. Place vertical bars within 2 inches of the required location along the length of the wall.

3.9 CONCRETE UNIT MASONRY

A. Lay masonry units with core cells vertically aligned clear of mortar dropping, debris, loose aggregates, and any material deleterious to masonry grout.

B. Do not place grout until height of masonry to be grouted has attained sufficient strength to resist grout pressure.

C. Do not wet concrete masonry units before laying.

D. Grout spaces less than two inches in width with fine grout using low lift grouting techniques. Grout spaces two inches or greater in width with course grout using high lift or low lift grouting techniques.

E. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.

F. Grouting:

1. Place grout in lifts not to exceed five feet. Consolidate grout at time of placement.

a. Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling.

b. Consolidate grout pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

2. When the grout pour height exceeds 5 feet 4 inches, provide cleanout opening no less than 3 inches high at the bottom of each cell to be grouted by cutting one face shell of masonry unit. Opening should be sufficient size to permit removal of debris.

3. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.

4. Limit grout lift to 60 inches and rod for grout consolidation. Wait 30 to 60 minutes before placing next lift.

3.10 GROUTING REINFORCED CONCRETE BLOCK WALLS

A. Provide reinforcing bars at indicated spacing and grout bars and voids solid with grout having a 28-day compressive strength as listed in the General Notes of the Drawings.

3.11 GROUTING BLOCK CELLS BELOW LINTELS AND BEAMS

A. For lintel spans greater than 5'-0": Grout block cells 24 inches beneath the lintel and 24 inches each side of lintel.

B. For all beams: Grout block cells 24 inches beneath the lintel and 24 inches each side of lintel

3.12 LINTELS AND BOND BEAMS

A. Steel Lintels: Install steel lintel supplied from Division 5 of this specification. Provide a minimum of 8 inches of end bearing on each side of opening unless noted otherwise. All exterior exposed steel lintels shall be hot-dip galvanized in accordance with ASTM A123.

B. Bond Beams:

1. Use specially shaped lintel units at hollow masonry unit walls, with reinforcing bars as shown and filled with concrete grout.

2. Provide minimum 8 inches of end bearing at each side of opening.

3. Provide reinforced concrete block lintels over openings less than 3'-0" wide which are not scheduled.

4. Place and consolidate concrete without disturbing the reinforcing.

5. Allow lintels to reach 100 percent of their design strength before removing temporary supports.

6. Do not place vertical control joints above bond beams or within 8 inches each side of bond beam.

3.13 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints except above wall openings.

B. Provide vertical expansion, control, and isolation joints as indicated on the drawings. If joints are not indicated, then provide control joints at a maximum spacing of 30'-0".

C. Install all built-in masonry accessory items as work progresses.

D. Rake out mortar where sealants are shown or required.

3.14 BUILT-IN WORK AND EMBEDDED ITEMS

A. As work progresses, build in metal door and glazed frames, fabricated metal lintels, anchor bolts, plates, and other items furnished by other Sections.

B. Place pipes and conduits passing horizontally through masonry beams or masonry walls in steel sleeves or cored holes.

C. Install pipes and conduits passing horizontally through non-bearing masonry partitions.

D. Install and secure connectors, flashing, weep holes, weep vents, nailing blocks, and other accessories.

E. Do not embed aluminum conduits, pipes, and accessories in masonry, grout, or mortar, unless effectively coated or covered to prevent aluminum-cement chemical reaction or electrolytic action between aluminum and steel.

F. Build in items plumb and level.

G. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

H. Do not build in organic materials subject to deterioration.

3.15 PREFABRICATED CONCRETE AND MASONRY ITEMS

A. Erect prefabricated concrete and masonry items in accordance with the requirements.

3.16 TOLERANCES

A. Comply with tolerances in the MSJC Specification and the following:

1. Maximum variation from alignment of columns and pilasters: 1/4 inch.

2. Maximum variation from unit to adjacent unit: 1/32 inch.

3. Maximum variation from plane of wall: 1/4 inch in 10 feet and 3/8 inch in 20 feet or more.

4. Maximum variation from plumb: 1/4 inch per story non-cumulative.

5. Maximum variation from level coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.

6. Maximum variation of bed joint thickness: 1/8 inch.

3.17 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and structural members. Coordinate with other Sections of work to provide correct size, shape, and location.

B. Obtain the Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.18 CLEANING

A. Remove excess mortar and mortar smears.

B. Replace defective mortar.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

E. Clean exposed masonry surfaces of all stains, efflorescence, mortar or grout droppings, and debris.

3.19 PROTECTION OF FINISHED WORK

A. Without damaging completed work, provide protective boards at exposed external corners that may be damaged by construction activities.

END OF SECTION

SECTION 05 12 23
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.

B. This section includes fabrication and erection of structural steel work, as shown on the Drawings and specified herein. Work shall include, but not be limited to the following items:

1. Structural steel
2. Base and bearing plates.
3. Deck support angles and framing for roof openings.
4. Steel lintel members for masonry openings.
5. Edge angles and bent plates.
6. Connection plates.
7. Architecturally Exposed Structural Steel (AESS).
8. All other steel items as listed in AISC – "Code of Standard Practice for Steel Buildings and Bridges" as shown on structural and architectural drawings.

C. Work shall also include grouting of all structural steel members where indicated.

D. Structural notes indicated on the drawings regarding structural steel framing should be considered a part of this specification.

E. No substitutions will be allowed without the Engineer's approval.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified.

1. AISC - Specification for Structural Joints Using High-Strength Bolts.
2. AISC - Code of Standard Practice for Buildings and Bridges.
3. AISC - Specification for the Design of Steel Hollow Structural Sections.
4. AISC - Specification for Allowable Stress Design of Single-Angle Members or Specification for Load and Resistance Factor Design of Single-Angle Members.
5. AISC 360-05 – Specification for Structural Steel Buildings – Allowable Strength Design, 13th Edition.
6. ASTM A36 - Standard Specification for Carbon Structural Steel.
7. ASTM A108 - Standard Specification for Steel Bar, Carbon, Cold-Finished, Standard Quality.
8. ASTM A123 - Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
9. ASTM A153 - Standard Specification for Zinc Coating (Hot Dip), on Iron and Steel Hardware.
10. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

11. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

12. ASTM A500 - Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

13. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

14. ASTM A572 - Standard Specification for High Strength, Low-Alloy Columbium-Vanadium Structural Steel.

15. ASTM A992 - Standard Specification for Steel for Structural Shapes for use in Building Framing.

16. ASTM A1085 - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections.

17. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

18. ASTM F436 - Standard Specification for Hardened Steel Washers.

19. ASTM F1554 - Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength

20. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength, Inch Dimensions.

21. AWS D1.1 - Structural Welding Code.

22. SSPC - Steel Structures Painting Council.

B. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

C. Fabrication, Erection, and Welding Qualifications:

1. Fabricate structural steel members in accordance with AISC Specification for the design, fabrication and erection of structural steel for buildings.

2. Steel fabricator shall not have less than five (5) years of continuous experience in fabrication of structural steel framing.

3. Steel detailer shall have five (5) years of continuous experience in the production of steel fabrication drawings.

4. Steel erector shall not have less than five (5) years of continuous experience in the erection of structural steel framing.

5. All welding of structural steel shall be performed by operators who have been recently qualified as prescribed in “Qualification Procedures” of the American Welding Society (AWS).

D. Tolerances: Tolerances shall be as indicated by the AISC Code of Standard Practice for Buildings and Bridges except that tolerances for fabricating, rolling, cambering and erection shall not be cumulative.

1.3 TESTING AND INSPECTION

A. Inspection and Testing:

1. The Contractor shall employ an Inspection Agency to perform the duties and responsibilities specified below.

2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.

3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Inspection Agency:

   a. Perform all testing and inspection required per approved testing and inspection program.

   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.

   c. Submit a final signed report stating whether the work requiring Inspection was, to the best of the Inspection Agency's knowledge in conformance with the approved plans and specifications.

5. Structural Component Testing and Inspection Schedule for Section 05 12 23 is as follows:

Structural Steel	Continuous	Periodic	Referenced Standard
1. Material verification of high-strength bolts, nuts, and washers:			
A. Identification markings to conform to ASTM standards specified in the approved construction documents.		X	Applicable ASTM material standards: AISC 360, Section A3.3
B. Manufacturer's certificate of compliance required.		X	
2. Inspection of high-strength bolting:			
A. Snug-tight joints.		X	AISC 360, Section M2.5
B. Pretensioned and slip-critical joints using turn-of-nut with matchmarking or direct tension indicator methods of installation.		X	
C. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	X		
3. Material verification of structural steel:			
A. Identification markings to conform to AISC 360.		X	AISC 360, Section M5.5
B. Manufacturer's certified test reports.		X	
4. Material verification of weld filler materials:			
A. Identification markings to conform to AWS specification in the approved construction documents.		X	AISC 360, Section A3.5 and applicable AWS A5 documents
B. Manufacturer's certificate of compliance required		X	
5. Inspection of welding:			
A. Complete and partial joint penetration groove welds	X		AWS D1.1
B. Multi-pass fillet welds	X		AWS D1.1
C. Single-pass fillet welds > 5/16" (7.9 mm)	X		AWS D1.1
D. Plug and slot welds.	X		AWS D1.1
E. Single-pass fillet welds ≤ 5/16" (7.9 mm)		X	AWS D1.1

Structural Steel	Continuous	Periodic	Referenced Standard
6. Inspection of steel frame joint details for compliance:			
A. Details such as bracing and stiffening.		X	
B. Member locations.		X	
C. Application of joint details at each connection.		X	

1.4 SUBMITTALS

A. Shop Drawings:

1. Prepare and submit complete erection and detailed shop drawings for Engineer's approval, including framing plans indicating size, weight and location of all structural members. Shop drawings shall indicate methods of connecting, anchoring, fastening, bracing and attaching work of other trades.

   a. Where contract documents indicate verify in field (VIF) dimensions, shop drawings shall indicate these dimensions and Contractor shall note that the dimensions have been verified.

   b. This specification modifies AISC Code of Standard Practice by deleting the following sentence from 4.4.1(c): "Release by the Owner's Designated Representatives for Design and Construction for the Fabricator to begin fabrication using the approved submittals." Review of the shop drawings by the Engineer shall not relieve the fabricator of this responsibility.

2. Furnish both the Engineer and Architect with one copy of the following:

   a. Final shop drawings containing all review notations.
   b. Field Use/For Construction Drawings.

3. The steel fabricator shall submit a setting plan for all embedded items for Engineer's approval.

4. Shop drawings shall identify and mark AESS members and items. Specific project requirements for AESS (required blast cleaning, SSPC designation, special handling etc.) relating to shop fabrication and field erection practices shall be indicated on the shop drawings.

5. Welder's Certification: Submit certification for all welders employed on the project demonstrating they have been AWS qualified to perform the welding procedures required for this project.

6. General Contractor/Construction Manager to provide copies of field concrete cylinder breaks indicating the concrete meets 75% of the design compressive strength to the steel erector.

B. The General Contractor shall conduct a field survey of as-built anchors and bearing plate locations and elevations prior to steel erection. Survey shall be furnished to the steel fabricator. Contractor shall identify deviations from approved shop drawings and submit proposed repairs and modifications to the Engineer and steel fabricator for approval.

C. Product Data:

1. Prepare and submit product data for Engineer's approval for shop applied primers, finished paint system, expansion and/or adhesive anchors, non-shrink grout and other miscellaneous materials.

D. LEED Certification: Submit manufacturer's certification for each steel product including the following:

1. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer's name, product cost and steel processing furnace type.

2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Steel members shall be transported, stored and erected in a manner that will avoid any damage or deformation. Materials should be stored to allow easy access for inspection and identification. Bent or deformed members will be rejected and shall be replaced or repaired at the expense of the responsible party. Store clear of the ground and in such a manner as to eliminate excessive handling.

B. Store fasteners in a protected location. Clean and re-lubricate bolts and nuts before use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel:

1. All structural steel shall be free from defects impairing strength, durability or appearance. All structural steel shall meet the latest minimum requirements as follows:

a. Structural steel shapes, bars and plates shall conform to the ASTM designations listed in the General Notes of the Drawings.

b. Square and rectangular structural tubing shall be cold formed conforming to the ASTM designations listed in the General Notes of the Drawings.

B. High Strength Structural Bolts:

1. High strength structural bolts shall conform to the ASTM designations listed in the General Notes of the Drawings.

2. High strength bolts shall be detailed and installed in accordance with AISC - "Specification for Structural Joints Using High-Strength Bolts."

3. Manufacturer's symbol and grade markings shall appear on all bolts and nuts.

C. Anchoring Devices:

1. Anchor Rods: Anchor rods used with structural steel members shall be plain threaded rods conforming to the ASTM designations listed in the General Notes of the Drawings.

2. Expansion Anchors: Expansion anchors shall consist of one-piece wedge type carbon steel anchors with heavy-duty nuts and washers. All components shall be zinc plated in accordance with ASTM B633. Refer to the drawing details and General Notes for the expansion anchors used as the basis of design and the acceptable alternates.

3. Adhesive Anchoring System: Adhesive anchoring system shall consist of a threaded anchor rod complete with nut and washer and the adhesive cartridge. Refer to the drawing details and General Notes for the adhesive anchoring systems used as the basis of design and the acceptable alternates.

   a. Nuts shall meet ASTM A563, Grade DH, and washers shall meet ASTM F436.

   b. All components shall be zinc plated in accordance with ASTM B633 SC1.

   c. Adhesive shall consist of a two-part acrylic based adhesive applied in a dual cartridge dispensing system that properly mixes the components at the point of application.

D. Welding Materials:

1. Type required for material being welded in conformance with AWS D1.1.

E. Stud Connectors:

1. For threaded studs that are being used to connect steel beams to embed plates, use ASTM A108, Type A, Grades 1010 through 1020 forged steel, headed uncoated with a minimum tensile strength of 61,000 psi. Fabricated within the tolerances set forth in AWS D1.1.

2. Studs applied by means of the electric arc welding process and shall use an arc shield ferrules of heat resistant ceramic.

F. Paints and Primers:

1. Fabricator's standard lead- and chromate-free, non-asphalitic, rust-inhibiting primer.

2. Galvanizing repair paint: SSPC Paint 20.

3. Refer to Specification Section 09 90 00 for additional paint requirements.

G. Non-Shrink Grout for Base and Bearing Plates: Non-shrink grout, conforming to ASTM C1107, shall be pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sand, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents. All constituents shall meet the requirements of these specifications. Minimum compressive strength at 28-days shall be 7,000 psi as determined by ASTM C109. Follow manufacturer's instructions for handling, mixing, placing and curing. Acceptable products are:

1. Euclid Chemical Company - Euco N.S. Grout
2. L&M Construction Chemical - Crystex.
3. Master Builders - Masterflow 713.
4. Sonneborn - Sonnogrout.
5. Five Star Products Inc. – Five Star Grout.
6. Dayton Superior - Sure-Grip High Performance Grout.
7. Dayton Superior – 1107 Advantage Grout.

2.2 FABRICATION AND MANUFACTURE

A. Fabrication Procedures:

1. Fabricate all structural steel items in accordance with AISC Specifications and as indicated on the drawings.

2. Properly mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize handling of materials.

3. Complete structural steel assemblies before shop priming or galvanizing.

B. Architecturally Exposed Structural Steel (AESS):

1. Fabricate and erect all structural steel items identified on the drawings as AESS in accordance with the AISC Code of Standard Practice for Buildings and Bridges.

a. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.

b. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

2. Prepare AESS surfaces according to the following specifications and standards:

a. SSPC-SP6 "Commercial Blast Cleaning"

C. Shop Connections:

1. All shop connections shall be welded, unless noted otherwise on drawings. Connections shall develop the full strength of the adjoining members unless detailed otherwise.

2. All holes shall be either drilled or punched, as no burning of holes will be permitted, including the enlargement of holes. Provide all holes required for connections and for attaching the work of other trades where such holes are shown if furnished prior to fabrication.

3. Connections shall be detailed as standard framed beam connections (bearing type) in accordance with the AISC Manual of Steel Construction - Allowable Stress Design. Connections which require oversized holes or slotted holes in which the force is other than normal to the axis of the slot shall be detailed as "Slip-Critical Connections" and noted as such on the erection drawings. Provide bearing plates and end anchorage for beams resting on masonry.

4. All full and partial penetration welds shall be fully detailed on the shop drawings. Use backing for all full penetration welds.

5. Weld access holes shall be fabricated in accordance with the recommendations of AWS D1.1 and AISC Specification.

D. Shear Connectors:

1. Steel stud shear connectors shall be securely welded in the field to structural steel beams as detailed on the drawings. Welds shall be such that the shear connector stud will deform before weld failure occurs. Welding shall be done in accordance with AWS D1.1.

2. Shear stud connector for embedded plates and angles shall be welded in the fabrication shop in accordance with AWS D1.1.

E. Deck support framing and seats: Furnish all miscellaneous framing necessary to fully support the roof and floor steel decking.

F. Shop Priming:

1. Unless noted otherwise below, structural steel shall be shop primed.

2. The following surfaces are exceptions to shop priming:

a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

b. Surfaces to be field welded.

c. Surfaces to be high-strength bolted with slip-critical connections.

d. Surfaces to receive sprayed fire-resistive materials.

e. Galvanized surfaces.

3. Surface Preparation: Clean Surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

a. SSPC-SP3, "Power Tool Cleaning."

4. Priming: Apply primer in accordance with paint manufacturer's recommendations, and at a rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

G. Finished Paint System:

1. Finished paint coats shall be in accordance with paint manufacturer's recommendations, and specification Division 9.

2. Paint shall be free of sags, runs, drips or other defects. Allow ample drying time before handling to prevent damage to coatings.

3. Strip paint corners, crevices, bolts, welds, and sharp edges.

4. Apply one coat of shop paint to surfaces that will be inaccessible after assembly or erection.

H. Galvanizing:

1. Hot-Dip Galvanized Finish: Apply Zinc coating by the hot-dip process to structural steel according to ASTM A 123.

a. Fill vent holes and grind smooth after galvanizing.

b. Unless otherwise noted on drawings or in Division 9, all exterior steel components exposed to the elements shall be galvanized, including, but not limited to, lintels.

2.3 LEED CREDIT

A. LEED Credit MRc 4.1/4.2:

1. Steel products shall be made using an Electric Arc Furnace and shall have a minimum recycled content of 80%, including at least 65% post-consumer recycled content and 15% post-industrial recycled content.

2. Steel products made using a Basic Oxygen Furnace shall have a minimum recycled content of 25%, including at least 20% post-consumer recycled content and 5% post-industrial recycled content.

B. LEED Credit MRc 5.1/5.2:

1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 ERECTION

A. Erection Procedures:

1. The erector and not the structural engineer of record shall be responsible for the means, methods and safety of erection of the structural steel framing.

2. Erection of all structural steel items shall meet the requirements of AISC "Specification and Code of Standard Practice."

3. All work shall be erected square, plumb, straight and true, accurately fitted and with tight joints and intersections, by mechanics experienced in the erection of structural steel. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

4. All base plates shall be supported on steel wedges, steel shims or heavy duty leveling nuts until the supported members have been leveled and plumbed.

   a. Snug tighten anchor rods after supported members have been positioned and plumb. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.

   b. Promptly place non-shrink grout between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturers written installation instructions for shrinkage-resistant grouts.

5. Field connections of structural work shall be made with either high strength bolts (bearing type) or by welding. Proper precaution shall be taken to ensure that anchored items will not be distorted or overstressed due to improperly fabricated items.

6. Splice members only where indicated.

7. Remove erection bolts on welded, Architecturally Exposed Structural Steel; fill holes with plug welds; and grind smooth at exposed surfaces.

8. Do not use thermal cutting during erection unless approved by the Engineer/Architect in writing.

9. Steel erection shall not proceed without concrete in footings, piers, and walls attaining 75% of the intended minimum compressive design strength. Documentation must be provided indicating compliance with this requirement.

B. Bracing and Protection:

1. Steel shall be well plumbed, leveled and braced to prevent any movement.

   a. Contractor shall provide and maintain all necessary temporary guying of steel frame to resist safely all wind and construction loads during erection and to assure proper alignment of all parts of the steel frame.

2. Provide all temporary flooring, bracing, shoring and guards necessary to prevent damage or injury. All partially erected steel shall be secured in an approved manner during interruptions of work.

C. Anchor and Foundation Rods:

1. All anchor or foundation rods and similar steel items to be built into concrete or masonry are to be set by the concrete or masonry contractors and shall be furnished promptly so that they may be built in as the work progresses because cutting of structural steel members to accommodate errors pertaining to embedded items will not be permitted.

3.2 FIELD WELDING

A. Welding Procedures:

1. All field welding shall be in accordance with AISC Specifications and conform to AWS D1.1 "Structural Welding Code - Steel".

a. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

b. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice" for Steel Buildings and Bridges" for mill material.

c. Verify that weld sizes, fabrication sequence, and equipment used for Architecturally Exposed Structural Steel will limit distortions to allowable tolerances. Prevent damage due to field welding on exposed surfaces.

1) Grind butt welds flush.

2) Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2. Contractor shall remove ceramic ferrules from shear connectors in sufficient time so as to allow for inspection of welds prior to placement of the concrete.

3.3 REPAIRS, PROTECTION, AND TOUCH UP

A. Repair damaged galvanized coatings and on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touch up Painting: After installation, promptly clean, prepare, and prime or reprime field welds, final connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP2 hand-tool cleaning or SSPC-SP3 power-tool cleaning.

2. Apply a compatible primer of the same type as shop primer used on adjacent surfaces.

3.4 GROUTING

A. Grouting under structural framing members shall be completed after all members have been plumbed and braced and before imposed loads are placed thereon.

B. Remove all defective concrete, dirt, oil, grease and other foreign matter from surfaces to which grout will be placed.

3.5 MISCELLANEOUS STEEL AND STEEL LINTELS

A. Furnish and install all miscellaneous steel as detailed in Architectural and Structural Drawings.

B. The steel fabricator shall furnish all steel lintels required for masonry wall construction indicated in the Architectural and Structural Drawings and Schedules.

C. Provide additional steel framing for continuous support of steel deck edges at openings and column interruptions.

D. All exterior exposed steel shall be hot-dip galvanized in accordance with ASTM A123.

END OF SECTION

SECTION 05 21 00
STEEL JOISTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.

B. This section includes the fabrication and erection of open web steel joists. Work shall include but not be limited to, the following items:

1. K-series and DLH-series joists.
2. Bridging.
3. Joist anchors and connections.

C. Perform work in accordance with SJI Standard Specifications, Load Tables, and Weight Tables for Steel Joist and Joist Girders.

D. Structural notes indicated on drawings regarding steel joists shall be considered a part of this specification.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified.

1. AISC 360-05 – Specification for Structural Steel Buildings – Allowable Strength Design, 13th Edition.
2. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
3. ASTM A153 - Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
5. ASTM A36 – Standard Specification for Carbon Structural Steel
6. ASTM A572 - Standard Specification for High Strength, Low-Alloy Columbium-Vanadium Structural Steel
7. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength, Inch Dimensions.
8. AWS D1.1 - Structural Welding Code.
9. SJI – Standard Specification for Open Web Steel Joists, K-Series
10. SJI - Standard Specifications for Longspan Steel Joists LH-Series and Deep Longspan Steel Joists DLH-Series.
11. SSPC - Steel Structures Painting Council.

B. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1.3 SUBMITTALS

A. Prepare and submit shop and erection drawings for Engineer's approval.

B. Shop Drawings:

1. Indicate standard designations, configuration, sizes, spacing, location of joists, joist chord extensions.

2. Joining and anchorage details of attachment to other construction.

3. Size, location and configuration of all code required bridging, bracing and connections.

4. Joist cambers.

5. Type of paint and shop primer.

C. Welder's Certificates: Submit certification for all welders employed on the project demonstrating they have been AWS qualified to perform the welding procedures required for this project.

D. LEED Certification: Submit manufacturer's certification for each steel product including the following:

1. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer's name, product cost and steel processing furnace type.

2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in performing the work of this section with minimum ten (10) years documented experience. Fabrication Company shall be certified by the Steel Joist Institute (SJI) to manufacture joists complying with the SJI Standard Specifications and Load Tables.

B. Manufacturer shall assume responsibility for engineering special joists indicated on the Drawings to comply with the SJI standard specification performance requirements. This responsibility includes the preparation of Shop Drawings and comprehensive engineering analysis by a qualified structural engineer licensed in the state where the project is located.

C. Erector: Company specializing in performing the work of this section with minimum five (5) years documented experience.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All joists and accessories shall be transported, stored and erected in a manner, which will prevent any damage or deformation. Damaged joists shall not be erected or repaired without Structural Engineer's approval. Joists shall be stored clear of the ground in such a manner so as to eliminate excessive handling, and protect from weather with a weatherproof covering.

B. Deliver and store all joists and accessories to the site according to all SJI requirements.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bar Joists: Steel used in the manufacture of bar joists shall be as allowed by the Steel Joist Institute (SJI) standard specification for chord and web members.

B. High Strength Bolts and Nuts: ASTM F3125, Grade A325, Type 1 heavy hex steel structural bolts, heavy hex carbon steel nuts, and hardened carbon steel washers. Finish shall be plain, uncoated.

C. Carbon Steel Bolts and Threaded Fasteners: ASTM A307, Grade A, carbon steel, hex head bolts and threaded fasteners; carbon steel nuts; and flat unhardened steel washers. Finish shall be plain, uncoated.

D. Miscellaneous items, such as bridging, headers, bolts, nuts, washers, anchors and all other appurtenances for a complete metal joist installation shall be furnished as a part of the work of this section.

E. Primer: Provide the manufacturer's standard shop primer with good resistance to normal atmospheric corrosion and complying with the performance requirements specified in the SJI "Standard Specification" previously cited.

1. Do not prime paint joists and accessories scheduled to receive spray applied fireproofing.

2. Contractor shall certify compatibility of shop primer coat with field applied paint finishes.

F. Welding Materials: AWS D1.1; type required for materials being welded.

2.2 FABRICATION AND MANUFACTURE

A. Manufacture K-Series steel joists according to "Standard Specification for Open Web Steel Joists, K-Series," in SJI "Specifications," with steel angle top and bottom chord members, underslung ends, and parallel top chords; of joist type indicated.

B. Manufacture long span steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on the Drawings.

C. All steel joists shall consist of an electrically welded open-web type, designed and fabricated to conform to the "Standard Specifications" included in the SJI or AISC publications cited above and shall be manufactured by a current member of the Steel Joist Institute.

D. Provide holes in chord members for connecting and securing other construction to joists. General Contractor shall coordinate this information and provide the manufacturer with drawings outlining the location of any required holes.

E. Bridging members for open web joists, unless otherwise indicated on the drawings, shall be continuous wall to wall, complete with suitable anchorage at each end, all in accordance with SJI "Standard Specifications".

F. Design and fabricate joists and bridging to support a minimum net uplift as indicated on the drawings. A 1/3 stress increase shall not be used in uplift design.

G. Camber joists in accordance with SJI Standard Specification or as indicated.

H. All steel joists including all accessories, before leaving the shop shall be thoroughly cleaned of all mill scale, rust and foreign matter and shall be given one (1) coat of primer complying with the performance requirements specified in the SJI "Standard Specification" previously cited.

I. Provide bottom and top chord extensions as indicated on the Drawings.

2.3 CLEANING, PRIMING AND PAINTING

A. Clean joist by using solvent cleaning, SSPC-SP 1 to remove oil and grease.

B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous dry film thickness of not less than 1 mil.

C. Painting of joists and joist accessories is specified in Division 9 Section "Painting."

2.4 LEED CREDIT

A. LEED Credit MRc 4.1/4.2:

1. Steel products shall be made using an Electric Arc Furnace and shall have a minimum recycled content of 80%, including at least 65% post-consumer recycled content and 15% post-industrial recycled content.

2. Steel products made using a Basic Oxygen Furnace shall have a minimum recycled content of 25%, including at least 20% post-consumer recycled content and 5% post-industrial recycled content.

B. LEED Credit MRc 5.1/5.2:

1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 ERECTION

A. Erection of all metal joist items shall meet the applicable requirements of the SJI “Standard Specifications” previously cited.

B. All anchor bolts, wall anchors, bridging anchors, bearing plates and similar items to be built into concrete or masonry are to be set by the concrete or masonry contractors and shall be furnished promptly so that they may be built-in as the work progresses as no cutting for the same afterward will be permitted. Beginning of installation means erector accepts existing conditions.

C. All metal joists shall be accurately set to the lines, elevations and dimensions indicated on the approved shop drawings.

D. Bridging shall be installed concurrently with joist erection and before loads are applied. Bridging shall be securely welded to joist chords in a manner that will not damage joist members and so as to insure positive resistance to both tensile and compressive stresses. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

E. All K-series joists must bear a minimum of 4 inches on masonry or concrete surfaces and a minimum of 2-1/2 inches on steel surfaces. All DLH-series joists shall bear a minimum of 6 inches on masonry or concrete surfaces and a minimum of 4 inches on steel surfaces. All joists bearing on concrete or masonry shall bear on a steel bearing plate and joists bearing on steel shall be welded to the supporting steel.

F. K-series joists shall be anchored at a minimum with (2) 1/8" fillet welds (1" long) at each support, or (2) 1/2" diameter bolts. DLH-series joists shall be anchored at a minimum with (2) 1/4" fillet welds (2" long) at each support, or (2) 3/4" diameter bolts.

G. All field welding shall be in accordance with AWS previously cited.

H. All construction loads shall be kept off joists until they are permanently anchored and bridged. During construction, care shall be taken to avoid excessive concentrated or moving loads. Provide for adequate distribution of any such loads so that the carrying capacity of the joists is not exceeded.

I. Joist shall not be positioned any greater than 1/4 inch from true alignment, and shall not vary more than 1/4 inch from plumb.

3.2 FIELD TOUCH UP

A. Immediately after erection, Contractor shall touch up all erection bolts, all field welds and all scratched or abraded areas and paint out erection markings with matching rust-inhibitive primer in color and formulation to match shop primer.

END OF SECTION

SECTION 05 31 00
STEEL DECK

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.

B. This section includes the fabrication and erection of steel deck. The Work shall include, but not be limited to the following:

1. Roof deck, roof deck accessories, and roof deck fasteners.
2. Acoustical roof deck, acoustical insulation component and accessories.

C. Structural notes indicated on the drawings regarding steel decking shall be considered a part of this specification.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified.

1. AISI - Specification for the Design of Cold-Formed Steel Structural Members.
2. ANSI/AWS D1.1 - Structural Welding Code.
3. ANSI/AWS D1.3 - Structural Welding Code - Sheet Steel.
4. ASTM A1008- Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
5. ASTM A36 – Standard Specification for Carbon Structural Steel.
6. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
7. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
8. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks by the Steel Deck Institute.

B. Manufacture steel decking in accordance with the Steel Deck Institute's (SDI) "Design Manual for Composite Decks, Form Decks and Roof Decks".

C. All steel deck shall be designed and fabricated in accordance with the above AISI and SDI specifications. The gauges and section moduli indicated on the drawings or specified herein are minimum and the gauge and section modules of the deck furnished shall meet or exceed these minimum requirements. All gauges are United States standard, measured prior to coating.

D. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1.3 QUALIFICATIONS

A. Fabricator: Company specializing in performing the work of this section with minimum five (5) years documented experience at manufacturing steel deck. Fabrication Company shall be a current member of the Steel Deck Institute (SDI).

B. Erector: Company specializing in performing the work of this section with minimum five (5) years documented experience at erecting steel deck.

1.4 SUBMITTALS

A. Prepare and submit shop drawings for Engineer's approval. Shop drawings shall indicate deck layout, depth, uncoated metal thickness, framing and supports with unit dimensions and sections and complete end jointing.

B. Provide details of all accessories.

C. Shop drawings shall also indicate typical welding or mechanical anchoring pattern for steel deck and accessories.

D. Prepare and submit allowable construction span tables and allowable total load tables for Engineer's approval. Tables shall be accompanied with a letter of certification from the manufacturer stating the tabulated design values were determined in accordance with the steel deck institute's "Design Manual for Composite Decks, Form Decks, and Roof Decks."

E. Provide manufacturer's latest recommendations and installation instructions.

F. Prepare and submit product data of proposed materials.

G. LEED Certification: Submit manufacturer's certification for each steel product including the following:

1. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer's name, product cost and steel processing furnace type.

2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All decking materials shall be transported, stored and erected in a manner that will prevent damage or deformation of sheets. Damaged material shall not be erected or repaired without Structural Engineer's approval.

B. Deck panels shall be stored clear of the ground, elevated on one end, and protected from weather with waterproof covering.

1.6 COORDINATION

A. Coordinate the installation of the sound-absorbing insulation strips in the topside ribs of the acoustical deck with roof installation specified in Division 7 to ensure protection of insulation strips against damage from the effects of weather and other elements.

PART 2 - PRODUCTS

2.1 STEEL ROOF DECK

A. Standard Steel Roof Deck: Fabricate panels to comply with "SDI Specification and Commentary for Steel Roof Deck," and the following:

1. Steel decking sheet material, minimum yield strength, depth, gage, profile, and finish are indicated on the Drawings, as classified by Steel Deck Institute (SDI). Panels shall be formed with integral ribs and overlapping side flanges.

2.2 ACOUSTICAL STEEL ROOF DECK

A. Acoustical Steel Roof Deck: Fabricate panels to comply with "SDI Specification and Commentary for Steel Roof Deck," and the following:

1. Steel decking sheet material, minimum yield strength, depth, gage, profile, and finish are indicated on the Drawings, as classified by Steel Deck Institute (SDI). Panels shall be formed with integral ribs and overlapping side flanges.

2. Acoustical Perforations: Deck units with manufacturer's standard perforated vertical webs.

3. Sound Absorbing Insulation: Provide the deck manufacturer's standard premolded roll or strip glass fiber or mineral fiber insulation. Provide continuous wire mesh deck/insulation spacers for field painted decking.

4. Acoustical Performance: NRC = 0.95

2.3 FASTENERS

A. Support Fasteners:

1. Welded: 5/8" diameter electric arc spot (puddle) welds. Refer to Drawings for weld spacing requirements.

a. Weld washers required for material less than 0.028" thick. Welding washers shall a minimum thickness of 0.0598 inches and be applicable to AWS D1.3 type welding and of type as recommended by the deck manufacturer.

b. Weld metal shall penetrate all layers of deck material and shall have good fusion to the supporting steel. Fasten ribbed deck to steel support members at ends and intermediate supports.

1) All welding shall be in conformance with previously cited AWS recommendations in appearance and quality of welds, and the methods used in correcting welding work.

B. Side Lap Fasteners:

1. Mechanical: Zinc coated self-drilling, self-tapping type (minimum No. 10) steel screws. Refer to Drawings for fastener spacing requirements.

2.4 ACCESSORIES

A. Provide all closers, fillers, starters, sump pans, metal cant strips, ridge and valley plates, and similar accessories required for a complete installation. Provide cover plates at all locations where direction of deck span changes. Unless otherwise noted, accessories shall be of the same steel sheet material, finish, and thickness as the deck sections.

2.5 LEED CREDIT

A. LEED Credit MRc 4.1/4.2:

1. Steel products shall be made using an Electric Arc Furnace and shall have a minimum recycled content of 80%, including at least 65% post-consumer recycled content and 15% post-industrial recycled content.

2. Steel products made using a Basic Oxygen Furnace shall have a minimum recycled content of 25%, including at least 20% post-consumer recycled content and 5% post-industrial recycled content.

B. LEED Credit MRc 5.1/5.2:

1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 ERECTION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Deck units and deck accessories herein specified shall be thoroughly and securely erected by experienced workmen fastening to supporting steel members as herein specified. All work shall be in conformance with manufacturer's latest printed recommendations and approved shop drawings.

C. Beginning of installation means installer accepts existing conditions.

D. The finished work shall be true, flat planes and to slopes indicated with end joints flush and without sharp protruding edges. Exposed underside of deck shall be true without defect.

E. Erector shall cut all openings in deck for piping and equipment furnished by other trades. Wherever ribs are cut and are not supported by supplemental framing, the erector shall provide steel angles of adequate size on all sides of the opening welded to the underside of each rib.

F. Burning of holes in decking will not be permitted.

G. Steel decking shall be installed to span supporting steel members at right angles. Panels shall be securely anchored to each structural support it rests on or passes.

3.2 ROOF DECK

A. Fasten roof deck panels to steel supporting members using welds as specified herein and on the Drawings.

B. Unless noted otherwise, secure side laps and perimeter edges of units with fasteners at mid-span between supports or 36 inches on center, whichever distance is smaller.

C. Deck shall be fastened through the bottom of the deck rib to all structural supports for the specific deck sections.

D. End bearing of roof decking shall have a minimum of 1-1/2 inches of bearing occurring over structural supports

E. End joints shall be lapped 2 inches minimum.

F. Install sound absorbing insulation into the topside ribs of the acoustical deck as specified in the deck manufacturer's installation instructions. Coordinate with the roofing installation to protect the insulation from damage.

G. Place deck panels on structural supports and adjust to final position with ends aligned. Attach to supports immediately after placement.

H. Roof sump pans shall be installed over openings provided in roof deck with flanges welded to the top of the deck. Space welds at 12 inches apart with at least 1 weld in each corner.

I. Install all roof deck accessories in accordance with the roof deck manufacturer's written instructions.

3.3 FIELD TOUCH UP

A. After erection, all weld burn marks and abraded spots shall be cleaned and field painted with a rust-inhibiting metal primer matching formulations and color of shop coat or a zinc-rich rust inhibiting paint for galvanized deck surfaces.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.
   1. Fabricated items include, but are not limited to, the following:
      a. Steel lintels.
      b. Bollards.
      c. Trash enclosure gates.
      d. Steel framing and supports for applications where framing and supports are not specified in other Sections.
      e. Photovoltaic panel roof attachment system.

B. Prefabricated ladders and ship ladders.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.

I. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

J. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

K. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

L. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2012.

M. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric); 2012.

N. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012.

O. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.

P. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

Q. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

R. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

S. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

T. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

U. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.

V. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.4 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Signed and sealed by the qualified professional engineer responsible for thier preparation and structural calculations, include loads from photovoltaic

B. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.

E. Bolts, Nuts, and Washers: Stainless steel.

F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.3 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATED ITEMS

A. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
   1. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

B. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; galvanized finish.
1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
2. Rungs: Minimum 3/4 inch diameter solid square bar spaced 12 inches on center.
3. Space rungs with no less than 7 inches of clearance from wall and/or nearest object.
4. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
5. Provide minimum of 15 inch clearance from center line of ladder to walls/obstructions to left and right sides of ladder.
6. Provide step across gap distance from top rung to a weight bearing surface of no more than 12 inches.
7. Provide mounting for wall mounting and floor mounting.

C. Bollards: Steel pipe, concrete filled, crowned cap, or as otherwise detailed; galvanized finish.
1. Bollards for mounting of ADA actuators shall have welded steel plate cap.

D. Lintels: As detailed; galvanized finish.

E. Miscellaneous Steel Trim
1. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
2. Galvanize miscellaneous steel trim.

2.5 PREFABRICATED LADDERS

A. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.
3. Incline: As indicated on drawings.
4. Finish: Mill finish aluminum.
5. Manufacturers:
a. O'Keeffe's Inc; Model 520: www.okeeffes.com/sle.

2.6 PHOTOVOLTAIC PANEL ROOF ATTACHMENT SYSTEM

A. Pre-engineered Photovoltaic Panel Roof Attachment System: Aluminum rails and roof attachement system specifically manufactured for attaching photovoltaic panels to standing seam metal roof panel system. Provide manufacturer's standing seam clamps that securely clamp to roof seams and do not interfere or damage the integrity of the seam.
1. Fasteners: ASTM A666, Type 316 stainless steel.
2. Angle: Provide system that mounts photovoltaic panels at 15 degrees from horizontal.
3. Provide fully engineered system with shop drawings signed and sealed by the qualified professional engineer responsible for thier preparation and structural calculations. Coordinate structural design of system with design of metal roof panel system.
4. Basis-of-Design: Schletter, FixZ-7.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Anchor bollards in place with concrete footings, unless otherwise indicated. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Field weld components as indicated on drawings.

E. Perform field welding in accordance with AWS D1.1/D1.1M.

F. Obtain approval prior to site cutting or making adjustments not scheduled.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 51 00

METAL STAIRS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Stairs with concrete treads.

B. Structural steel stair framing and supports.

C. Handrails and guards.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete fill in stair pans.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.

H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

K. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.4 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's stamp or seal on each sheet of shop drawings.

B. Delegated Design Data: Include loads and other information as required by authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.1 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.

2. Structural Design: Provide complete stair and railing assemblies complying with the applicable local code.
3. Dimensions: As indicated on drawings.
4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
b. Welds Exposed to View: Ground smooth and flush.
c. Mechanical Joints: Butted tight, flush, and hairline.
d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
e. Exposed Edges and Corners: Eased to small uniform radius.
f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.2 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
1. Concrete Depth: 1-1/2 inches, minimum.
2. Tread Pan Material: Steel sheet.
3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
4. Concrete Reinforcement: Welded wire mesh.
5. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.
1. Nosing Depth: Not more than 1-1/2 inch overhang.
2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Steel tubes.
1. Stringer Depth: 10 inches.

F. Railings: Steel pipe railings.

G. Finish: Shop- or factory-prime painted.

2.3 PIPE AND TUBE HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.

B. Guards:
1. Hand Rails: Round pipe or tube rails unless otherwise indicated.
a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
2. End and Intermediate Posts: Same material and size as top rails.
a. Horizontal Spacing: As indicated on drawings.
b. Mounting: Welded to top surface of stringer.

2.4 MATERIALS

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

E. Concrete Fill: Type specified in Section 03 30 00.

F. Concrete Reinforcement: Mesh type, galvanized.

2.5 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.6 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.
   2. Number of Coats: One.

2.7 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
   1. Join components by welding unless otherwise indicated.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without impairing work.

D. Weld connections to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning.

D. Apply shop primer to uncoated surfaces of metal stair components. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.2 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sheathing.

B. Preservative treated wood materials.

C. Fire retardant treated wood materials.

D. Concealed wood blocking, nailers, and supports.

E. Miscellaneous wood nailers, furring, and grounds.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing and photovoltaic panel roof attachment system.

B. Section 07 41 13 - Metal Roof Panels: Metal roof panel system.

1.3 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2016.

E. PS 1 - Structural Plywood; 2009.

F. PS 20 - American Softwood Lumber Standard; 2015.

1.4 SUBMITTALS

A. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

B. Include structural analysis signed and sealed by qualified structural engineer, indicating conformance of roof sheathing system to loading conditions including loads from metal roofing panels and photovoltaic panel attachment system.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.2 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.3 CONSTRUCTION PANELS

A. Glass Mat Gypsum Roof Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant.

B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.4 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

B. Glass Mat Faced Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing with a history of successful service.

2.5 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:
   1. Manufacturers:
      a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
      b. Hoover Treated Wood Products, Inc: www.frtw.com.
      c. Koppers, Inc: www.koppers.com.
   2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat all exterior rough carpentry items, including sheathing.
      c. Do not use treated wood in direct contact with the ground.
   3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.4 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
1. At long edges provide solid edge blocking where joints occur between roof framing members.
2. Screw panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
1. Wood Structural Panel Sheathing Installation:
   a. Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
   b. Fasten panels as indicated below:
      1) Screw to cold-formed metal framing.
      2) Space panels 1/8 inch apart at edges and ends.
2. Gypsum Sheathing Installation:
   a. Comply with GA-253 and with manufacturer's written instructions.
      1) Fasten gypsum sheathing to cold-formed metal framing with screws.
      2) Install boards with a 3/8 inch gap where non-load bearing construction abuts structural elements.
      3) Install boards with a 1/4 inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.

2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size and Location: As indicated on drawings.

3.5 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.6 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 74 19 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finish carpentry items.

1.2 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

1.3 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide the information required by AWI/AWMAC/WI (AWS).

B. Samples:
   1. Provide four samples of fasteners to be used for fastening wood treads to stair structure.
   2. Provide one full size stair tread sample with specified finish and nosing inserts. Allow for up to two additional stair samples with alternative finishes applied.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.1 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Grade.

B. Interior Woodwork Items:
   1. Wood Base and Chair Rail:
      a. Transparent finish: Species as indicated on drawing sheet A601, interior finish specifications.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.3 LUMBER MATERIALS

A. Hardwood Lumber: Maximum moisture content of 6 percent.

2.4 FASTENINGS

A. Fasteners: Of size and type to suite application.

2.5 ACCESSORIES

A. Wood Filler: Oil base, tinted to match surface finish color.

2.6 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Wood column surrounds shall be constructed of shop fabricated laminated lumber. Use wood glues for laminating lumber layers that are not visible in completed assemblies and that do not interfere with appearance of transparent finish.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.7 SHOP FINISHING OF INTERIOR FINISH CARPENTRY

A. Apply wood filler in exposed nail and screw indentations.

B. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

C. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent Finish:
      a. System - 5, Varnish, Conversion.
      b. Stain and Sheen: Match Architect's sample.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.3 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Specially fabricated cabinets and casework.

B. Cabinet hardware.

C. Shop finishing.

D. Preparation for installing utilities.

1.2 RELATED REQUIREMENTS

A. Section 12 36 00 - Countertops.

1.3 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

D. AWI/AWMAC (AWS) - Architectural Woodwork Standards, Eighth Edition.

1.4 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

B. Product Data: Provide data for hardware accessories.

C. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Company that follows AWI's "Architectural Woodwork Quality Standards", specializing in fabricating the products specified in this section with minimum seven years of documented experience. Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   1. Fabricator of this section must also provide work specified in Division 6 Section "Wood-Veneer Paneling".
   2. Fabricator of this section must also provide work specified in Division 12 Section "Countertops".

B. Quality Standards: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.7 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

PART 2 PRODUCTS

2.1 CASEWORK

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI Architectural Woodwork Standards for Custom Grade.

B. Wood Veneer Faced Cabinets and Casework: Custom grade.
   1. Exposed Surfaces: Grade A, slip matched.
      a. Species and Cut: Refer to Finish Specification on Drawing Sheet A602.

C. Plastic Laminate Faced Cabinets: Custom grade.

D. Wood Veneer Cabinets and Casework:
   1. Finish - Exposed Exterior Surfaces: Wood.
   2. Finish - Exposed Interior and Concealed Surfaces: Thermoset decorative laminate panels.
   3. Finish - Drawer Subfronts, Backs, Sides and Bottoms: Thermoset decorative laminate panels.
   4. Provide same finish on both sides of all panels. If different finishes are indicated for each side of finished panels, provide back to back layers.
   5. Door and Drawer Front Edge Profiles: Square edge with thick applied band.
   6. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
   7. Grain Direction: Vertical on all surfaces, except drawers shall be horizontal, unless otherwise indicated on drawings.
   8. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
      a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
   9. Adjustable Shelf Loading: 50 lbs. per sq. ft.
      a. Shelving shall be 1" thick minimum.
      b. Provide bored hole shelf rest system with metal shelf rests unless otherwise indicated.
   10. Cabinet Style: Flush overlay.
   11. Veneer Matching within Panel Face: Center-balance match.
   12. Cabinet Doors and Drawer Fronts: Flush style.
   13. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
      a. Join subfronts, backs, and sides with glued dovetail joints.
   14. Provide dust panels of ¼ inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

E. Plastic Laminate Cabinets and Casework:
   1. Cabinet Construction: Flush overlay.
   2. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate as follows:
      a. Laminate Grade: HGS.
   3. Edge Treatment for doors and drawers: PVC edge banding, 3 mm thickness, matching laminate in color, pattern, and finish.
   4. Materials for Semiexposed Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
   5. Drawer Sides and Backs: Thermoset decorative panels.
   6. Drawer Bottoms: Thermoset decorative panels.
   7. Colors, Patterns, and Finishes: Refer to sheet A602 for material finish specification.
   8. Adjustable Shelf Loading: 50 lbs. per sq. ft.
      a. Shelving shall be 1" thick minimum.
      b. Provide bored hole shelf rest system with metal shelf rests unless otherwise indicated.
   9. Core Material: Particleboard or Medium Density Fiberboard. Use exterior grade plywood for core material at sinks.

10. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
    a. Join subfronts, backs, and sides with glued dovetail joints.
11. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no added urea formaldehyde.
   2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no added urea formaldehyde.
   3. Wood Veneer-Faced Panel Products: HPVA HP-1, with plywood, particleboard or medium density fiberboard cores, made with adhesive containing no urea formaldehyde.
   4. Thermoset Decorative Panels (Melamine): Medium-density fiberboard or particleboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

C. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.3 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Grommets in Wood Veneer Surfaces: Standard plastic grommets for cut-outs, with notched cap, in color to match adjacent surface.

2.4 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Drawer and Door Pulls: Stainless steel, back mounted, solid metal, 5 inches long, 1-1/2 inches deep, and 5/16 inch in diameter.

C. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.

D. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: Heavy Duty grade.
   3. Mounting: Side mounted.
   4. Steel ball bearings.
   5. Provide all screws and mounting brackets.
   6. Approved Products:
      a. Accuride International, Inc; Product Heavy Duty Slide Full Extension Model 3607/3657: www.accuride.com.
      b. Knape & Vogt Manufacturing Company; Heavy Duty Full Extension Drawer Slide 8800: www.knapeandvogt.com.

E. Hinges: European style concealed self-closing type, 120 degree, steel with satin finish.
   1. Basis-of-Design:
      a. Grass America Inc #3903 with Clip Plates: www.grassusa.com.
      b. Julius Blum, Inc CLIP top hinges: www.blum.com.

F. Utility Shelving:
   1. Grade: Custom.
   2. Shelf Material: 3/4 inch melamine faced panel product with matching melamine edge.
   3. Shelf Supports: Knap & Vogt; 87 Standards with 187 brackets.
      a. Provide one of the following:
         1) Knap & Vogt; 87 Standards with 187 Brackets.
         2) Granger; 1WDP Standards with 1WDP Brackets.

b. Finish: White (powdercoat paint) or Anochrome (electrozinc-plated and clear lacquered cold rolled steel) as selected by the Architect.
c. Bracket and Standard Metal Thickness: 12 gauge.
d. Size: Provide brackets for shelf depths and spacing as indicated on drawings, if spacing is not indicated, provide the following:
   1) Standards: 2 standards for shelves 3 feet or less, 1 additional standard for each additional 3 foot shelf length.
   2) Brackets: Provide 1 bracket at every shelf.

G. Bumper Pads: ¼" diameter neoprene, adhesively applied to cabinet body at contact points for doors and drawers.

H. Counter Supports: Doug Mockett, 18 1/8" Inter-Arc Work Support SWS2. Color to be selected by Architect.

2.5 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces not exposed to view.

D. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
   1. Provide balance matched panels at each elevation.

E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.6 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 5, Varnish, Conversion.
      b. Stain and Sheen: Match Architect's sample.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

D. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.

E. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 14 00

FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fluid-Applied Waterproofing:
   1. Synthetic rubber waterproofing.

1.2 ABBREVIATIONS

1.3 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2015a).

B. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.

C. ASTM D3468 - Standard Specification for Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing; 1999 (Reapproved 2013).

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with the installation of other components that comprise the exterior building envelope.

1.5 SUBMITTALS

A. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

B. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

C. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

1.6 QUALITY ASSURANCE

A. Manufacturer: System shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of waterproofing and air barrier products. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer Qualifications:
   1. Company specializing is performing the work of this section as a primary occupation, which has at least 3 years of documented experience and is certified in writing by the manufacturer.
   2. Installer must show evidence of adequate equipment and trained field personnel to successfully complete the project in a timely manner.
   3. Company performing the work of this section will also perform the work of all other related air and weather barrier sections, including, but not limited to:
      a. Section 07 25 00 - Weather Barriers.

C. Materials: Fluid applied waterproofing material shall be cold vulcanized two part synthetic rubber based system free of isocyanates and bitumen. For each type of material required for the work of this section and related sections of performance, provide primary materials, associated materials, and material assemblies which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held two weeks prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Attendance shall include the contractors of adjacent systems and substrates, and the waterproofing manufacturer representative. Agenda for meeting shall include but not be limited to the following:
   1. Requirements for Building Envelope Commissioning.

2. Review of submittals.
3. Review of surface preparation, minimum curing period and installation procedures.
4. Review of special details and flashings.
5. Sequence of construction, responsibilities and schedule for subsequent operations.
6. Review of mock-up requirements.
7. Review of inspection, testing, protection and repair procedures.

1.7 MOCK-UP

A. Construct mock-up to represent finished work including inside and outside corners. Incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing and any other critical junction (roof, foundation, etc).

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

C. Protect fluid-applied membrane components from freezing and extreme heat.

D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.9 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive membrane waterproofing.

1.10 WARRANTY

A. Fluid Applied Waterproofing Membrane: Provide written 5 year material warranty issued by the membrane manufacturer upon completion of the work.

B. Contractor shall correct defective work within a two year period after date of substantial completion, remove and replace materials concealing waterproofing at no extra cost to the Owner. Bentonite grouting shall not be acceptable.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fluid applied membrane, two-part, self-curing, synthetic rubber based material:
   1. Basis-of-Design: Provide W.R. Grace; Procor System or a comparable product by one of the following:
      a. Henry Company. Aqua-Bloc System.
      b. W.R. Meadows, Mel-Rol System.
      c. Note that the same manufacturer of material used for Section 07 25 00 Weather Barriers of this project, shall be the same manufacturer of material used for this section. Written manufacturer compatibility and adhesion certification shall be required.

2.2 MEMBRANE AND FLASHING MATERIALS

A. Synthetic Rubber Waterproofing: Cold-applied neoprene or CSPE complying with ASTM D3468; one or two component, quick setting.
   1. Cured Thickness: 0.06 inch, minimum.
   2. Suitable for installation over concrete substrates.
   3. Cured Film Thickness: 1.5 mm (0.060 inch) nominal, measured in accordance with ASTM D 3767 Method A.
   4. Volatile Organic Compound content: < 75 g/L.
   5. Elongation: 500 percent, measured in accordance with ASTM D 412.

6. Water Vapor Permeability: 0.08 perm inch, measured in accordance with ASTM E96/E96M.
7. Peel Adhesion to Concrete: 5 lb./inch, according to ASTM D 903 Modified.
8. Minimum Application Temperature: 20 deg. F.
9. Brittleness Temperature: minus 40 degrees F, measured in accordance with ASTM D746.

2.3 INSULATION

A. Rigid Insulation: Specified in Section 07 21 00 Thermal Insulation.

2.4 ACCESSORIES

A. Prefabricated Drainage Composite: Hydroduct 660 Drainage Composite by Grace Construction Products for horizontal surfaces. Hydroduct 220 Drainage Composite by Grace Construction Products for all vertical surfaces. Drainage composite shall be designed to promote positive drainage while serving as a protection course.

B. Miscellaneous Materials: Tape and other accessories specified or acceptable to manufacturer of fluid applied waterproofing membrane.

PART 3 EXECUTION

3.1 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATE

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Tie-holes and “bugholes” larger than 1/2 inch in diameter or deeper than 1/8 inch, or both, should be either pretreated per manufacturer’s instructions or repaired with with a lean concrete mix or grout. See ASTM D 5295, Preparation of Concrete Surfaces for Adhered Membrane Waterproofing Systems, for further details on substrate preparation.

C. Cracked, pitted, honeycombed or heavily bugholed surfaces can be filled by spraying from close in (10” to 12”) but high material usage with result. Under these circumstances it may be more efficient to fill the surface with a parge coat of lean mortar mix before application of the waterproofing. It is also acceptable to fill in gaps with a compatible sealant or caulk.

D. Cast-In-Place Concrete Substrates:
   1. Surface shall be free of any visible water, frost, or ice.
   2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
   3. Repair bugholes greater than ½ inch in depth and ¼ inch in diameter deep and finish flush with surrounding surface.
   4. Remove scaling to sound, unaffected concrete and repair exposed area.
   5. Grind irregular construction joints to suitable flush surface.

E. Masonry Substrates: Apply waterproofing over concrete block and brick with smooth trowel-cut mortar joints or parge coat.

F. Plywood Substrates: Pretreat all plywood joints with 3 inches wide, reinforced self-adhesive tape. Secure all fasteners.

3.3 INSTALLATION

A. Apply waterproofing in accordance with manufacturer's instructions, including, but not limited to, the following:
   1. Apply minimum 0.060 in. in all areas to be waterproofed. Apply minimum 0.120 inches in all detail areas.
   2. If area to be waterproofed is in direct sunlight and temperature is rising, apply “scratch coat” (a thin application of fluid applied waterproofing) prior to the full application of the waterproofing membrane.
   3. In applications where a minimum slope of 0.13 in./ft cannot be achieved, a two coat application of membrane is recommended to achieve the total thickness.
   4. Apply protection board and related materials in accordance with manufacturer’s recommendations.
   5. For vertical applications, install board insulation before installing drainage panels.

B. Install flexible flashings and seal into waterproofing material. Seal items penetrating through membrane (i.e. water piping, electrical conduit, etc.) with flashings.

C. Seal membrane and flashings to adjoining surfaces.

3.4 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

C. Do not leave installed materials exposed to weather for longer than 30 days.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation at perimeter foundation wall, underside of floor slabs, and exterior wall behind masonry wall finish.

B. Mineral wool insulation in exterior wall construction.

1.2 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2016.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.3 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

B. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

C. Submit surface temperature and dew point analysis. Analytical models shall include building areas clad with Composite Wood Veneer Panels, Aluminum Composite Panels and Fiber Reinforced Cement Panels, regardless of whether those materials are included in this Section or not. Identify temperatures for all surfaces, not just surfaces exposed to view. Analyze typical details and sufficient number of non-typical details to assure that the worst case has been identified. Required data includes:
   1. Identification of dewpoint temperature.
   2. Isothermal plots with color legend and numerical temperature values for: coldest indoor surface; indoor surfaces at or below dew point; indoor surfaces 0 to 5 degrees warmer than dewpoint.
   3. Tabulation identifying solid materials, conductiveness and emissivities.
   4. Tabulation identifying cavity dimensions, temperatures and emissivities.
   5. Tabulation identifying boundary condition temperatures and film coefficients.

PART 2 PRODUCTS

2.1 LEED REQUIREMENTS

A. Recycled Content: Preference for products with a recycled content greater than 35 percent.

B. VOC Content: for adhesives applied on the interior, comply with requirements of Section 01 35 47 VOC CONTENT RESTRICTIONS.

2.2 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene board.

B. Insulation at Perimeter of Foundation: Extruded polystyrene board.

C. Insulation in Exterior Wall Cavity: Mineral wool insulation.

D. Insulation Inside Masonry Cavity Walls: Extruded polystyrene board.

2.3 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:

1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
3. R-value; 1 inch of material at 72 degrees F: 5, minimum.
4. Board Edges: Square.
5. Water Absorption, Maximum: 0.3 percent, by volume.
6. Compressive Strength: 25 psi.
7. Manufacturers:
   a. Dow Chemical Company; STYROFOAM: www.dow.com/sle.
   b. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/sle.

2.4 MINERAL WOOL INSULATION MATERIALS

A. Mineral Wool Insulation: Semi-rigid mineral fiber, ASTM C612; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Combustion: Rated non-combustible per NFPA Standard 220 in accordance with ASTM E 136
   3. Board Size: As required for application.
   4. Board Thickness: As indicated on drawings.
   5. Board Edges: Square.
   6. Moisture Absorption: 1% max. per ASTM C1104.
   7. Thermal Resistance: R-value of 4.2 degrees F hr sq ft/Btu at 75 degrees F, minimum, when tested according to ASTM C518.
   8. Products:
      a. Thermafiber, Inc; RainBarrier: www.thermafiber.com.
      b. ROXUL, Inc; CAVITYROCK: www.roxul.com/sle.

2.5 ACCESSORIES

A. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards vertically over waterproofing systems on foundation perimeter where indicated on Drawings.
   1. Butt edges and ends tightly to adjacent boards and to protrusions.
   2. Start board installation flush with foundation wall corner. Extend board end on opposite side of same corner to overlap end of first panel.
   3. Fit panel bottom ends tight to tops of spread footings.

B. Extend boards over expansion joints, unbonded to foundation on one side of joint.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.4 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.5 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.6 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 25 00

WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fluid-applied air and vapor barrier membrane system.

B. Materials and installation methods to bridge and seal air leakage pathways in wall junctions with roofs and foundations, and at window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.

C. Accessories and miscellaneous materials as required for complete membrane application.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 04 42 00 - Unit Masonry.

C. Section 07 14 00 - Fluid-Applied Waterproofing

1.3 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data, shop drawings as indicated, installation instructions, supplemental installation details, use limitations and recommendations, test data, and compatibility test results.

B. Shop Drawings: Provide drawings of special joint conditions.

C. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in the Owner's name and registered with the manufacturer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer must show evidence of adequate equipment and trained field personnel to successfully complete the project in a timely manner.
   2. Company performing the work of this section will also perform the work of all other related air and weather barrier sections, including, but not limited to:
      a. Section 07 14 00 - Fluid-Applied Below Grade Waterproofing.

B. Materials: Fluid-applied air and vapor barrier system. For each type of material required for the work of this section and related sections of performance, provide primary materials, associated materials, and material assemblies which are the products of one manufacturer. All accessory materials (self-adhered transition membranes, termination bars, compatible sealants/mastics, etc.) will be provided by, or approved by, the membrane system manufacturer to ensure compatibility and single-source responsibility.

1.6 MOCK-UP

A. Provide fluid-applied air and vapor barrier system in Exterior Wall Mock-up indicated on the Drawings.

B. Construct mock-up with specified product types with other components noted.

C. Locate where directed by Design Professional.

D. Mock-up may not remain as part of the Work.

PART 2 PRODUCTS

2.1 AIR AND WATER BARRIER

A. Air and Water Barrier: Liquid applied, resilient, UV-resistant coating and associated joint treatment.
   1. Suitable for use on concrete, masonry, plywood and gypsum sheathing.
   2. Joint Preparation Treatment: Coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
   3. Basis-of-Design: GPC Applied Technologies (Grace), Perm-A-Barrier Liquid.
   4. Other Acceptable Products:
      a. Carlisle Coatings and Waterproofing, Inc; Barriseal-R: www.carlisleccw.com/sle.
      b. Henry Company; Air-Bloc 32MR: www.henry.com/sle.
   5. Performance Requirements:

Property	Test Method	BOD Value
Cured Film Thickness	ASTM D 3767, Method A	60 mils (1.5 mm) nominal
Volatile Organic Compound (VOC) content, maximum		< 0.63 lb/gal (< 75g/L)
Air Permeance at 75 Pa (0.3 in. water) Differential Pressure	ASTM C 2178	<0.0002 cfm/ft2 (<0.001 L/s.m2)
Assembly Air Permeance at 75 Pa (0.3 in. water) Differential Pressure.	ASTM C 2357	<0.0008 cfm/ft2 (<0.004 L/s.m2)
Water Vapor Permeance	ASTM E 96, Method BW	0.08 perms (<4.6 ng/Pa.s.m2)
Pull Adhesion to Concrete Block (CMU)	ASTM D 4541-02	35 psi (0.24 N/mm²)
Pull Adhesion to Glass-Faced Gypsum Board	ASTM D 4541-02	18 psi (0.12 N/mm²)
Peel Adhesion to Concrete	ASTM D 903 Modified*1*	5 lbs/in (880 N/m)
Elongation	ASTM D 412	500% minimum
Pliability; 180° bend over 1 inch mandrel at -23°F	ASTM D 1970	Unaffected
Low Temperature Flexibility and Crack Bridging; 1/8 inch crack cycling at -15°F	ASTM C 836	Pass
Extensibility over 1/4 crack after heat aging	ASTM C 836	Pass
Application Temperature, minimum		20°F (-7°C)
Peak Heat Release	ASTM E 1354	< 150 KW/M²
Total Heat Release	ASTM E 1354	< 20 MJ/M²
Effective Heat of Combustion	ASTM E 1354	< 18 MJ/kg
Flame Spread Index	ASTM E 84 or UL 723	< 25
Smoke-Developed Index	ASTM E 84 or UL 723	< 450

Footnote *1*: Waterproofing membrane is applied to concrete and allowed to cure. Peel adhesion of the membrane is measured at a rate of 2 inches per minute with a peel angle of 90 degrees at room temperature.

   6. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.

2.2 ACCESSORIES

A. Transition Membrane: A 40 mil self-adhering waterproofing used for flashing around beams, columns, and wall openings (including window, door and curtain wall frames, louvers, etc.); consisting of 36 mils of rubberized

asphalt, integrally bonded to a 4 mil high-density cross- laminated polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed. Fully-supported self-adhered membranes must be provided at all corners, (inside and outside), transitions, and changes in substrate. Liquid applied membranes that utilize mesh reinforcements will not be allowed.

1. Basis-of-Design Product: GCP Applied Technologies (Grace) Perm-A-Barrier Detail Membrane.
2. Other Acceptable Manufacturers:
   a. Henry Corporation
   b. Carlisle Coatings & Waterproofing
3. Performance Requirements:

Property	Test Method	BOD Value
Water Vapor Transmission, max.	ASTM E 96, Method B	0.05 perms (2.9 ng/Pa.s.m2)
Air Permeance at 0.3 in. water (75 Pa) differential pressure, max.	ASTM C 2178	<0.0012 cfm/ft2
Puncture Resistance, minimum	ASTM E 154	40 lbs (178 N)
Lap Adhesion, min; at -25°F (-4°C)	ASTM E 1876	5 lbs/in (880 N/m)
Low Temperature Flexibility; at	ASTM D 1970	Unaffected
Tensile Strength, Film, minimum	ASTM D 412, Die C Modified	400 lbs/in2 (2.7 MPa)
Elongation, min; ultimate failure of rubberized asphalt, minimum	ASTM D 412, Die C	200%

B. Flexible Membrane Through-Wall Flashing: ASTM D1970/D1970M, 40 mil heavy-duty self-adhering membrane used for through-wall flashing; consisting of 32 mils of rubberized asphalt, integrally bonded to a 8 mil high-density cross-laminated polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

1. Basis-of-Design Product: GCP Applied Technologies (Grace) Perm-A-Barrier Wall Flashing.
2. Other Acceptable Manufacturers:
   a. Henry Corporation
   b. Carlisle Coatings & Waterproofing
3. Performance Requirements:

Property	Test Method	BOD Value
Water Vapor Transmission, max.	ASTM E 96, Method B	0.05 perms (2.9 ng/Pa.s.m2)
Water Absorption, maximum	ASTM D 570	0.1% by weight
Puncture Resistance, minimum	ASTM E 154	80 lbs (356 N)
Tear Resistance, Initiation, min.	ASTM D 1004	13 lbs (58 N) M.D.
Tear Resistance, Propagation, min	ASTM D 1938	9 lbs (40 N) M.D.
Lap Adhesion, min; at -25°F	ASTM E 1876	5 lbs/in (880 N/m)
Low Temperature Flexibility	ASTM D 1970	Unaffected at -45°F
Tensile Strength, Film, minimum	ASTM D 412, Die C Modified	800 lbs/in2 (5.5 MPa)
Elongation, min; ultimate failure of rubberized asphalt	ASTM D 412, Die C	200%

C. Metal Drip Edge: Provide metal drip edge where flashing is exposed or partially exposed and where indicated, complying with Division 7 Section "Sheet Metal Flashing and Trim" and as follows:
   1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
      a. Metal Drip Edges: Fabricate from stainless steel. Extend into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
   2. Basis-of-Design Product: Hohmann & Barnard 26 gage minimum, 1-1/2" minimum, stainless steel hemmed drip plate.

D. Detailing Compound: Two-part, elastomeric, trowel grade material for use with self-adhered membranes and tapes.
   1. Basis-of-Design Product: GCP Applied Technologies (Grace) Bituthene Liquid Membrane.
   2. Other Acceptable Manufacturers:
      a. Henry Corporation.
      b. Carlisle Coatings & Waterproofings.

E. Miscellaneous Materials: Tape and other accessories specified or acceptable to manufacturer of fluid- applied air and vapor barrier membrane.

F. Miscellaneous Materials: Tape and other accessories specified or acceptable to manufacturer of fluid- applied air and vapor barrier membrane.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

B. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the Contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected

C. Verify that items built-in under other sections are properly located, sized, and securely installed.

3.2 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

B. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of fluid-applied air and vapor barrier.

C. Cast-In-Place Concrete Substrates:
   1. Surface shall be free of any visible water, frost, or ice.
   2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
   3. Repair bug holes greater than 1/2 inch in diameter and 1/4 inch deep, and finish flush with surrounding surface.
   4. Remove scaling to sound, unaffected concrete, and repair exposed area.
   5. Grind irregular construction joints and protrusions taller than 1/8" .to suitable flush surface.

D. Exterior Sheathing Panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 2 to 3 inch wide, reinforced self-adhesive tape, or fiberglass mesh-style gypsum board tape. Fill gaps greater than 1/4 inch with mastic or caulk, allowing sufficient time for full curing before application of tape and fluid-applied membrane

E. Masonry Substrates: Apply air and vapor barrier over concrete block with smooth flush mortar joints. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.

F. Related Materials: Treat joints and install flashing as recommended by membrane manufacturer.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Application of Fluid-Applied Membrane:

1. Spray- or trowel-apply a continuous uniform film at minimum 60 mils dry film thickness using multiple, overlapping passes.
2. When spraying, use a cross-hatching technique (alternating horizontal and vertical passes) to ensure even thickness and coverage.
3. When spraying, use high pressure, multi-component, airless spray equipment approved by material manufacturer.
4. Carry membrane into any openings a minimum of 2 inches.
5. Seal all brick-ties and other penetrations as work progresses.

C. Application of Transition Membrane:
1. After allowing the fluid-applied membrane to cure to tack-free finish, apply transition membrane with a minimum overlap of 3 inches onto each surface at all beams, columns and joints as indicated on Drawings.
2. Tie-in to window and door frames, spandrel panels, roof and floor intersections and changes in substrate.
   a. Install products in accordance to manufacturer's installation instructions, necessary to provide a continuous weather barrier for all transitions in plane.
3. Use pre-cut, easily-handled lengths for each location.
4. Remove silicone-coated release paper and position membrane flashing carefully before placing it against the surface.
5. When properly positioned, place against surface by pressing firmly into place using hand roller.
6. Overlap adjacent pieces 2 inches, and roll all seams with a hand roller.
7. Seal top edge of flashing with sealant compatible with all surrounding materials.
8. Transition flashing is not to be pre-installed prior to application of fluid-applied membrane, apply transition flashing as above. Spray or trowel a continuous uniform film of Fluid-Applied Membrane at minimum 60 mils dry film thickness using multiple, overlapping passes, with a minimum overlap of 3 inches between the fluid applied and the transition flashing

D. Application of Flexible Membrane Wall Flashing:
1. Precut pieces of flashing to easily handled lengths for each location.
2. Remove silicone-coated release paper and position flashing carefully before placing it against the surface.
3. When properly positioned, place against surface by pressing firmly into place using hand roller. Fully-adhere flashing to substrate to prevent water from migrating under flashing.
4. Overlap adjacent pieces 2 inches and roll all seams with a hand roller.
5. Trim bottom edge 1/2 inch back from exposed face of the wall. Flashing shall not be permanently exposed to sunlight.
6. At heads, sills and all flashing terminations, turn up flashing ends a minimum of 2 inches, and make careful folds to form an end dam, with the seams sealed.
7. Seal top edge of flashing with sealant compatible with all surrounding materials.
8. Do not allow the rubberized-asphalt surface of the flashing membrane to come in contact with poly- sulfide sealants, creosote, uncured coal tar products, or ethylene-propylene-diene-terpolymer products (EPDM).

E. Installation of the primary membrane is to occur prior to all inside and outside corners, fenestration rough openings and penetrations, then install the initial application of detail membrane.

3.4 TOLERANCES

A. System to be installed to accommodate the following maximum live load deflection in the plane of the exterior wall:
1. Verify maximum live load deflection with structural requirements or 3/8 inch, whichever is greater.

3.5 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work using procedures as recommended by manufacturer.

B. Fluid-applied air and vapor barrier membrane is not suitable for permanent exposure and should be protected from the effects of sunlight.

C. Schedule work to ensure that the membrane system is covered as soon as possible after installation. Protect membrane system from damage during subsequent operations. If the air and vapor barrier membrane system cannot be covered within sixty (60) days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

3.6 FIELD QUALITY CONTROL

A. Do not cover installed fluid-applied air and vapor barrier until required inspections have been completed by testing agency.

B. The testing agency shall verify proper application thickness via a wet mil gauge during the application process.

C. Hose tests will be performed for areas clad with composite wood panels, aluminum composite panels, fiber reinforced cementitions panels, and thin limestone adhered panel. Refer to those sections for testing requirements. Replace and/or repair components that have failed field testing and retest until performance is satisfactory.

3.7 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 26 00

UNDER-SLAB VAPOR BARRIER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vapor Barrier

B. Seam Tape/Mastic

C. Pipe Boots

1.2 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements

B. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 07 21 00 – Thermal Insulation

E. Section 07 90 05 – Joint Sealers

1.3 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

B. American Society for Testing and Materials (ASTM)

1. ASTM E 1745-97 (2004) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
2. ASTM E 154-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials
4. ASTM F 1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
5. ASTM E 1643-11 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

C. American Concrete Institute (ACI)

1. ACI 302.1R-04 Vapor barrier component (plastic membrane) is not less than 10 mils thick.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with the installation of other components that comprise the exterior building envelope.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Installation instructions: Submit manufacturer's installation instructions for placement, seaming, and pipe boot installation.

C. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

1.6 QUALITY ASSURANCE

A. Manufacturer: System shall be manufactured and marketed by a firm with a minimum of 15 years experience in the production and sales of waterproofing and air barrier products. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer Qualifications:

1. Company specializing is performing the work of this section as a primary occupation, which has at least 3 years experience.

C. Materials: For each type of material required for the work of this section, provide primary materials, associated materials, and material assemblies which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held two weeks prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Attendance shall include the contractors of adjacent systems and substrates, and the manufacturer representative. Agenda for meeting shall include but not be limited to the following:
1. Requirements for Building Envelope Commissioning.
2. Review of submittals.
3. Review of surface preparation and installation procedures.
4. Review of special details and flashings.
5. Sequence of construction, responsibilities and schedule for subsequent operations.
6. Review of inspection, testing, protection, and repair procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

C. Sequence deliveries to avoid delays, but minimize on-site storage.

1.8 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive vapor barrier.

PART 2 PRODUCTS

2.1 MATERIALS

A. Multi-layer, reinforced polyethylene or equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is PROHIBITED.
1. Thickness: Minimum 15 mil, 0.015 inch (0.38 mm).
2. Water Vapor Permeance: ASTM E 96 or ASTM F 1249; less than 0.01 perm after mandatory conditioning tests per ASTM E 1745 (7.1.1 - 7.1.5)
3. Water Vapor Transmission Rate: ASTM E 96 or ASTM F 1249; less than 0.006 grains/hr.ft2
4. after mandatory conditioning tests per ASTM E 1745 (7.1.1 - 7.1.5).
5. Tensile Strength: ASTM D882 or ASTM E 154; minimum 60lbf/in.
6. Puncture Resistance: ASTM D 1709; minimum 2750 grams.

B. Acceptable Manufacturers:
1. Insulation Solutions, Inc; Viper VaporCheck II: www.insulationsolutions.com.
2. Raven Industries, Inc; Vapor Block 15: www.ravenind.com.
3. W.R. Meadows, Inc; Perminator 15 Mil: www.wrmeadows.com.
4. IntePlast Group; Barrier-Bac VB350 16 mil: www.barrierbac.com.

2.2 ACCESSORIES

A. Seam Tape:
1. Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96

B. Vapor Proofing Mastic:

1. Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96

C. Pipe Boots
   1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

B. Ensure that subsoil is approved by Geotechnical Engineer.
   1. Level and tamp or roll aggregate, sand or granular base.

3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643-11.
   1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete pour. Level and compact base material
   2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments (such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier). At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
   3. Overlap joints 6 inches and seal with manufacturer's tape.
   4. Apply seam tape to a clean and dry vapor barrier.
   5. Seal all penetrations (including pipes) per manufacturer's instructions.
   6. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
   7. If non-permanent stakes are driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
   8. Repair damaged areas by cutting patches of vapor barrier material of similar (or better) permeance, puncture and tensile, overlapping damaged area 6 inches and taping all four sides with tape.

3.3 CLEANING AND PROTECTION

A. Protect membrane in accordance with manufacturer's recommendations until placement of concrete. Inspect for damage just prior to placement of concrete and make repairs in accordance with manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

A. Do not place concrete until required inspections have been completed by manufacturer's technical representative.

3.5 SCHEDULE

A. Follow the installation sequence as directed by the manufacturer specification.

END OF SECTION

SECTION 07 41 13

METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roofing system of preformed steel panels.

B. Fastening system.

C. Accessories and miscellaneous components.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00- Metal Fabrications: Photovoltaic panel roof attachment system.

B. Section 06 10 00 - Rough Carpentry: Roof sheathing.

1.3 REFERENCE STANDARDS

A. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

D. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2012, with Editorial Revision (2015).

1.4 SUBMITTALS

A. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.
   2. Include loads for photovoltaic panel roof attachnent system.
   3. Include structural analysis signed and sealed by qualified structural engineer, indicating conformance of roofing system to loading conditions.

B. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

C. Test Reports: Indicate compliance of metal roofing system to specified requirements.

D. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.6 WARRANTY

A. Waterproofing Warranty: Provide manufacturer’s warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ARCHITECTURAL METAL ROOF PANELS

A. Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.

1. Steel Panels:
   a. Aluminum-zinc alloy-coated steel conforming to ASTM A792/A792M; minimum AZ55 coating.
   b. Steel Thickness: Minimum 22 gage (.029 inch).
2. Profile: Standing seam, with minimum 2.0 inch seam height; concealed fastener system for field seaming with special tool.
3. Texture: Smooth.
4. Length: Full length of roof slope, without lapped horizontal joints.
5. Width: Maximum panel coverage of 12 inches.
6. Basis-of-Design: MBCI, BattenLok HS.

2.2 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement and support of photovoltaic panel roof support system.

2.3 ACCESSORIES AND MISCELLANEOUS ITEMS

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
   1. Downspouts: Open face, rectangular profile.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

D. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
   1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
   2. Sheet Thickness: 22 mil (0.022 inch) minimum total thickness.
   3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   5. Water Vapor Permeance: 0.067 perm, maximum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).

2.4 FABRICATION

A. Panels: Fabricate panels and accessory items at factory, using manufacturer92s standard processes as required to achieve specified appearance and performance requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

B. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

C. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install panels in strict accordance with manufacturer92s instructions, minimizing transverse joints except at junction with penetrations.

3.4 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.5 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 42 13

COMPOSITE WOOD VENEER PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood veneer composite panel system including the following:
      a. Wood veneer composite panels with mounting system. Panel mounting system including anchorages, clips, shims, offsets furring, fasteners and related flashing adapters as required for a complete system.

1.2 DEFINITION

A. Composite wood veneer panel Assembly: Composite wood veneer panels, attachment system components, miscellaneous metal framing and accessories necessary for a complete rainscreen wall system.

1.3 RELATED SECTIONS

A. Section 07 21 00 – Thermal Insulation: Insulation.

B. Section 07 25 00 – Weather Barriers.

C. Section 07 62 00 - Sheet Metal Flashing and Trim.

D. Section 07 92 00 – Joint Sealants.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheet on each product to be used including:

B. Preparation instructions and recommendations.

C. Storage and handling requirements and recommendations.

D. Installation methods.

E. Quality Assurance: Certified test results from independent testing laboratory substantiating specified performance characteristics and physical properties.

F. Design Drawings: Include installation details and elevations showing all panel sizes, fastener locations.
   1. Provide details and calculations indicating loads of cladding system on thermal clip support assembly.
   2. Include design engineer's stamp or seal on shop drawings for panels, backup framing, attachments and anchors. Engineer shall be licensed in Iowa.

G. Samples: Submit two 6"x6" samples of specified color.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Provide installation and materials for mockups indicated on Drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver Materials to site in Manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store Materials in accordance with the Manufacturer's instruction in unopened packaging until ready for installation. Store materials in a covered area, away from water, on a flat, level surface with adequate support to prevent sagging.

C. Handling: Protect materials during handling to prevent damage.

1.7 ACCLIMATIZATION

A. All boxes shall be opened and all components removed from the packaging and stacked flat with spacers between the pieces in their final environment for a minimum 3-4 days prior to installation.

1.8 PROJECT CONDITIONS

A. Do not install composite wood veneer panel material under environmental conditions where it is likely to be immersed in water, or where the temperature is likely to exceed 120 degrees Fahrenheit for extended periods of time.

1.9 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's 10 year warranty.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Products: Subject to compliance with requirements, provide the following:
   1. ProdEX, Prodema North America. Website: www.prodema.com

B. System Description
   1. A complete, engineered metal aluminum or stainless steel clip girt system with metal member framing, closure pieces, trim and flashing. The system is to be composed of composite wood veneer panels fastened to metal sub-frame. System to be designed and engineered to attach to wall assembly substructure as indicated below. System shall be designed to incorporate flashing and drainage components in such a way that system will properly perform as a rear ventilated rainscreen system.
   2. System installation shall allow for all movements within structure and to support loads transferred from the adjacent construction and to fit within the space allotted without projections into the finished space as shown on the Drawings.
   3. Provide in conjunction with wall substrate and air/water barrier a weather tight wall assembly utilizing the “rain screen principle”.
      a. System design shall be single-source responsibility by the cladding supplier. All design criteria shall be project specific in accordance with the requirements of cladding supplier. Products provided must conform to the design intent shown.
      b. Panel System: Drained and Back Ventilated Rainscreen Design. System shall drain water and condensation to exterior. A complete pre-engineered system including but not limited to cladding panels, support structure, closure pieces, trim and flashing. Wall panels shall be removable. Fasteners are exposed. The panels shall be secured to a thermally broken above grade cladding support wall assembly substructure provided in this section with fastening to bracket horizontally to allow for concealed attachment of panels.
      c. Joints: Shall be dry and un-caulked.
      d. Metal Flashing: Provide metal flashing for a proper water managed assembly, to direct condensation and water infiltration within the wall to weeping points.
         1) Drainage flashing is the primary component of a water managed system which diverts water that has penetrated the exterior cladding away from the cladding compartment or condensation that occurs at the interior face of cladding surface.
         2) Provide metal drainage flashing at locations listed below prior to installation of membrane to assure proper water drainage. Membrane shall assure proper lap over flashing:
            (a) At bottom of system.
            (b) At penetrations: windows, doors, louvers, etc.
            (c) At floor line or other locations which accommodate vertical movement.
   4. System shall provide minimum 1 inch “clear” airspace behind cladding for proper ventilation.
   5. Design Modifications: Shall be provided only as necessary to satisfy as-built conditions and to meet performance requirements. Significant system and aesthetic design shall be requested in writing to architect 10 days prior to bid date.
   6. Material supplier shall be responsible for engineering system per architectural design criteria and performance requirements.
   7. Condensation: System shall accommodate positive drainage for moisture entering or condensation occurring within panel system.
   8. Flatness: System shall be flat with no noticeable warpage, buckling, deflections or other surface irregularities

C. System Description: The system shall consist of composite wood veneer panels and a system of custom aluminum extrusions in profiles indicated on drawings. The back-up framing shall utilize Cascadia fiberglass clips with aluminum extrusions in profiles indicated on the drawings. The details show the preferred profiles and performance requirements. Provide a rainscreen and structurally sound, self-draining wall panel system with minimal water penetration.

2.2 THERMAL CLIP CLADDING SUPPORT ASSEMBLY

A. Thermal Clip Cladding Support Assembly:
1. All thermal clip systems are to be designed for a fully engineered, sub-framing thermal spacer insulation clip.
2. Provide a system designed to thermally isolate the exterior cladding systems. The system shall provide the insulation retainage in addition to withstanding the loads, wind loads and dead loads imposed by the cladding systems.
   a. Approved Manufacturers:
      1) Advanced Architectural Products: SMARTci
3. Insulation clip system design: Minimum 4” wide thermal spacer designed for cladding system girt attachment.
4. Clip System and final girt attachment must be coordinated with cladding system manufacturers.
5. Final girt attachment must be designed to be perpendicular to the cladding system primary attachment system.
6. All fastener penetrations through air and vapor shall be fully sealed with compatible sealant where clip system is attached to substrate.
7. No push pin installations allowed for insulation. Insulation to be retained without fasteners.
8. Insulation to be installed in staggered layers with no gaps or voids.
9. Transition between the insulation clip system and the cladding final girt attachment will occur within the staggered layers of the insulation. Attachment of the cladding to the insulation clip may not occur at the outside face of the final layer of insulation.
10. System to be designed to accommodate the following maximum live load deflection in the plane of the exterior wall:
    a. Verify maximum live load deflection with structural requirements or 3/8 inch, whichever is greater.

2.3 MATERIALS

A. Wood Veneer Exterior Wall Panel with Resin Core
1. Panels: Grade A rotary cut, hardwood veneer from farmed forests and bonded to a bakelite core.
2. Fire Rating: Class A in accordance with ASTM E-84 criteria for flame spread 10 and smoke development 10 and Class 2 (M1) fire rating in accordance with UNE-EN 2372
3. Color: Pale
4. Panel Thickness: 8 mm.
5. Panel Dimensions: As indicated on drawings. Provide panels factory cut to required sizes. Factory finish all factory cut edges.
6. Adjacent flashings to match reveals.
7. Mounting: Exposed Fasteners to an subframe as required to suit loading.
8. Subframe Assembly: Extruded aluminum system. Provide manufacturer's standard sections as required for support and alignment of metal panel system which allows for attachment clips as necessary to accommodate continuous insulation.
9. Fasteners: Self-threading screws (SFS-SX3-L-12) with smooth heads lacquered to match panels.
10. Copings, Break Metal, Flashings and Trim: Provide as specified in Section 07 62 00 Sheet Metal Flashing and Trim.

B. MOUNTING SYSTEM
1. Manufacturer's ventilated facade mounting system.
   a. Sub-Structure: Exposed Fasteners to an Aluminum Subframe.
   b. Fasteners: Manufacturer's exposed head fasteners, color matched to color of wood veneer panel

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine supporting structure and conditions under which the work is to be erected, and notify the Contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with erection until unsatisfactory conditions have been corrected.

B. Prior to installation, verify water barrier has been properly installed over sheathing substrate. Notify Architect in writing of unsatisfactory conditions prior to beginning installation.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.

3.3 EXTERIOR WALL THERMAL CLIP SYSTEM AND INSULATION

A. Install thermal clip assembly in accordance with approved shop drawings and manufacturer's instructions. Install to depth of cladding attachment system as detailed.

B. Install exterior wall insulation in conjunction with installation of attachment system provided as part of each cladding system.

C. All fastener penetrations through air and vapor shall be fully sealed with compatible sealant where clip system is attached to substrate.

D. No push pin installations allowed for insulation. Insulation to be retained without fasteners.

E. Insulation to be installed in staggered layers with no gaps or voids.

F. Transition between the insulation clip system and the cladding final girt attachment will occur within the staggered layers of the insulation. Attachment of the cladding to the insulation clip may not occur at the outside face of the final layer of insulation.

3.4 INSTALLATION

A. Comply with panel manufacturer’s instructions for assembly, installation and erection of panels, trims, flashings and sealants.

B. Do not install component parts, which are observed to be defective, including warped, bowed, dented, abraded and/or broken members

C. Install composite wood veneer panel subframe per manufacturer’s written instructions.

D. Do not force panels into place.

E. Install structural supports required to provide a complete system. Support system shall be installed to the same tolerance as required of the panel system.

F. Attach panels with exposed fastening. Space fastener symmetrically in straight rows as approved in shop drawings.

3.5 FIELD QUALITY CONTROL

A. Field hose testing for resistance to water leakage shall be conducted and results interpreted as defined herein. Perform a minimum of three (3) field hose tests. Test areas shall include both panel and adjacent curtain wall construction. Coordinate testing of panel areas with adjacent curtain wall construction contractors as required. Area and time of tests shall be per the direction of the Architect. Initial testing shall be conducted early in the construction schedule. Schedule any out of sequence work necessary, such as out of sequence sealant work, so that selected areas can be tested as specified.

B. Size of panel test areas will be as selected by Architect and will primarily be at areas surrounding curtain wall test area openings. There shall be no unacceptable water leakage as defined in this Section.

C. Conduct test with Monarch Type B-25 #6.030 brass nozzle and 3/4 inch diameter hose. Water pressure to nozzle shall be in the range 30 to 35 psi. Working upward from bottom of test area, direct water at 5 foot long segments

of panel joints and perimeter joints, moving slowly back and forth on each segment for minimum of 5 minutes. Sustained spraying at one point while the nozzle remains stationary is acceptable. Tip of nozzle shall be 12 inches from specimen exterior surface. Nozzle shall generally be perpendicular to specimen surface, but shall be tilted to any angle that maximizes exposure of a given joint to water flow rate and kinetic energy. Continuously check for leakage on indoor side. If necessary to pinpoint leak sources, perform additional testing. Repeated testing of joints is acceptable. The use of masking to pinpoint leaks is acceptable.

D. Check completed areas below test area, and report any leaks that occur. A test that results in leakage at a completed area below a designated test area is a failure.

E. Contractor performing work of this Section shall provide powered scaffold, hose, water supply, and manpower to perform each test, plus any unsuccessful tests.

F. If failure occurs, revise and retest specimens. Modifications must be realistic in terms of project conditions, must maintain standards of quality and durability and are subject to approval.

G. If failure necessitates retesting, Contractor for Work of this Section shall pay all additional fees associated with retesting, including fees and costs incurred by the testing agency, the Architect, Owner and their representatives.

H. Submit, for information only, reports that contain dates of tests, elevation drawings of test areas with locations relative to grid lines (including any lower areas where leaks occur), and location of each leak.

I. Coordinate testing under this section with testing specified in Section 08 44 13 - Glazed Aluminum Curtain Walls.

J. Replace and/or repair components that have failed field testing and retest until performance is satisfactory.

3.6 MAINTENANCE

A. Remove stains and graffiti with mild ph-neutral, non-abrasive soap and damp cloth.

B. Avoid use of caustic cleaning solutions, automatic cleaners or excessive liquids.

END OF SECTION

SECTION 07 42 13.23

ALUMINUM COMPOSITE PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior cladding consisting of formed aluminum composite material (ACM) sheet, secondary supports, and anchors to structure, attached to solid backup.

B. Matching flashing and trim.

C. Interior aluminum composite column covers.

1.2 RELATED REQUIREMENTS

A. Section 07 21 00 – Thermal Insulation: Insulation and thermal clip assembly.

B. Section 07 25 00 - Weather Barriers

C. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016a.

E. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2016a.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

H. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

I. ASTM D523 - Standard Test Method for Specular Gloss; 2014.

J. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2012).

K. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2016.

L. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2016.

M. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007 (Reapproved 2015).

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

O. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

P. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

Q. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.

1. Require attendance by the installer and relevant sub-contractors.
2. Include ACM sheet manufacturer's representative and wall system manufacturer's representative to review storage and handling procedures.
3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
4. Review procedures for protection of work and other construction.

1.5 SUBMITTALS

A. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.

B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.

C. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
   6. Provide calculations indicating loads of cladding system on thermal clip support assembly.
   7. Include design engineer's stamp or seal on shop drawings for panels, backup framing, attachments and anchors. Engineer shall be licensed in Iowa.

D. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

E. Maintenance Data: Care of finishes and warranty requirements.

F. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Compatibility:
   1. Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use.
   2. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of any accumulated water.
   4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F.

5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including rupturing, cracking or puncturing.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Three years from date of Substantial Completion.

B. ACM Sheet Manufacturer's Finish Warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for minimum of 20 years:
   1. Chalking: No more than that represented by a No. 8 rating based on ASTM D4214.
   2. Color Retention: No fading or color change in excess of 5 Hunter color difference units, calculated in accordance with ASTM D2244.
   3. Gloss Retention: Minimum of 30 percent gloss retention, when tested in accordance with ASTM D523.

PART 2 PRODUCTS

2.1 LEED REQUIREMENTS

A. Recycled Content: Minimum 30 percent recycled content value: post-consumer recycled content plus one-half of pre-consumer recycled content.

2.2 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
   1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
   2. Provide drained and back ventilated, reveal joint, rout and return panel system:
      a. The system shall consist of ACM panels, and a system of custom aluminum extrusions of size and shape indicated on drawing as specified herein. The system must utilize a Rout and Return configuration and a system of custom aluminum extrusions of size and shape indicated on drawings and as specified herein. The panel system shall be non-directional/non-sequential type installation and shall allow for the indiscriminate removal of any panel without disturbing adjacent panels. The system must allow for the removed panel to be replaced in the original and tested method.
   3. Basis-of-Design: Metal Design System, Series 44.

B. System Description
   1. A complete, engineered metal aluminum or stainless steel clip girt system with metal member framing, closure pieces, trim and flashing. The system is to be composed of aluminum composite panels attached to perimeter channels. System to be designed and engineered to attach to wall assembly substructure as provided under Section 07 21 00. System shall be designed to incorporate flashing and drainage components in such a way that system will properly perform as a rear ventilated rainscreen system.
   2. System installation shall allow for all movements within structure and to support loads transferred from the adjacent construction and to fit within the space allotted without projections into the finished space as shown on the Drawings.
   3. Provide in conjunction with wall substrate and air/water barrier a weather tight wall assembly utilizing the "rain screen principle".
      a. System design shall be single-source responsibility by the cladding supplier. All design criteria shall be project specific in accordance with the requirements of cladding supplier. Products provided must conform to the design intent shown.
      b. Panel System: Drained and Back Ventilated Rainscreen Design. System shall drain water and condensation to exterior. A complete pre-engineered system including but not limited to cladding panels, support structure, closure pieces, trim and flashing. Wall panels shall be removable. Fasteners are exposed.
      c. Joints: Shall be dry and un-caulked.

d. Metal Flashing: Provide metal flashing for a proper water managed assembly, to direct condensation and water infiltration within the wall to weeping points.
   1) Drainage flashing is the primary component of a water managed system which diverts water that has penetrated the exterior cladding away from the cladding compartment or condensation that occurs at the interior face of cladding surface.
   2) Provide metal drainage flashing at locations listed below prior to installation of membrane to assure proper water drainage. Membrane shall assure proper lap over flashing:
      (a) At bottom of system.
      (b) At penetrations: windows, doors, louvers, etc.
      (c) At floor line or other locations which accommodate vertical movement.

4. System shall provide minimum 1 inch “clear” airspace behind cladding for proper ventilation.
5. Design Modifications: Shall be provided only as necessary to satisfy as-built conditions and to meet performance requirements. Significant system and aesthetic design shall be requested in writing to architect 10 days prior to bid date.
6. Material supplier shall be responsible for engineering system per architectural design criteria and performance requirements.
7. Condensation: System shall accommodate positive drainage for moisture entering or condensation occurring within panel system.
8. Flatness: System shall be flat with no noticeable warpage, buckling, deflections or other surface irregularities

C. Performance Requirements:
1. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
2. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
   a. Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 20 pounds per square foot (psf) and 30 psf on parapet and corner panels.
   b. Maximum deflection of perimeter framing member of L/175 or 3/4", whichever is less, normal to plane of the wall; maximum deflection of individual panels of L/60.
   c. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.
   d. At 1-1/2 times design pressure, permanent deflections of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16".
3. Air Infiltration: 0.06 cfm/sq ft of wall area, maximum, when tested at 1.57 psf in accordance with ASTM E283.
4. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.24 psf minimum, after 15 minutes.
   a. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
   b. Dynamic Water Infiltration – System will show compliance with the requirements stated in the AAMA 501 Dynamic Water Infiltration test.n to drain leakage and condensation to the exterior face of the wall.

D. Panels: One inch deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
1. Reinforce corners with riveted aluminum angles.
2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
3. Flatness Criteria: Maximum 1/8” in 15’-0” on panel in any direction for assembled units (non-accumulative).
4. Secure members to back face of panels using structural silicone sealant approved by ACM sheet manufacturer.
5. Fabricate panels under controlled shop conditions.
6. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
7. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
   a. Make panel lines, breaks, curves and angles sharp and true.

b. Keep plane surfaces free from warp or buckle.
c. Keep panel surfaces free of scratches or marks caused during fabrication.

8. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.

E. Perimeter Channels: Extruded aluminum channels which integrate to the continuous sub-system as detailed on drawings, so as to provide the following essential features:
1. Edges of ACM shall be supported by aluminum channels on all four sides.
2. Minimum overall system is 1-7/8".
3. The ACM panel shall be held in place with stainless steel pins through the panel returns and engaged over the channel extrusion allowing the panel to free float for thermal expansion in all directions. Panel systems utilizing attachment methods which secure two edges of the panel to the structure will not be allowed.
4. Channels shall be mill finished.

F. Reveals at Panel Joints:
1. Panel joints are to be joined with manufacturer's standard clip and snap cover. Snap covers shall be painted to match aluminum composite panel color.
2. Panel joints shall be ½" wide x 3/8" deep open reveal (Nominal).

G. Flashings:
1. Fabricate flashing from aluminum sheet in matching color; where exposed to view finish to match adjacent panels. Provide lap strip under flashing at abutted conditions; with lapped surfaces sealed with a full-bed of non-hardening sealant.

2.3 MATERIALS

A. Aluminum Composite Material (ACM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
1. Overall Sheet Thickness: 3 mm, minimum.
2. Face Sheet Thickness: 0.020 inches, minimum.
3. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
4. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
5. Flammability: Self-ignition temperature of 650 degrees F or greater, when tested in accordance with ASTM D1929.
6. Finish: Exterior surfaces shall be coil coated with FEVE or PVDF based resin which meets or exceeds AAMA 2605-02 testing for durability In particular, the coating must have successfully passed the following or equal tests:
a. Humidity Resistance:
1) Test Method: ASTM D-2247. No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100 degree Fahrenheit for 3000 hours.
b. Salt Spray Resistance
1) Test Method: ASTM B-117; expose coating system to 3000 hours, using 5% NaCl solution.
(a) Corrosion creepage from scribe line: 1/8" max.
(b) Minimum blister rating of 8 within the test specimen field.
c. Weather Exposure
1) Outdoor
(a) Ten year exposure at 45 degree angle facing south Florida exposure.
(b) Maximum color change of 5 Delta E units as calculated in accordance with ASTM D-2244.
(c) Maximum chalk rating of 8 in accordance with ASTM D-659.
(d) No checking, crazing, adhesion loss.
7. Color: As selected by Architect.
8. Products:
a. ALPOLIC material manufactured by Mitsubishi Plastics Composites America, Inc. ALPOLIC Materials Division.
b. REYNOBOND material manufactured by Reynolds Metals Company, Alcoa Architectural Products (USA).

c. ALUCOBOND material manufactured by 3A Composites USA Inc.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
1. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
3. Stainless Steel Sheet Components: ASTM A480/A480M.

C. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet.

D. Anchors, Clips and Accessories: Use one of the following:
1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
2. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A153/A153M.
3. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A123/A123M Coating Grade 10.

E. Fasteners:
1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
3. Bolts: Stainless steel.
4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

F. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.

2.4 FABRICATION

A. Fabricate panel units to dimensions indicated on the drawings based on an assumed design temperature of 70 degrees F.

B. Fabricate panels in sizes shown using composite aluminum panel material and perimeter clips so that the panel thickness at the joinery is as required by design. Completed panel shall be properly fabricated and designed so that no restraints can be placed on the panel, which might result in compressive skin stresses. The installation detailing shall be such that the installed panels shall remain flat due to temperature changes and at all times remain water and wind tight. Oil canning of panel surface is not acceptable.

C. Shop fabricate units ready for erection. If not shop assembled, pre-fabricate components at the shop as required for proper and expeditious field assembly.

D. Design, fabricate, assemble, and erect wall panel units.

E. Where drawings indicate, factory curve panels to required radius.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of ACM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Do not cut, trim, weld, or braze component parts during erection, in a manner which would damage finish, decrease strength, or result in a visual imperfection or a failure in performance of wall panels. Return component parts which require alteration to shop for re-fabrication, if possible, or for replacement by new parts.

D. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

E. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

F. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with ACM sheet manufacturer's instructions and recommendations for field forming.

G. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

H. Install flashings as indicated on shop drawings At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

I. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

J. Replace damaged products.

3.3 FIELD QUALITY CONTROL

A. Field hose testing for resistance to water leakage shall be conducted and results interpreted as defined herein. Perform a minimum of one (1) field hose test. Test areas shall include both panel and adjacent curtain wall construction. Coordinate testing of panel areas with adjacent curtain wall construction contractors as required. Area and time of tests shall be per the direction of the Architect. Initial testing shall be conducted early in the construction schedule. Schedule any out of sequence work necessary, such as out of sequence sealant work, so that selected areas can be tested as specified.

B. Size of panel test areas will be as selected by Architect and will primarily be at areas surrounding curtain wall test area openings. There shall be no unacceptable water leakage as defined in this Section.

C. Conduct test with Monarch Type B-25 #6.030 brass nozzle and 3/4 inch diameter hose. Water pressure to nozzle shall be in the range 30 to 35 psi. Working upward from bottom of test area, direct water at 5 foot long segments of panel joints and perimeter joints, moving slowly back and forth on each segment for minimum of 5 minutes. Sustained spraying at one point while the nozzle remains stationary is acceptable. Tip of nozzle shall be 12 inches from specimen exterior surface. Nozzle shall generally be perpendicular to specimen surface, but shall be tilted to any angle that maximizes exposure of a given joint to water flow rate and kinetic energy. Continuously check for leakage on indoor side. If necessary to pinpoint leak sources, perform additional testing. Repeated testing of joints is acceptable. The use of masking to pinpoint leaks is acceptable.

D. Check completed areas below test area, and report any leaks that occur. A test that results in leakage at a completed area below a designated test area is a failure.

E. Contractor performing work of this Section shall provide powered scaffold, hose, water supply, and manpower to perform each test, plus any unsuccessful tests.

F. If failure occurs, revise and retest specimens. Modifications must be realistic in terms of project conditions, must maintain standards of quality and durability and are subject to approval.

G. If failure necessitates retesting, Contractor for Work of this Section shall pay all additional fees associated with retesting, including fees and costs incurred by the testing agency, the Architect, Owner and their representatives.

H. Submit, for information only, reports that contain dates of tests, elevation drawings of test areas with locations relative to grid lines (including any lower areas where leaks occur), and location of each leak.

I. Coordinate testing under this section with testing specified in Section 08 44 13 - Glazed Aluminum Curtain Walls.

J. Replace and/or repair components that have failed field testing and retest until performance is satisfactory.

3.4 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, and trim.

B. Sealants for joints within sheet metal fabrications.

1.2 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

B. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

C. CDA A4050 - Copper in Architecture - Handbook; current edition.

D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.3 SUBMITTALS

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

B. Samples for Verification: For each type of exposed finish required, prepared on samples of size below:
   1. Sheet Metal Flashing: 12 inches long. Include fasteners, closures, and other attachments.
   2. Trim: 12 inches long. Including fasteners and other exposed accessories.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Steel:
   1. Aluminum-zinc alloy-coated (Galvalume) steel conforming to ASTM A792/A792M; minimum AZ55 coating.

2.2 FABRICATION, GENERAL

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

2.3 SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96 inch long, but not exceeding 10 foot long sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of exernal leg. Miter corners, seal watertight. Fabricate from the following material:
   1. Galvalume Coated Steel: 0.050 inch thick.

B. Skylight Flashings: Fabricate from the following material:

1. Galvalume Coated Steel: 0.050 inch thick.

2.4 ACCESSORIES

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Stainless steel.

C. Primer: Zinc chromate type.

D. Concealed Sealants: Non-curing butyl sealant.

E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

F. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement and to comply with SMACNA's "Architectural Sheet Metal Manual". Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contract surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufactuers of dissimilar materials.

E. Install exposed sheet metal flashing and trim without excessive oil canning, buckling and tool marks.

F. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposeure of solder, welds and elastomeric sealant.

G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

H. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.
   1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16 inch centers.
   2. Anchor interior leg of coping with screw fasteners at washers at 18 inch centers.

I. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof.

J. Miscellaneous Trims: Install with concealed fastener. Install work with laps, joints and seams that will be permanently watertight.

K. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof hatches.

B. Smoke Hatch

C. Snow guards.

1.2 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders; current edition.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

B. Shop Drawings: Submit detailed layout developed for this project. Show dimensioned location and number for each type of roof accessory.

C. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.5 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 ROOF HATCHES

A. Manufacturers - Roof Hatches:
   1. Babcock-Davis; ThermalMAX: www.babcockdavis.com/sle.
   2. Bilco Company, Type TB: www.bilco.com/sle.

B. Manufacturers - Smoke and Heat Vents:
   1. Colt AXS 140 combined AOV smoke ventilator and roof access hatch. provide guardrails similar to roof hatch..

C. Roof Hatches, General: Factory-assembled steel frame and cover, complete with operating and release hardware.
   1. Style: Provide flat metal covers unless otherwise indicated.
   2. Mounting: Provide frames and curbs suitable for mounting on standing seam metal roofing.
   3. Thermally Broken Hatches: Added insulation to frame and cover; available in all manufacturer's standard, single leaf sizes; special sizes available upon request
   4. Size(s): As indicated on drawings; single-leaf style unless indicated as double-leaf.

D. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Galvanized steel, 14 gage, 0.0747 inch thick.
   2. Finish: Factory prime paint.
   3. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
   4. Curb Height: 12 inches from finished surface of roof, minimum.

E. Metal Covers: Flush, insulated, hollow metal construction.
   1. Capable of supporting 40 psf live load.
   2. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch thick, liner 22 gage, 0.03 inch thick.
   3. Finish: Factory prime paint.
   4. Insulation: Manufacturer's standard 1 inch rigid insulation.

F. Safety Railing System: Manufacturer's standard accessory safety rail system mounted directly to curb.
   1. Comply with 29 CFR 1910.23, with a safety factor of two.
   2. Manufacturers:
      a. Keehatch https://simplifiedsafety.com/safety-railing/roofhatch-guardrail/ galvanized with gate.

G. Hardware: Type 316 stainless steel, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.
   4. Latch: Upon closing, engage latch automatically and reset manual release.
   5. Manual Release: Pull handle on interior.
   6. Locking: Padlock hasp on interior.

2.2 SNOW GUARDS

A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard pipe, bar, channel, or solid rod, set in brackets or posts, with optional plates and optional metal trim to match roof.
   1. Brackets: Zinc plated steel.
   2. Pipe or Square Tube: Aluminum, mill finish.
      a. Sleeve Couplings: As recommended by manufacturer.
      b. End Collars and Caps: Metal to match.
   3. Manufacturers:
      a. https://www.rockymountainsnowguards.com/products/s5-blizzard-ii-fence-style-snow-guard-bracket.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
   2. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

C. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

D. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.4 CLEANING

A. Clean installed work to like-new condition.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 REFERENCE STANDARDS

A. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).

B. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015b.

C. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.

D. ITS (DIR) - Directory of Listed Products; current edition.

E. FM 4991 - Approval Standard for Firestop Contractors; 2013.

F. FM (AG) - FM Approval Guide; current edition.

G. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

H. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

I. UL (FRD) - Fire Resistance Directory; current edition.

1.3 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Certificate from authority having jurisdiction indicating approval of materials used.

F. Installer Qualification: Submit qualification statements for installing mechanics.

1.4 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:.
   2. With minimum 3 years documented experience installing work of this type.
   3. Able to show at least 5 satisfactorily completed projects of comparable size and type.
   4. Licensed by authority having jurisdiction.

1.5 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetration items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water:
   1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
   2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
      a. Penetrations located outside wall cavities.
      b. Penetrations located outside fire-resistance-rated shaft enclosures.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
   3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined bu ASTM E84.

1.6 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING - GENERAL REQUIREMENTS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

2.2 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
   1. Movement: In addition, provide systems that have been tested to show movement capability as required.
   2. Temperature Rise: In addition, provide systems that have been tested to show T Rating as required.

B. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
   1. Movement: In addition, provide systems that have been tested to show movement capability as required.

C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: In addition, provide systems that have been tested to show movement capability as required.
   2. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.3 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: Penetrations through fire-rated assemblies shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water, and as follows:
    a. Wall Penetrations: Shall have an F rating of not less than the required fire-resistance rating of the wall penetrated.
    b. Horizontal Assembly Penetrations: Shall have an F Rating/T Rating not less than 1 hour but not less than the required rating of the floor penetrated.
        1) Exceptions:
            (a) Floor penetrations contained and located within the cavity of a wall above the floor or below the floor do not require a T rating.
            (b) Floor penetrations by floor drains, tub drains, or shower drains contained and located within the concealed space of a horizontal assembly do not require a T rating.
    c. Membrane Penetrations: Membrane penetrations by boxes other than electrical boxes, provided such penetrating items and the annular space between the wall membrane and the box, are protected by an approved membrane penetration firestopping shall have an F and T rating of not less than the required fire-resistance rating of the wall penetrated and shall be installed in accordance with their listing.

2.4 MATERIALS

A. Provide all materials required to comply with approved firestopping systems.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.3 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Install forming/damming/backing materials and other accessories of types requried to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
    1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
    1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
    2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
    3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

D. Identification: Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. Include the following information on labels:
    1. The words "Warning - Through-Penetration Firestop System- Do Not Disturb. Notify Building Management of Any Damage."
    2. Through-penetration firestop system designation of applicable testing and inspecting agency.
    3. Date of installation.
    4. Through-penetration firestop system manufacturer's name.
    5. Installer's name.

3.4 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.5 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

D. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

E. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

F. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.

1.4 SUBMITTALS

A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

B. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

C. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

D. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

1.5 QUALITY ASSURANCE

A. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Test date.
      b. Copy of test method documents.
      c. Age of sealant upon date of testing.
      d. Test results, modeled after the sample form in the test method document.
      e. Indicate use of photographic record of test.

B. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.

4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

C. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inch long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

1.6 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on the drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
   a. Wall expansion and control joints.
   b. Joints between door, window, and other frames and adjacent construction.
   c. Joints between different exposed materials.
   d. Openings below ledge angles in masonry.
   e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. Joints in concrete floors.
   c. Expansion joints in finish flooring.
   d. Other joints indicated below.
3. Do not seal the following types of joints.
   a. Intentional weepholes in masonry.
   b. Joints within rainscreen system.
   c. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   d. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   e. Joints where installation of sealant is specified in another section.
   f. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing; includes the following:
   a. Thresholds.
   b. Sheet metal flashings and trim joints, including scuppers and gutters.
2. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

4. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.2 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Products:
a. Dow Corning Corporation; 795 Silicone Building Sealant: www.dowcorning.com/construction/sle.
b. Sika Corporation; Sikasil WS-290/WS-295: www.usa-sika.com.
c. Tremco, Spectrem 1/Spectrem 2/Spectrem 4-TS: www.tremcosealants.com.
5. Applications:
a. Exterior joints unless otherwise indicated, including, but not limited to, the following:
1) Exterior vertical and horizontal nontraffic joints in cast-in-place concrete.
2) Exterior vertical and horizontal nontraffic joints between plant-precast architectural concrete units.
3) Exterior vertical control and expansion joints in unit masonry.
4) Exterior horizontal pressure-relieving joints in unit masonry.
5) Exterior joints between flashing materials and unit masonry.
6) Exterior butt joints between metal panels.
7) Exterior perimeter joints between different materials listed above.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.
2. Products:
a. Dow Corning Corporation, 786 Mildew Resistant.
b. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com.
c. Sika Corporation; Sikasil GP: www.usa-sika.com.
d. Tremco; Tremsil 200: www.tremcosealants.com.
3. Applications:
a. Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Joints between counters and adjoining walls and floors at bathrooms, kitchens and other wet areas.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Color: Match adjacent finished surfaces.
2. Manufacturers:
a. BASF; MasterSeal NP1/NP2.
b. Pecora Corporation; DynaTrol I-XL/DynaTrol II.
c. Sika Corporation; Sikaflex-1a/Sikaflex-2c: www.usa-sika.com.
d. Tremco; Vulkem 116/Dymeric 240: www.tremcosealants.com
3. Applications:
a. Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
b. Interior perimeter joints of exterior openings.
c. Joints between top of non-load bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.

D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Products:

a. Pecora, AC-20 + Silicone: www. pecora.com.
b. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
c. Tremco, Tremflex 834: www.tremcosealants.com.

3. Applications:
   a. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.

E. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.
1. Applications:
   a. Thresholds.

2.3 SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Products:
   a. Pecora Coprporation, Urexpan NR-200: www.pecora.com
   b. Sika Corporation; Sikaflex-1c SL: www.usa-sika.com.
   c. Tremco Sealants; THC-900/THC-901: www.tremcosealants.com.
4. Applications:
   a. Exterior horizontal nontraffic and traffic isolation and contraction joints in cast-in-place concrete slabs.
   b. Exterior control and expansion joints in horizontal traffic surfaces of brick pavers, ceramic tile, stone paving units and similar materials unless otherwise specified in individual specification sections.
   c. Interior expansion, control, contraction, and isolation joints in horizontal traffic surfaces in concrete, ceramic tile, dimension stone, dimension stone tile and brick, unless otherwise specified in individual specification sections.

2.4 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location shown in the test plan.
1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
2. Notify Architect of date and time that tests will be performed, at least 7 days in advance.
3. Record each test on Preinstallation Adhesion Test Log as indicated.
4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

1. Clean porous joint substate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include, but are not limited to, the following:
   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.
2. Clean nonporous surfaces surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include, but are not limited to, the following:
   a. Metal.
   b. Porcelain enamel.
   c. Glazed surfaces of ceramic tile.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Precast Architectural Concrete Panel Joints: Install two-stage sealant joints and expansion joints in accordance with PCI Architectural Precast Concrete Design Manual, Section 4.7 and as detailed on drawings.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal doors and frames.

C. Thermally insulated hollow metal doors with frames.

D. Hollow metal borrowed lites glazing frames.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

1.3 REFERENCE STANDARDS

A. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

B. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ITS (DIR) - Directory of Listed Products; current edition.

E. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

H. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C.

B. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80that are listed and labeled, by a testing and inspecting agency acceptance to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 DESIGN CRITERIA

A. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.2 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Grade: ANSI A250.8 Level 4, physical performance Level A, Model 2, seamless (continuously welded with seams dressed smooth).
   2. Core Material: Mineral fiberboard insulation with 22-guage vertical steel stiffener ribs, welded at both ends.
   3. Door Thickness: 1-3/4 inch, nominal.
   4. Top Closures: Inverted steel channel closure, installed flush, filled and finished smooth
   5. Door edges shall be fabricated using beveled edges on hinge and lock sides.
   6. All door seams shall have 1-inch welds every 6-inches on center, ground and finished smooth.
   7. Insulating Value: R-value of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
   8. Weatherstripping: Refer to Section 08 71 00.
   9. Door Finish: Factory primed for field finishing.

B. Interior Doors, Non-Fire Rated:
   1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.
   2. Core Material: Sound insulation core with 22-guage vertical steel stiffener ribs, welded at both ends.
   3. Door Thickness: 1-3/4 inch, nominal.
   4. Door Finish: Factory primed for field finishing.

C. Fire-Rated Doors:
   1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.
   2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
      a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
      b. Attach fire rating label to each fire rated unit.
   3. Core Material: As required to provide fire-protection ratings indicated with 22-guage vertical steel stiffener ribs, welded at both ends.
   4. Door Thickness: 1-3/4 inch, nominal.
   5. Door Finish: Factory primed for field finishing.

2.3 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type. “Timely” and “Redi-frames” are prohibited.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
   2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
   3. Weatherstripping: Integral, recessed into door edge or frame.

C. Interior Door Frames, Non-Fire Rated: Fully welded type. “Timely” and “Redi-frames” are prohibited.
   1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

D. Door Frames, Fire-Rated: Fully welded type. “Timely” and “Redi-frames” are prohibited.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

F. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

G. Provide 6" styrofoam block with same profile as frame so as not to allow grout in the bottom 6" of frame.

H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

I. Frame corner joints shall be mitered, interlocked, welded and ground smooth.

J. Doors shall be template reinforced for hardware 7 ga. on hinges, 12 ga. everywhere else.

2.4 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
   1. Provide 6 inch polystyrene rigid insulation fillers cut to frame profile installed in bottoms of frames to keep grout out of bottom 6 inches of frame.

C. Sound Batt Insulation for Frames: At all interior frames in metal framed walls, provide acoustic batt insulation as specified in Section 09 21 16.

D. SPF Insulation for Frames: Provide SPF insulation as specified in Section 07 21 19 Spray Polyurethane Insulation Air Barrier.

E. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

F. Ceiling Struts: Minimum 1/4 inch thick by 1 inch wide steel.

G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

H. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
   3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8 inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

I. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with extension clips, allowing not less than 2-inch hieght adjustment. Terminate bottom of frames at finish floor surface.

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, same material as door face sheet.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, same material as frames.

2.6 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Automotive Undercoating: Provide a field applied, non-flammable, low-VOC automotive undercoat layer to the inside of all frames that will be in contact with anti-freezing agents in plaster or mortar.

2.7 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

B. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in door.

3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.
4. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.

C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indiated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacigin of anchor as follows:
    a. Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
7. Door Silencers: Except on weather-stripped doors, drill stips to receive door silencers.
    a. Single-Door Frames: Three door silencers.
    b. Double-Door Frames: Two door silencers.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware".
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electical connections with Division 26 electrical sections.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
3. Provide loose stops and moldings on inside of hollow metal work.
4. Coordinate rabbet width between fixed and removeable stops with type of glazing and type of installation indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

G. Metal-Stud Partitions: Solidly pack batt insulation behind frames.

H. Masonry Walls: Coordinate installation of frames to allow for solidly filling space betwwen frames and masonry with grout.

I. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

J. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

K. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

L. Coordinate installation of hardware.

M. Comply with glazing installation requirements of Section 08 80 00.

3.3 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified door and frame standards or custom guidelines indicated.

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with glavanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.2 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 71 00 - Door Hardware.

C. Section 08 80 00 - Glazing.

1.3 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

C. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

B. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

C. Specimen warranty.

D. Samples: Submit two samples of door veneer, 12 by 12 inch in size illustrating wood grain, stain color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special installation instructions.

F. Warranty, executed in Owner's name.

1.5 QUALITY ASSURANCE

A. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.7 WARRANTY

A. Interior Doors: Provide manufacturer's warranty for the life of the installation.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries: www.eggersindustries.com.
   3. Graham Wood Doors: www.grahamdoors.com.

4. Marshfield Door Systems, Inc: www.marshfielddoors.com.

2.2 DOORS

A. Doors:
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply or 7-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

2.3 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as indicated below:
   1. Blocking: Provide composite blocking with improved screw-holding capability approved for use in door of fire-protection ratings indicated:
      a. 5 inch top rail blocking.
      b. 5 inch bottom rail blocking, in doors indicated to have protection plates.
      c. 5 inch midrail blocking, in doors indicated to have armor plates or exit devices.
   2. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.4 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Species and cut as indicated on material finish specifications on drawing sheet A602, veneer grade in accordance with quality standard indicated, with with slip match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.5 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

D. Provide edge clearances in accordance with the quality standard specified.

2.6 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 5, Varnish, Conversion.
      b. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

2.7 ACCESSORIES

A. Hollow Metal Door Frames: As specified in Section 08 11 13.

B. Glazing: As specified in Section 08 80 00.

C. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.

D. Door Hardware: As specified in Section 08 71 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Align in frames for uniform clearances at each edge.

F. Coordinate installation of glazing.

3.3 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 36 13

SECTIONAL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Overhead sectional doors, electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Steel channel opening frame.

B. Section 06 10 00 - Rough Carpentry: Rough wood framing for door opening.

C. Section 07 90 05 - Joint Sealers: Perimeter sealant and backup materials.

1.3 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

D. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

E. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

B. Product Data: Show component construction, anchorage method, and hardware.

C. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.

D. Operation Data: Include normal operation, troubleshooting, and adjusting.

E. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

B. Conform to applicable code for motor and motor control requirements.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified.

1.6 WARRANTY

A. Correct defective Work within a 10 year period after Date of Substantial Completion.

B. Warranty: Include coverage for electric motor and transmission.

C. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Aluminum and Glass Sectional Doors - Basis of Design: Overhead Door Corproration, Model 521.

B. Basis-of-Design: The design for sectional overhead doors is based on the products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Clopay Corporation: www.clopaydoor.com.
   2. Raynor.
   3. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.

2.2 ALUMINUM DOOR COMPONENTS

A. Aluminum Doors: Stile and rail aluminum with glazed panels; lift as indicated on drawings with track and hardware.
   1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
   2. Door Assembly: Stile and rail assembly secured with 1/4 inch diameter through rods.
   3. Door Nominal Thickness: 1-3/4 inches thick.
   4. Center Stile Width: 2-11/16 inches.
   5. End Stile Width: 3-5/16 inches.
   6. Intermediate Rail Pair Width: 3-11/16 inches.
   7. Stiles and Rails: 6063 - T6 aluminum.
   8. Finish: Factory anodized; **powder coated black**
   9. Weatherstripping:
      a. Flexible bulb-type strip at bottom section.
      b. Flexible Jamb seals.
      c. Flexible Header seal.
   10. Operation: Electric.

B. Door Panels: Paneled aluminum construction; extruded aluminum stiles and rails; 1/2 inch thick infill panels of glass; stile and rail joints welded; rabbeted weather joints at meeting rails.

C. Glazing: Fully tempered glass; insulated; clear, low-E; 1/2 inch thick.

2.3 DOOR COMPONENTS

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type and clearances indicated on Drawings. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed. Powder coat all tracks and brackets for aluminum doors, white color.

B. Hinge and Roller Assemblies: Heavy duty (14 gage) double hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 7 to 1. Provide springs calibrated for a minimum of 50,000 cycles. Provide spring bumpers.
   1. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either cable breaks.
   2. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level shaft and prevent sag.

D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

F. Head Weatherstripping: EPDM rubber seal, one piece full length.

G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

H. Chain Lock Keeper: Suitable for padlock.

I. Provide safety interlock switch to disengage power supply when door is locked.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Float Glass: Provide float glass glazing, unless noted otherwise.
   1. Heat-Strengthened and Fully Tempered Types: ASTM C1048.

2.5 ELECTRICAL OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by a testing agency acceptable to authorities having jurisdiction.

B. General: Provide heavy-duty, electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified to move door in either direction at not less than 2/3 foot nor more than 1 foot per second; with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

C. Comply with NFPA 70.

D. Disconnect Device: Hand-operated disconnect device for automatically engaging operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect device and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

E. Electrical Characteristics:
   1. Provide hp as recommended by manufacaturer for door size, but not less than 1/2 hp.; manually operable in case of power failure, transit speed of not less than 12 inches per second.
   2. 115 volts, single phase, 60 Hz.

F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

G. Disconnect Switch: Factory mount disconnect switch in control panel.

H. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to stop door upon striking object; hollow neoprene covered to provide weatherstrip seal.

I. Safety Beams: Manufacturer's photoelectric safty sensors to reverse door. Provide two on each side of every sectional door. Locate at two different heights as directed by Owner.

J. Control Station: Standard three button (open-close-stop) momentary type control for each electric operator.
   1. Surface mounted.
   2. Locate at inside door jamb.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.2 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

3.3 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

F. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

G. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 90 05.

3.4 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.

B. Maximum Variation from Level: 1/16 inch.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.5 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.6 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.7 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 36 14

FOUR-FOLD DOOR SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes Four-Fold metal doors with surface mounted tube frames.

B. Operation of Four-Fold metal doors includes overhead mounted electro-mechanical operators.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified consisting of manufacturer's technical Product Data and installation instructions for each type of door required, including data substantiating that products comply with requirements.

C. Submittal Drawings showing fabrication and installation of Four-Fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade.

D. Reference list including (5) successful installations of this type of door within the past two (2) years.

1.3 QUALITY ASSURANCE

A. Doors shall be designed to withstand external or internal horizontal wind loads of 20 pounds minimum per square foot. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC "Steel Construction Manual".

B. Door manufacturer shall have at least 10 years experience in manufacturing door type specified for emergency vehicle applications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store delivered materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling.

B. Handle materials carefully to prevent damage.

1.5 WARRANTY

A. The door manufacturer shall provide a written standard limited warranty for material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Door Engineering and Manufacturing, FF300 Series - Glazed.

2.2 MATERIALS

A. Steel Tube: ASTM A513 and ASTM A500/A500M

B. Steel Sheets: Steel sheets of commercial quality, complying with ASTM A1011/A1011M hot-rolled steel sheet.

C. Hardware: Manufacturer's standard components.

D. Fasteners: Zinc-coated steel.

2.3 FOUR-FOLD DOORS

A. Construction: Door framing shall be minimum 14-gauge structural steel tube with 14-gauge steel sheet on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than

1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.

B. Surface Mounted Tube Frame: Supply pre-hung tube frame system constructed of minimum TS6x4x0.25, designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.

C. Factory finish: Door Panels and Tube Frames shall be finished with manufacturer's standard PPG Spectracron epoxy primer and polyurethane top coat. Customer to select from Manufacturer's standard color chart or furnish sample to match.
   1. Operator and operating hardware shall be powder-coated manufacturer's standard gray.

D. Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation.

E. Hinges: Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Fold hinges shall be stainless steel and be dual shear with two thrust bearings. All bearings shall be completely concealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum ¾" diameter hardened steel.

F. Weatherstripping: Material shall be adjustable and readily replaceable and provide a substantially weather-tight installation. Weatherstripping at center shall be 1/16" cloth inserted neoprene and include no exposed fasteners on the exterior face of the panel. Weatherstripping at sill shall include two 1/16" cloth inserted neoprene sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.

G. Perimeter Weatherstripping: Provide jamb and head weatherstipping of 1/16" cloth-inserted neoprene bulb (or closed cell neoprene).

H. Vision Panels or Grilles: Provide 1" insulated vision panels or grilles of the size, shape and location as noted on the drawings.

2.4 OPERATOR

A. Each Four-Fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.

B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to free wheeling mode for manual operation.

C. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/230/480 VAC, 60 Hertz operation.

D. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards. Incoming electrical shall be 208VAC single phase, 208/230VAC 3-phase, 480VAC 3-phase.
   1. Controls shall include a programmable logic controller with digital message display or LED indicators. Controller shall include programmable close timers and programmable inputs/outputs.
   2. Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.
   3. If incoming voltage is single phase, control panel shall include a variable frequency drive to convert voltage to 3-phase for the motor
   4. Enclosures shall be NEMA 4 with disconnect switch.
   5. Pushbuttons (interior) for each door shall have one (1) momentary pressure three-button push-button station marked "OPEN", "CLOSE" and "STOP". Push button enclosure shall be NEMA 4.
   6. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
   7. Safety edges: Provide electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.
   8. Photo eyes: Provide (1) exterior, jamb mounted, thru-beam type photo eyes, NEMA 4 rated.

9. Presence Sensor: Provide (1) interior, overhead mounted, presence sensor.
10. Radio controls: Provide one (1) Liftmaster 850 radio receiver and (2) Liftmaster 811 single button remotes per door. Remotes to open and close doors with single button.
11. Timer Activation Loop Detectors (fire station applications): Provide "pulse on exit type" loop detector to activate auto close timer once loop has been activated and cleared, include hand/auto switch to deactivate timer. G.C. to coordinate installation of preformed loop with installer prior to exterior apron being poured.

E. Wiring: Door manufacturer shall supply controls and components only. Electrical contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Four-Fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the general contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the door opening before installation is started and shall be completed so as not to delay the inspection test.

B. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.

3.2 ADJUSTING AND CLEANING

A. Inspection of the doors and a complete operating test will be made by the installer in the presence of the general contractor or architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the general contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the owner and final inspection is made.

B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory-applied finish.

END OF SECTION

SECTION 08 43 13

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

1.2 RELATED REQUIREMENTS

A. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.4 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required. Include plans, elevations, sections, details, attachements to other work, embedment type, size and layout.

1. Provide water control diagrams for condensation and infiltration evacuation.
2. Include structural analysis data signed and sealed by the professional engineer, licensed in the State of Iowa, responsible for their preparation.

C. Samples: Submit two samples 2 x 3 inches in size illustrating finished aluminum surface, color matched to existing storefront framing..

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Mockups: Provide materials and installation for mockups specified in Division 01 Section "Mock-Up Requirements and as indicated on Drawings Sheet A---- to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.7 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.8 WARRANTY

A. Standard Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within spedified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Water leakage through fixed glazing and framing areas.
      e. Failure of operating components to function property.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: See below under description of products.
   1. Exterior Storefront System: Kawneer, Trifab VG 451T.

B. Other Acceptable Manufacturers:
   1. EFCO Corporation: www.efcocorp.com.
   2. Architectural Wall Systems.
   3. YKK AP America Inc
   4. Manko Window Systems, Inc.: www.mankowindows.com.
   5. United States Aluminum Corp
   6. Vistawall Architectural Products
   7. Pittco Architectural Metals Inc: www.pittcometals.com/sle.
   8. Tubelite, Inc.: www.tubeliteinc.com.

2.2 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.

B. Performance Requirements:
   1. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
      a. Structural loads.
      b. Thermal movements.
      c. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
      d. Dimensional tolerances of building frame and other adjacent construction.
      e. Failure includes the following:

1) Deflection exceeding specified limits.
2) Thermal stresses transferred to building structure.
3) Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
4) Noise or vibration created by wind and thermal and structural movements.
5) Loosening or weakening of fasteners, attachments, and other components.
6) Sealant failure.
7) Failure of operating units to function properly.

2. Structural Loads:
   a. Wind Loads: As indicated on Structural Drawings.
   b. Seismic Loads: As indicated on Structural Drawings.
3. Deflection of Framing Members Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of coear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
4. Structural-Test Performance: Systems tested according to ASTM E 330 as follows:
   a. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   b. When tested at 150 percent of positieve and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   c. Test Durations: As required by design wind velocity but not less than 10 seconds.
5. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
6. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
7. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
8. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
9. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at minimum static-air-pressure difference of 6.24 lbf/sq. ft. across assembly in accordance with ASTM E 283.
10. Condensation Resistance Factor: Measure in accordance with AAMA 1503 with 1 inch insulating glass installed. Fixed glazing and framing areas of systems have condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.
11. Water Leakage: None, when measured in accordance with ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
12. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
13. Air and Vapor Seal: Maintain continuous water barrier membrane throughout assembly, primarily in line with pane of glass and heel bead of glazing compound.
14. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.3 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Cross-Section: As indicated on drawings.

B. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches.
   2. Top Rail: 3-1/2 inches wide.
   3. Vertical Stiles: 3-1/2 inches wide.

4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.

2.4 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glass: As specified in Section 08 80 00.

D. Glazing Accessories: As specified in Section 08 80 00.

2.5 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.6 HARDWARE

A. Door Hardware: As specified in Section 08 71 00 - Door Hardware.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

2.7 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal and that have the following characteristics:
   1. Profiles that are sharp, straight and free of defects or deformations.
   2. Accurately fitted and secure joints and corners. Make joints flush, hairline, and weatherproof.
   3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior of building.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extend possible.

B. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops. Provide continous aluminum drip above all doors, extend to outside of door frame.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

C. Doors: Reinforce doors as required for installing hardware.
   1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

D. Prepare components to receive anchor devices. Fabricate anchors.

E. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

F. Arrange fasteners and attachments to conceal from view.

G. Reinforce components internally for door hardware .

H. Reinforce framing members for imposed loads.

I. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.2 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Install anti-walking clips in openings that are more than three frames wide per manufacturers instructions.

I. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

J. Coordinate attachment and seal of perimeter air and vapor barrier materials.

K. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

L. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufactuer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
   3. If necessary protect the exterior framing during masonry wash down.

M. Install glass and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

N. Entrances: Install to produce smooth operation and tight fit at contact points.
   1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
   2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

O. Door Hardware: Install door hardware specified in Division 8 Section "Door Hardware."

P. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 FIELD QUALITY CONTROL

A. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 25 feet by 1 story of aluminum-framed systems designated by Architect shall be tested for water leakage in accordance with AAMA 501.2 and shall not evidence water penetration.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.6 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Remove excess sealant by method acceptable to sealant manufacturer.

3.7 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 44 13

GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.

B. Miscellaneous components.

1.2 RELATED REQUIREMENTS

A. Section 07 42 13 - Composite Wood Veneer Panels.

B. Section 07 42 13.23 - Aluminum Composite Panels.

1.3 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting two weeks before starting work of this section; require attendance by all affected installers. Preinstallation meeting shall to establish procedures to maintain optimum working conditions, and to coordinate this work with related and adjacent work. Agenda for the meeting shall include, but not limited to, the following:
   1. Requirements for Building Envelope Commissioning.
   2. Review of submittals.
   3. Review of surface preparation, minimum curing period and installation procedures.
   4. Review of special details and flashings.
   5. Sequence of construction, responsibilities and schedule for subsequent operations.
   6. Review of mock-up requirements.
   7. Review of inspection, testing, protection and repair procedures.

C. Provide necessary compatibility information for Building Envelope Commissioning.

1.5 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

B. Provide stamped structural calculations for curtain wall assemblies and anchorages prepared by a professional engineer licensed in the State of Iowa.

C. Shop Drawings: : Indicate configurations (including plans, elevations and section views), and construction of all parts of the work, including metal and glass thickness, methods of joining, details of all field connections and

anchorage, fastening and sealing methods, metal finishes, and all pertinent information; completed by the curtain wall manufacturer.

1. Submit full size sections when needed for clarity.
2. Clearly indicate relationship to other work.
3. Begin fabrication only after shop drawings for that work have been accepted by the Design Professional.
4. Submit manufacturer's installation instructions.

D. Verification Samples: Include representative samples of the following for approval:
1. Submit three (3) samples of finished aluminum, 6 x 6 inch in size, illustrating specified color and finish for review and approval by the Design Professional.
2. Glass, each type.
3. Frame, mullion and corner sections.
4. Fasteners and anchors.

E. Test Reports: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Provide test reports stating the performance as specified in Article 1.05, not more than four (4) years old.

B. Manufacturer test reports shall be accompanied by the curtain wall manufacturer's letter of certification stating that the tested curtain wall meets or exceeds the referenced criteria for the appropriate curtain wall type.

C. Manufacturer: System shall be manufactured and marketed by a firm with a minimum of twenty (20) years experience in the production and sales of curtain wall systems. Manufacturers proposed for use, but not named in these specifications, shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five (5) years.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.8 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.9 WARRANTY

A. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

B. Total Curtain Wall System:
1. Provide a total system warranty for performance of the total curtain wall installation for five years after the date of Substantial Completion. This includes the glazing (including insulated units), anchorage and setting system, sealing, flashing, etc. as it relates to air, water, and structural adequacy, and these specifications and approved shop drawings.
2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at his expense during the warranty period.

PART 2 PRODUCTS

2.1 LEED REQUIREMENTS

A. Recycled Content: Provide highest recycled content available, but not less than minimum postconsumer plus one half of pre-consumer content 35 percent.

B. Comply with Section 07 92 00 "Joint Sealants" for silicone sealants. Coordinate with adjacent curtain wall construction.

C. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 MANUFACTURERS

A. Glazed Aluminum Curtain Walls: Kawneer Company, Inc.: Product 1600 Wall System 1 / System 2.

B. Acceptable manufacturers:
   1. EFCO Corporation
   2. Oldcastle BuildingEnvelope
   3. Wausau Window and Wall Systems
   4. YKK AP
   5. Tubelite.
   6. Pittco Architectural Metals

2.3 COMPONENTS

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Outside dry glazed; includes exterior aluminum pressure plate and snap-on mullion cover with interior and exterior dense EPDM preset gasket.
   2. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
      a. Cross-Sections: Sizes and shapes as indicated on the Drawings.
      b. Extrusion Wall Thickness: Minimum 1/8 inch (3 mm); all vertical and horizontal members.
   3. Finish: Superior performing organic coatings.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   4. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   7. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Entrance Doors: Glazed aluminum.
   1. Basis-of-Design Product: Kawneer Company, Inc.; 190 Standard Entrance.
   2. Acceptable manufacturers:
      a. EFCO Corporation
      b. Oldcastle BuildingEnvelope
      c. Wausau Window and Wall Systems
      d. YKK AP
      e. Tubelite Inc.
      f. Pittco Architectural Metals
   3. Major Extruded Sections: 1-3/4 inch thick; minimum 1/8 inch wall thickness.
      a. Top Rail: Minimum 2-1/4 inches wide.
      b. Vertical Stiles: Minimum 2-1/8 inches wide.
      c. Bottom Rail: Minimum 10 inches wide.
   4. Glazing Method: Dry glazed with extruded pressure-fitting aluminum glazing stops, and a gasket that complies with ASTM E 2203.
   5. Glazing Stops: Square; minimum 0.050 inch thickness. Exterior stops shall be an integral part of the door; interior stops shall be snap-in type.
   6. Finish: Same as curtain wall frames.
   7. Construction: Welded corner. Tie rod only construction is not acceptable.

8. Storefront and Vestibule Framing: Where storefront framing is indicated on drawings, provide storefront framing by same manufacturer as curtain wall in sizes as indicated on drawings.

C. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with the applicable code.
   2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
      c. Movement of curtain wall relative to perimeter framing.
      d. Deflection of structural support framing, under permanent and dynamic loads.

D. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 psf.

E. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.

F. Thermal Performance Requirements:
   1. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
   2. Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F), maximum.

G. COMPONENTS

H. Glazing: As specified in Section 08 80 00.

2.4 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Structural Steel Sections: ASTM A36/A36M; shop primed.

D. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

E. Concealed Flashings: Stainless steel, 20 gage, 0.032 inch minimum thickness.

F. Curtain Wall Break Metal: Aluminum, minimum 0.064 inch thick, finished to match curtain wall framing.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: As specified in Section 08 80 00.

I. Silicone Transision: Provide silicone transition strip at perimeter conditions between composite wood panels, aluminum composite panels, fiber reinforced cementitions panels, thin limestone adhered panels and the work of this section to provide an air and watertight seal. Silicone transition strip must be compatible with the air and vapor barrier being applied to the exterior sheathing withing the exterior cladding systems.
   1. Acceptable Products:
      a. Dow Corning 123 Preformed Silicone Seal
      b. Momentive UltraSpan US1100
      c. Tremco Spectrem Simple Seal

2.5 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.2 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Structural Sealant Glazing (SSG) Adhesive: Install structural sealant glazing adhesive and weatherseal sealant in accordance with manufacturer's instructions.

H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

I. Silicone Transition Installation:
   1. Coordinate installation methods and sequencing of installation with weather barrier, composite wood panels, aluminum composite panels, fiber reinforced cementitions panels, and thin limestone adhered panel contractors. Silicone transition must be installed and sealed to air/water/vapor barrier within panel walls after air/water/vapor barrier components have been installed and prior to installation of cladding panels.
   2. Clean surfaces where silicone transition is to be applied in accordance with transition boot manufacturer’s written recommendations. Set transition material in a continuous bed of sealant.
   3. Secure silicone transition on both sides of the perimeter joints and provide continuous sealant compatible with air/water/vapor barrier.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. Hose Tests
   1. Field hose testing for resistance to water leakage shall be conducted and results interpreted as defined herein. Perform a minimum of five (5) field hose tests. Test areas shall include both curtain wall system(s) and adjacent construction. Coordinate testing of curtain wall areas with adjacent construction contractors as required. Area and time of tests shall be per the direction of the Architect. Initial testing shall be conducted early in the construction schedule. Schedule any out of sequence work necessary, such as out of sequence sealant work, so that selected areas can be tested as specified.
   2. For curtain wall areas, each test area shall be three glass openings wide by two floors high, or 400 ft2, whichever is greater. There shall be no unacceptable water leakage as defined in this Section.
   3. Conduct test with Monarch Type B-25 #6.030 brass nozzle and 3/4 inch diameter hose. Water pressure to nozzle shall be in the range 30 to 35 psi. Working upward from bottom of test area, direct water at 5 foot long segments of glazing seals, frame joints and perimeter joints, moving slowly back and forth on each segment for minimum of 5 minutes. Where a framing member is between two glass units and its width does not exceed 4 inches, both lines of glazing seal may be tested as one segment by centering the spray on one glazing seal while moving in one direction, and centering the spray on the other glazing seal while moving in the opposite direction. Sustained spraying at one point while the nozzle remains stationary is acceptable. Tip of nozzle shall be 12 inches from specimen exterior surface. Nozzle shall generally be perpendicular to specimen surface, but shall be tilted to any angle that maximizes exposure of a given joint to water flow rate and kinetic energy. Continuously check for leakage on indoor side. If necessary to pinpoint leak sources, perform additional testing. Repeated testing of joints is acceptable. The use of masking to pinpoint leaks is acceptable.
   4. Check completed areas below test area, and report any leaks that occur. A test that results in leakage at a completed area below a designated test area is a failure.

5. Contractor performing work of this Section shall provide powered scaffold, hose, water supply, and manpower to perform each test, plus any unsuccessful tests.
6. If failure occurs, revise and retest specimens. Modifications must be realistic in terms of project conditions, must maintain standards of quality and durability and are subject to approval. If failure necessitates retesting, Contractor for Work of this Section shall pay all additional fees associated with retesting, including fees and costs incurred by the testing agent, the Architect, Owner and their representatives.
7. Submit, for information only, reports that contain dates of tests, elevation drawings of test areas with locations relative to grid lines (including any lower areas where leaks occur), and location of each leak.

B. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

3.5 ADJUSTING

A. Adjust operating sash for smooth operation.

3.6 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

3.7 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 45 10

INSULATED TRANSLUCENT WALL PANEL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for daylighting - insulated translucent wall panel system as shown and specified herein

1.2 WORK INCLUDES

A. Design, engineer, manufacture and installation of unitized quad glazed insulated translucent wall light panel system. An assembly of two independent insulated 10mm single glazing multi-cell polycarbonate panels in one integrated daylighting panel assembly, incorporated into a complete aluminum framed system that has been tested and warranted by the manufacturer as a single source system. Design shall provide for the replacement of the exterior panel, independently of the interior single panel and without exposing the interior or compromising the weather tightness or interfering with the normal working functions of the building. The interior single insulated panel remains intact for the life of the building envelope. Single panel extruded polycarbonate cellular or fiberglass sandwich panel systems in lieu of 2 panel's assembly with removable skin technology will not meet these requirements and are not acceptable.

B. All anchors, brackets, and hardware attachments necessary to complete the specified structural assembly, weatherability and water-tightness performance requirements. All flashing up to but not penetrating adjoining work are also required as part of the system and shall be included.

C. Trained and factory authorized labor with supervision to complete the entire panel installation.

1.3 QUALITY ASSURANCE

A. The glazing panels must be evaluated and listed by recognized building code evaluation organization: International Council Evaluation Service Inc (ICC-ES)

B. Materials and Products shall be manufactured by a company continuously and regularly employed in the manufacturing, engineering, and designing, stocking and building of wall lights using the specified material and system for a period of at least ten (10) years.

C. Erection shall be by a factory-approved installer who has been in the business of erecting similar material for at least five (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

D. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system, in accordance with the requirements of this specification.

1.4 SUBMITTALS

A. Manufacturer shall submit written guarantee accompanied by substantiating data, stating that the products to be furnished are in accordance with or exceed these specifications.

B. The manufacturer shall submit certified test reports made by an independent organization. Reports shall verify that the material will meet all performance requirements of this specification. Previously completed test reports will be acceptable if they are indicative of products used on this project. Test reports required are:
   1. Self-Ignition Temperature (ASTM 1929-3)
   2. Smoke Density (ASTM D-2843)
   3. Burning Extent (ASTM D-635)
   4. Interior Flame Spread (ASTM E-84)
   5. Color Difference (ASTM D-2244-85)
   6. Tests on a weathered system after approximately10 years of actual exposure in Florida field conditions. Tests shall include:
      a. Uniform static air pressure per ASTM 330
      b. Impact loading per ASTM E695
      c. Cyclic static air pressure and missile impact level D per ASTM 1886 & ASTM E1996.
   7. Weathering Evaluation before and after exposure to 300°F, 25 minutes include Light Transmission and Color Change, per ASTM E-1175, and ASTM D-2244 respectively.

8. Large Missile Test - Impact Resistance per SFBC PA 201-94
9. Impact loading per ASTM E695
10. Insulation's 'U' value for Center of Glazing per NFRC100.
11. Insulation's 'U' value for wall-light system, glazing and aluminum framing, per NFRC 100 & NFRC 700 certification.
12. Visible light Transmission (VT) per ASTM E972 & ASTM E1084
13. Solar Heat Gain Coefficient (SHGC) based on tests or calculations which are based on tests per methodology and procedure given in the NFRC/Calorimeter Standard.
14. Maximum air infiltration rate for fenestration assemblies of Curtain walls, per NFRC 400 or ASTM E283.
15. Water Penetration (ASTM E-331)
16. Load Bearing Capability (ASTM E-330-97).
17. Performance of exterior windows, curtain walls per ASTM E 1886 & ASTM E 1996-02, Level D
18. Haze per ASTM D 1003 for glare measurement.
19. ICC evaluation service report for compliance with IBC building code for polycarbonate glazing as an approved light transmission plastic with CC1 rating per chapter 26, and class A interior finish glazing per chapter 8.

C. MAINTENANCE DATA: The manufacturer shall provide recommended maintenance procedures, schedule of maintenance and materials required or recommended for maintenance.

D. Submit Installer Certificate signed by installer, certifying compliance with project qualification requirements.

1.5 WARRANTY

A. Provide a single source Wall Light system manufacturer warranty against defective materials and fabrication. Submit manufacturer's written warranty agreeing to repair Wall Light system work, which fails in materials within two years from date of delivery.

B. Provide single source Wall Light's manufacturer 10 year glazing panel warranty. Third party warranty for glazing panels shall not be acceptable. Glazing warranty to include:
1. Change in light transmission of no more than 6% per ASTM D-1003
2. No delamination of panel affecting appearance, performance or structural integrity of the panel or the system
3. Thermal aging - the light transmission and the color shall not change after exposure to heat of 300°F for 25 minutes (when measured per ASTM D-1003 and ASTM D-2244 respectively).

C. In addition submit installer's written warranty agreeing to repair installation workmanship, defects and leaks two years from date of delivery.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: UniQuad – Unitized quad-glazed (2 panel's assembly) Wall-Light system as manufactured by CPI Daylighting, Inc.

2.2 TRANSLUCENT PANEL PERFORMANCE AND APPEARANCE

A. Panel construction for Longevity and Resistant to Buckling and Pressure:
1. Translucent panels must be constructed of tight cell sizes not exceeding 0.18". Wide cell l size exceeding 0.18"shall not be acceptable.
2. The translucent panel shall include an integral extruded tight-cell structural core. The panel's exterior skins shall be connected with supporting continuous ribs, perpendicular to the skins, at a spacing not to exceed 0.18" (truss-like construction). In addition, the space between the two exterior skins shall be divided by multiple parallel horizontal surfaces, at a spacing not to exceed 0.18".

B. Translucent Wall Panel – Unitized Quad Glazed
1. Design, engineer, manufacture and installation of unitized quad glazed insulated translucent wall-light system. An assembly of two independent insulated single glazing polycarbonate multi-cell panels in one integrated daylighting panel assembly, incorporated into a complete aluminum framed system that has been tested and warranted by the manufacturer as a single source system. Design shall provide for the replacement of the exterior panel independently of the interior single panel and without exposing the interior

or compromising the weather tightness or interfering with the normal working functions of the building. The interior single insulated panel remains intact for the life of the building envelope. Single panel extruded polycarbonate cellular or fiberglass sandwich panel systems in lieu of 2 panel's assembly with removable skin technology will not meet these requirements and are not acceptable.

2. Panel glazing assembly thickness shall be a minimum 4" two panel system with concealed interlocking connector or H battens. Minimum thickness of the exterior and the interior single panels shall be 10mm thick each.

C. Thermal and Solar Performance:
   1. Insulation "U" Value performance per NFRC100 & 700, is required by the IBC/IECC/ASHRE energy code. Such performance values must be certified and labeled by NFRC.
   2. U value for standard panel assembly with no bat or aerogel insulation, Center of Glazing per NFRC100: 0.22
   3. U value for panel system assembly with no bat or aerogel insulation and including wall-light aluminum framing per NFRC100 & NFRC700: 0.26.
   4. Visible Light Transmission - Center of Glass 50% per ASTM E972 ASTM & E1084.
   5. Solar Heat Gain Coefficient (SHGC) 0.39 independently tested or calculated based on testing per methods and procedures given in the NFRC Calorimeter
   6. Standard Color: Clear Matt.

D. Translucent Panel Joint System:
   1. Panel shall be extruded in one single formable length. Transverse connections are not acceptable.
   2. The panels should be manufactured with grip-lock double tooth upstands that are integral to the unit. The upstands shall be 90 degrees to the panel face (standing seam dry glazed concept). Welding or gluing of upstands or standing seam is not acceptable.
   3. The metal H battens shall consist of 2 pieces, male/female concept with build in silicon gasket, allowing for a unitized panel assembly.
   4. Water Penetration: No water penetration of the panel H joint connection length at test pressure of 6.24 PSF per ASTM E-331
   5. Air Infiltration: In accordance with NFRC 400.
   6. Free movement of the panels shall be allowed to occur without damage to the weather tightness of the completed system.
   7. The panel joint connection shall comply with the deflection limitation of IBC Table 1604.3 for exterior walls with flexible finishes - span/120 per ASTM E-330.

E. Flammability:
   1. The exterior and interior panels shall be an approved light transmitting panel with a CC1 fire rating classification per ASTM D-635. Flame spread no greater than 25 per ASTM E-84. Smoke density no greater than 75 per ASTM D2843 and a minimum self-ignition temperature of 1000°F per ASTM 1929.
   2. Interior flame spread classification of Class A per ASTM E84.

F. Impact Resistance - the panels shall pass the following tests:
   1. SFBC – PA 201-94, impact resistance of 350 ft. lbs.
   2. ASTM E 695 - Impact loading per - 500 ft. lbs.
   3. ASTM E-1996-02 - Must comply with standard specification for performance of exterior windows or curtain walls when impacted by windborne debris at level D and after cyclic wind loading at the specified design load.

G. Cyclic Wind Load:
   1. Translucent Panels shall be tested for cyclic wind loads and impact resistance per ASTM E 1886-97 and ASTM E 1996-02 at test load to verify the positive and negative design loads and level D impact.

H. Weatherability:
   1. The light transmission shall not decrease more than 6% as measured by ASTM D-1003 over 10 years, or after exposure to temperature of 300°F for 25 minutes (thermal aging performance standard).
   2. The weathering performance should be justified by successful testing of the glazing panel's performance after exposure to actual Florida weather conditions for approximately 10 years in comparison to a new panel assembly. This performance must be demonstrated by providing independent lab test reports for the exposed and a new panel assembly of Quadwall with 10mm exterior, 6' wide x 12' long for:
      a. Uniform static air pressure per ASTM 330 at negative load of -105psf and positive load of 130psf
      b. Impact loading per ASTM E695 of 500 ft-lb.
      c. Cyclic static air pressure at 65 PSF and impact level D per ASTM 1886 & ASTM E1996

3. Test results must show that there is no deterioration in performance for the 10 year's exposed panels versus a new panel.
4. Panels must be manufactured from polycarbonate resin with a permanent, co- extruded ultra-violet protective layer. Post-applied coatings or films of dissimilar materials are unacceptable.
5. The faces shall not become readily detached when exposed to temperatures of 300°F and 0°F for 25 minutes.
6. Thermal aging - the interior and exterior panel shall not change color in excess of 0.75 Delta E per ASTM D2244 and shall not darken more than 0.3 units Delta L per ASTM D2244 and shall show no cracking or crazing when exposed to 300°F for 25 minutes.
7. Panel shall be factory sealed at the sill to restrict dirt ingress.

I. Glare and Diffused Light Transmission:
1. To avoid glare per IECC requirements, the panels shall have a matte finish with a minimum Haze measurement of 90% per ASTM D1003.

2.3 METAL FRAME STRUCTURE

A. Design loads: As indicated on Structural Drawings.

B. The wall light framing is designed to be self-supporting between the support constructions. The deflection of the structural framing members in a direction normal to the plane of the glazing, when subjected to a uniform load deflection, shall not exceed L/120 for the unsupported span per IBC 2012 table 1604.3. The wall lights will impose reactions to the support construction. All adjacent and support construction must support the transfer of all loads including horizontal and vertical, exerted by the wall lights. Design or structural engineering services for the supporting structure or building components is not included in the wall light scope of this section.

C. Water Penetration: The metal framed wall light panels shall allow no water penetration at a minimum differential static pressure of 6.24 lbs. per sqf per AAMA 501 pressure difference recommendations and as demonstrated by prior testing of typical framing sample per ASTM E-331

D. Water test of metal frame structure shall be conducted according to procedures in AAMA 501.2.

E. Maximum air infiltration rate for fenestration of the two panel assemblies of wall light shall be per NFRC 400.

2.4 METAL MATERIALS

A. Extruded Aluminum shall be ANSI/ASTM B221; 6063-T6: 6063-T5 or 6005-T5.

B. Flashing:
1. 5005 H34 aluminum
2. Sheet metal flashings/closures/claddings are to be furnished shop formed to profile - when lengths exceed 10 ft. in nominal 10-ft lengths. Field trimming of the flashing and field forming the ends is necessary to suit as-built conditions. Sheet metal ends are to overlap at least 6-in. to 8-in., set in a full bed of sealant and riveted if required.

C. All Fasteners for aluminum framing to be stainless steel or cadmium plated steel, excluding the final fasteners to the building.

D. Finish: Clear anodized with 5 year warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Contractor to verify when structural support is ready to receive all work in this section and to convene a Pre-Installation Conference at least one week prior to commencing work of this Section. Attendance required of General Contractor, wall light installer and all parties directly affecting and effected by the work of this section.

B. All submitted opening sizes, dimensions and tolerances are to be field verified by general contractor unless otherwise stipulated.

C. Installer shall examine area of installation to verify readiness of site conditions. Notify general contractor about any defects requiring correction. Do not work until conditions are satisfactory.

3.2 INSTALLATION

A. Install components in strict accordance with manufacturer's instructions and approved shop drawings. Use proper fasteners, caulking and hardware for material attachments as specified.

B. Use methods of attachment to structure allowing sufficient adjustment to accommodate tolerances.

C. Remove all protective coverings on panels immediately after installation.

3.3 CLEANING

A. Follow manufacturer's instructions when washing down exposed panel surfaces using a solution of mild detergent in warm water that is applied with soft, clean wiping cloths. Always test a small area before applying to the entire area.

B. Follow strict panel manufacturer guidelines when removing foreign substances from panel surfaces requiring mineral spirits or any solvents that are acceptable for use. Always test a small sample to validate compliance before applying to the entire glazing panels.

C. Installers shall leave panel system clean at completion of installation. Final cleaning is by others upon completion of project, following manufacturer's cleaning instructions.

END OF SECTION

SECTION 08 62 23

TUBULAR SKYLIGHTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.

1.2 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

B. AAMA Standard 1600, Voluntary Specification for Skylights

C. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.

D. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2016.

E. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics; 2010.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, flashings and accessories.

C. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

D. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than ten years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Skylights: Manufacturer's standard warranty for 10 years.

B. Electrical Parts: Manufacturer's standard warranty for three years, unless otherwise indicated.

PART 2 PRODUCTS

2.1 TUBULAR SKYLIGHTS

A. Tubular Skylights: Transparent roof-mounted skylight dome and curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.
   1. Fabrication and assembly of components is by single manufacturer.
   2. Non-Metal Parts: Flammability less than the following.
      a. Roof-Top Components: Class B when tested in accordance with ASTM E108 or UL 790.
      b. Self-Ignition Temperature: Greater than 650 degrees F, when tested in accordance with ASTM D1929.
      c. Smoke Developed Index: Maximum of 450, when tested in accordance with ASTM E84; or maximum rating of 75, when tested in accordance with ASTM D2843.
      d. Combustibility - Light Transmitting Parts: Minimum 2.5 inches/min (ICC Class CC-2), when tested in accordance with ASTM D635.
      e. Combustibility - Non-Light Transmitting Parts: Minimum 2.5 inches/min (ICC Class CC-2), when tested in accordance with ASTM D635.
   3. Thermal Movement: Fabricate to allow for thermal movement resulting from temperature differential from minus 30 to 180 degrees F without damage to components, fasteners, or substrates.

B. Basis-of-Design: Solatube Model 750 DS-O Closed Ceiling, 21 inch Daylighting System:
   1. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
      a. Outer Dome Glazing: Type DA, 0.125 inch minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV C), impact modified acrylic blend.
      b. Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
      c. Inner Dome Glazing: Type DAI, 0.115 inch minimum thickness acrylic classified as CC2 material.
   2. Roof Flashing Base:
      a. One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M, 0.028 inch thick.
         1) Base Style: Type FC, Curb cap, with inside dimensions of 27 inches by 27 inches to cover roof curb.
   3. Dome Edge Protection Band: Type PB, For fire rated roofs with turret height less than 8 inches Galvanized steel. Nominal thickness of 0.039 inch.
   4. Tube Ring: Attached to top of base section; 0.090 inch nominal thickness injection molded high impact PVC; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
   5. Tube Ring Seal: Attached to the base of the dome ring; butyl glazing rope 0.24 inch diameter; to minimize air infiltration
   6. Dome Seal: Adhesive backed weatherstrip, 0.63 inch tall by 0.28 inch wide.
   7. Reflective Tubes: Aluminum sheet, thickness 0.018 inch.
      a. General:
         1) Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Specular reflectance for visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum reflectance (400 nm to 2500 nm) less than 80.2 percent.
         2) Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
   8. Diffuser Assemblies for Tubes Not Penetrating Ceilings (Open Ceiling): Solatube Model 750 DS-O. 21 inch diameter diffuser attached directly to bottom of tube.
      a. Lens: Type L2, Prismatic lens designed to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.100 inch thick. Classified as CC2.

b. Diffuser Seal: Open cell foam, acrylic adhesive backed, 0.75 in wide by 0.125 in thick to minimize condensation and bug, dirt and air infiltration per ASTM E 283.
c. Diffuser Trim Ring: Injection molded acrylic. Nominal wall thickness 0.172 inches.

9. Accessories:
   a. Closed Ceiling Trim Ring: Type R, ABS Plastic, White; nominal thickness of 0.04 inch.
   b. Local Dimmer Control utilizing a butterfly baffle design of Spectralight Infinity reflective material to minimize shadowing when in use: Provided with dimmer switch and cable.
      1) Daylight Dimmer: (Provide in locations indicated) Type D Electro-mechanically actuated daylight valve; for universal input voltages ranging between 90 and 277 V at 50 or 60 Hz; maximum current draw of 50 ma per unit; controlled by low voltage, series Type T02: circuited, 4 conductor, size 22 cable; providing daylight output between 2 and 100 percent. Provided with dimmer switch and cable.
      2) Switch: Type SW, Manufacturer-specific low voltage DC DP/DT switch (white) required to operate Daylight Dimmer.
      3) Cable: Type CA, Two conductor low voltage cable (500 foot) for multiple unit DC connection.
   c. Security Kit: Type SK Dome Security Kit, rivets with nylon spacers to replace dome screws.

2.2 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific tubular skylight:
   1. Product Type: Tubular Daylighting Device, Closed Ceiling (TDDCC).

B. Positive and negative wind loads as indicated on structural drawings.

C. No permanent deflection in excess of 0.2 percent of span.

D. Air Infiltration: Maximum 0.10 cu ft/min sq ft per unit area of outside frame dimension at 6.27 psf pressure differential when tested in accordance with ASTM E283.

E. Water Resistance: No uncontrolled water leakage at 6.27 psf pressure differential with water rate of 5 gallons/h/sf, when tested in accordance with ASTM E331; design to ensure that water will not accumulate inside assembly.

2.3 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

C. Sealant: Elastomeric, silicone or polyurethane; compatible with materials being sealed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Set roof assembly flashing in continuous bead of sealant.

C. Seal joints exposed to weather in accordance with sealant manufacturer's written instructions.

D. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

   a. Swinging doors.
   b. Sliding doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Details of electrified door hardware.

C. Samples: For each exposed product and for each color and texture specified.

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

   a. Format: Use same scheduling sequence and vertical format and use same door numbers as in the Contract Documents.
   b. Content: Include the following information:

      1) Identification number, location, hand, fire rating, size, and material of each door and frame.
      2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.

2. Keying Schedule: Prepared by or under the supervision of Supplier, detailing Owner's final keying instructions for locks.

1.3 QUALITY ASSURANCE

A. Supplier Qualifications: The hardware supplier shall be a corporate member in good standing of The Door and Hardware Institute (DHI), employing at least one Architectural Hardware Consultant (AHC) who is currently participating in DHI's continuing education program (CEP).

B. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

C. Items of hardware not definitely specified herein but necessary for completion of the work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.

D. Include such nuances as strike type, strike lip length, raised barrel hinges, mounting brackets, blade stop spacers, special templates, fasteners, shims, and coordination between conflicting products. All doors shall be provided with a stop.

E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated. Provide positive latching and self-closing, regardless if specified in sets.

F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
    b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
    c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degress from the latch, measured to the leading edge of the door.

J. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Manufacturers' standard warranty period.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. Select Products Limited.
c. Stanley Commercial Hardware; Div. of The Stanley Works.

2.3 MECHANICAL LOCKS AND LATCHES

A. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

B. Bored Locks: BHMA A156.2; Grade 1; Series 4000.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Best Access Systems; Div. of Stanley Security Solutions, Inc.
b. Corbin Russwin Architectural Hardware; n ASSA ABLOY Group Company.
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

C. Push-Pull Latches: Mortise, BHMA A156.13; Grade 1; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Architectural Builders Hardware Mfg., Inc.
b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.4 AUXILIARY LOCKS

A. Narrow Stile Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.

2.5 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. Rockwood Manufacturing Company.
c. Trimco.

2.6 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. Rockwood Manufacturing Company.
c. Trimco.

2.7 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
b. Precision Hardware, Inc.; Division of Stanley Security Solutions, Inc.
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.8 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Best Access Systems; Div. of Stanley Security Solutions, Inc.

B. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.9 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
1. Existing System:

a. Master key or grand master key locks to Owner's existing Best system.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Owner.

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.

2.10 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Key Boxes and Cabinets.
b. GE Security, Inc.

c. HPC, Inc.
d. Lund Equipment Co., Inc.
e. MMF Industries.
f. Tri Palm International.

2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.11 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. Rockwood Manufacturing Company.
c. Trimco.

2.12 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.13 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force. Provide extra duty arms at parallel arm closers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company. DC8000 Series.
b. SARGENT Manufacturing Company; an ASSA ABLOY Group company. 281 Series.
c. Stanley Door Closers; a Division of Stanley Security Solutions, Inc. D-4550 Series.

2.14 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass base metal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. Rockwood Manufacturing Company.

c. Trimco.

2.15 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Architectural Builders Hardware Mfg., Inc.
b. Rockwood Manufacturing Company.
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.16 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. National Guard Products.
c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
d. Reese Enterprises, Inc.

2.17 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. National Guard Products.
c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
d. Reese Enterprises, Inc.

2.18 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. Rockwood Manufacturing Company.
c. Trimco.

2.19 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hager Companies.
    b. Rockwood Manufacturing Company.
    c. Stanley Commercial Hardware; Div. of The Stanley Works.
    d. Trimco.

2.20 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
2. Hanchett Entry Systems, Inc.; an ASSA ABLOY Group company.
3. Trine Access Technology.

2.21 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
        2) Strike plates to frames.
        3) Closers to doors and frames.

    b. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.
        2) Closers to doors and frames.
        3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.22 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

C. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

F. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

G. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

H. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, in equipment room. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

I. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

J. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

K. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

L. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

M. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

N. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.2 DOOR HARDWARE SCHEDULE

HARDWARE SET 1

1	EA	CONTINUOUS HINGE	780-112HD	628	HAG
1	EA	ELECTRIC STRIKE	9600	630	HES
1	EA	SMART PAC	2005M3		HES
1	EA	EXIT DEVICE	2103CD X CA-03	630	PRE
2	EA	CYLINDER	AS REQUIRED	626	BES
1	EA	PULL	BF157	630	ROC
1	EA	OVERHEAD STOP	1000	630	ABH
1	EA	AUTO OPERATOR	MAC-LL1C-R	628	MOT
1	EA	ACTUATOR	10PBS1	630	BEA
1	EA	WEATHER RING	10WRSQ475		BEA
1	EA	BOLLARD	10BOLLARDSLV	689	BEA
1	EA	THRESHOLD	8425	719	NGP
1	EA	SWEEP	200NA	628	NGP
1	SET	WEATHERSTRIPPING	BY DOOR AND FRAME MANUFACTURER		
1	EA	CARD READER	BY SECURITY CONTRACTOR		

OPERATIONAL DESCRIPTION: Door normally closed, locked and exterior actuator is deactivated. Valid credential allows entry and use of exterior actuator. Vestibule actuator always active for use. Door remains closed and locked upon loss of power. Free egress at all times.

HARDWARE SET 2

1	EA	CONTINUOUS HINGE	780-112HD	628	HAG
1	EA	DUMMY BAR	674DR	630	PRE
1	EA	PULL	BF157	630	ROC
1	EA	AUTO OPERATOR	MAC-ML1C-R	628	MOT
1	EA	ACTUATOR	10PBDGP1	630	BEA
1	EA	ACTUATOR	10PBS1	630	BEA
2	EA	MOUNTING BOX	10BOX475SQFM	BLK	BEA
1	EA	WALL STOP	403	626	ROC

HARDWARE SET 3

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	ELECTRIC STRIKE	1500	630	HES
1	EA	STOREROOM	9K3 7D 14C S3	626	BES
1	EA	CLOSER	D-4551	689	STA
1	EA	KICK PLATE	10” X 2” LDW	630	ROC
1	EA	WALL STOP	403	626	ROC
1	EA	CARD READER	BY SECURITY CONTRACTOR		

OPERATIONAL DESCRIPTION: Door normally closed and locked. Valid credential allows entry. Door remains closed and locked upon loss of power. Free egress at all times.

HARDWARE SET 4

HARDWARE BY DOOR SUPPLIER

HARDWARE SET 5

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	PRIVACY	9K3 0L 14C S3	626	BES
1	EA	WALL STOP	403	626	ROC

HARDWARE SET 6

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	OFFICE	9K3 7AB 14C S3	626	BES
1	EA	WALL STOP	403	626	ROC
1	SET	SEALS	5050	BLK	NGP

HARDWARE SET 7

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	STOREROOM	9K3 7D 14C S3	626	BES
1	EA	CLOSER	D-4551	689	STA
1	EA	KICK PLATE	10” X 2” LDW	630	ROC
1	EA	WALL STOP	403	626	ROC

HARDWARE SET 8

1	EA	CONTINUOUS HINGE	780-112HD	628	HAG
1	EA	ELECTRIC STRIKE	9600	630	HES
1	EA	SMART PAC	2005M3		HES
1	EA	EXIT DEVICE	2103CD X CA-03	630	PRE
2	EA	CYLINDER	AS REQUIRED	626	BES
1	EA	PULL	BF157	630	ROC
1	EA	OVERHEAD STOP	1000	630	ABH
1	EA	DROP PLATE	P45-180	689	STA
1	EA	CLOSER	D-4550	689	STA
1	EA	THRESHOLD	8425	719	NGP
1	EA	SWEEP	200NA	628	NGP
1	SET	WEATHERSTRIPPING	BY DOOR AND FRAME MANUFACTURER		
1	EA	CARD READER	BY SECURITY CONTRACTOR		

OPERATIONAL DESCRIPTION: Door normally closed and locked. Valid credential allows entry. Door remains closed and locked upon loss of power. Free egress at all times.

HARDWARE SET 9

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	STOREROOM	9K3 7D 14C S3	626	BES
1	EA	CLOSER	D-4550 CS	689	STA
1	EA	KICK PLATE	10” X 2” LDW	630	ROC
1	EA	THRESHOLD	8425	719	NGP
1	EA	SWEEP	200NA	628	NGP
1	SET	WEATHERSTRIPPING	9700A	628	NGP
1	EA	DRIP CAP	16A	628	NGP

HARDWARE SET 10

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	CLASSROOM	9K3 7R 14C S3	626	BES
1	EA	KICK PLATE	10” X 2” LDW	630	ROC
1	EA	WALL STOP	403	626	ROC

HARDWARE SET 11

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	PASSAGE	9K3 0N 14C S3	626	BES
1	EA	CLOSER	D-4551 DA H	689	STA
1	EA	KICK PLATE	10" X 2" LDW	630	ROC
1	EA	WALL STOP	403	626	ROC

HARDWARE SET 12

1	EA	CONTINOUS HINGE	780-224HD	628	HAG
1	EA	PUSH PLATE	70F 8" X 16" LDW	630	ROC
1	EA	PULL PLATE	BF111 X 70C 4" X 16" LDW	630	ROC
1	EA	OVERHEAD STOP	4400	630	ABH
1	EA	CLOSER	D-4551	689	STA
1	EA	KICK PLATE	10" X 2" LDW	630	ROC
1	SET	SEALS	5050	BLK	NGP
1	EA	AUTO DOOR BOTTOM	423N	628	NGP

HARDWARE SET 13

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	EXIT DEVICE	2101	630	PRE
1	EA	CLOSER	D-4550 CS	689	STA
1	EA	KICK PLATE	10" X 2" LDW	630	ROC
1	EA	THRESHOLD	8425	719	NGP
1	EA	SWEEP	200NA	628	NGP
1	SET	WEATHERSTRIPPING	9700	628	NGP
1	EA	DRIP CAP	16A	628	NGP

HARDWARE SET 14

2	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	FLUSH BOLT	555	626	ROC
1	EA	CLASSROOM	9K3 7R 14C S3	626	BES
2	EA	OVERHEAD STOP	4400	630	ABH

HARDWARE SET 15

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	DEADLATCH	2190-4-1-1-1-01	630	ADA
1	EA	CYLINDER	AS REQUIRED	626	BES
1	EA	ADA THUMBTURN CYLINDER	AS REQUIRED	626	BES
1	EA	OVERHEAD HOLDER	1000	630	ABH
1	EA	DROP PLATE	P45-180	689	STA
1	EA	CLOSER	D-4550	689	STA
1	EA	THRESHOLD	8425	719	NGP
1	EA	SWEEP	200NA	628	NGP
1	SET	WEATHERSTRIPPING	BY DOOR AND FRAME MANUFACTURER		

HARDWARE SET 16

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	CLASSROOM	9K3 7R 14C S3	626	BES
1	EA	CLOSER	D-4551	689	STA
1	EA	WALL STOP	403	626	ROC
1	EA	SWEEP	198NA	628	NGP
1	SET	WEATHERSTRIPPING	BY DOOR AND FRAME MANUFACTURER		

HARDWARE SET 17

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	ELECTRIC STRIKE	1500	630	HES
1	EA	STOREROOM	9K3 7D 14C S3	626	BES
1	EA	CLOSER	D-4551	689	STA
1	EA	WALL STOP	403	626	ROC
1	EA	CARD READER	BY SECURITY CONTRACTOR		

OPERATIONAL DESCRIPTION: Door normally closed and locked. Valid credential allows entry. Door remains closed and locked upon loss of power. Free egress at all times.

HARDWARE SET 18

2	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	FLUSH BOLT	555	626	ROC
1	EA	STOREROOM	9K3 7D 14C S3	626	BES
2	EA	OVERHEAD STOP	4400	630	ABH

HARDWARE SET 19

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	PRIVACY	9K3 0L 14C S3	626	BES
1	EA	OVERHEAD STOP	4400	630	ABH

HARDWARE SET 20

1	EA	BYPASS HARDWARE	HBP200A	628	PEM
1	EA	BYPASS FASCIA	F134C	628	PEM
2	EA	FLUSH PULL	BF97L	630	ROC

HARDWARE SET 21

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	EXIT DEVICE	2108CD X 4908D	630	PRE
2	EA	CYLINDER	AS REQUIRED	626	BES
1	EA	CLOSER	D-4550 CS	689	STA
1	EA	KICK PLATE	10” X 2” LDW	630	ROC

HARDWARE SET 22

1	EA	CONTINUOUS HINGE	780-224HD	628	HAG
1	EA	ELECTRIC STRIKE	9600	630	HES
1	EA	SMART PAC	2005M3		HES
1	EA	EXIT DEVICE	2103CD X CA-03	630	PRE
2	EA	CYLINDER	AS REQUIRED	626	BES
1	EA	PULL	BF157	630	ROC
1	EA	CLOSER	D-4550 CS	689	STA
1	EA	THRESHOLD	8425	719	NGP
1	EA	SWEEP	200NA	628	NGP
1	SET	WEATHERSTRIPPING	9700A	628	NGP
1	EA	DRIP CAP	16A	628	NGP
1	EA	CARD READER	BY SECURITY CONTRACTOR		

OPERATIONAL DESCRIPTION: Door normally closed and locked. Valid credential allows entry. Door remains closed and locked upon loss of power. Free egress at all times.

END OF SECTION 087100

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Plastic films.

D. Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

D. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing furnished as part of wall assembly.

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

E. ASTM C1036 - Standard Specification for Flat Glass; 2016.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

K. GANA (GM) - GANA Glazing Manual; 2009.

L. GANA (SM) - GANA Sealant Manual; 2008.

M. ITS (DIR) - Directory of Listed Products; current edition.

N. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

Q. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.4 SUBMITTALS

A. Product Data on Insulating Glass Unit, Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Samples: Submit two samples 12 by 12 inch in size of glass units.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.7 WARRANTY

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com.
   2. Guardian Industries Corp: www.sunguardglass.com.
   3. Pilkington North America Inc: www.pilkington.com/na.
   4. PPG Industries, Inc: www.ppgideascapes.com.

B. Fire-Protection-Rated Glass Manufacturers: Provide products as required to achieve indicated fire-rating period.
   1. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite I-XL: www.safti.com/sle.
   2. Technical Glass Products; FireLite Plus: www.fireglass.com.

2.2 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
   4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.4 INSULATING GLASS UNITS

A. Manufacturers:
   1. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
   2. Cardinal Glass Industries: www.cardinalcorp.com.
   3. Guardian Industries Corp: www.sunguardglass.com.
   4. Pilkington North America Inc: www.pilkington.com/na.
   5. PPG Industries, Inc: www.ppgideascapes.com.
   6. Viracon, Apogee Enterprises, Inc: www.viracon.com.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal Edge Spacers: Aluminum, bent and soldered corners.
   4. Spacer Color: Aluminum.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
   6. Color: Black.
   7. Purge interpane space with dry air, hermetically sealed.

2.5 INSULATING GLASS UNITS

A. Insulating Glass Units: Vision glazing, with Low-E coating.
   1. Applications: Exterior insulating glass glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Total Thickness: 1 inch.
   4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.29, nominal.
   5. Visible Light Transmittance (VLT): 70 percent, nominal.
   6. Solar Heat Gain Coefficient (SHGC): 0.39, nominal.
   7. Glazing Method: Dry glazing method, gasket glazing.
   8. Basis of Design - PPG Industries, Inc: www.ppgideascapes.com.
   9. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum. Provide fully tempered units where saftety glass is required.
      a. Low-E Coating: PPG Solarban 60 on #2 surface.
   10. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick. Provide fully tempered units where saftety glass is required.
      a. Coating: No coating on inboard lite.

2.6 GLAZING UNITS

A. Fire-Protection-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire-rating period of 45 minutes or less.
   1. Applications:
      a. Glazing in fire-rated door assembly.
      b. Glazing in fire-rated window assembly.
      c. Other locations as indicated on drawings.
   2. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
   3. Safety Glazing Certification: 16 CFR 1201 Category II.
   4. Fire-Rating Period: As indicated on drawings.
   5. Manufacturers:
      a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite I: www.safti.com/sle.
      b. SCHOTT North America Inc; Pyran Platinum: www.us.schott.com.
      c. Technical Glass Products; Firelite Plus: www.fireglass.com.

B. Monolithic Safety Glazing: Non-fire-rated.

1. Applications:
   a. Glazed lites in doors, except fire doors.
   b. Glazed sidelights to doors, except in fire-rated walls and partitions.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on drawings.
2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thicknesses:
   a. For glass units with fully captured edges: 1/4" unless otherwise indicated.
   b. For glass units with top and bottom captured edges, butt-glazed sides:
      1) Up to 5' in height: 1/4".
      2) Over 5' up to 8' in height: 3/8"
      3) Over 8' up to 10' in height:1/2"
      4) Over 10' up to 12' in height: 5/8"
      5) Over 12' up to 14' in height: 3/4"
      6) Over 14' up to 16' in height: 7/8"
      7) Over 16' up to 18' in height: 1"

2.7 GLAZING COMPOUNDS

A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.8 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.2 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.3 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.4 INSTALLATION - PRESSURE GLAZED SYSTEMS

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install pressure plates without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - STRUCTURAL SILICONE GLAZING

A. Follow basic guidelines of structural silicone glazing for glazing application.
   1. Two-Sided Structural: Glass structurally adhered to vertical mullions with horizontal sides captured in glazing pockets.

B. Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.

C. Provide only structural silicone sealant, tested and manufactured for structural glazing.

END OF SECTION

SECTION 08 83 00

MIRRORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass mirrors.

1.2 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood mirror frames.

1.3 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass; 2016.

B. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

C. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors); 2011.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

1.5 WARRANTY

A. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: ASTM C1036, Type 1 - Transparent Flat, Class 1 - Clear, Quality - Q1 (high-quality mirrors); silvering, protective coating, and quality requirements in compliance with ASTM C1503.
   1. Size: As noted on drawings.
   2. Provide polished edges with no sharp edges.

2.2 ACCESSORIES

A. Mirror Adhesive: Chemically compatible with mirror coating and wall substrate.

PART 3 EXECUTION

3.1 PREPARATION

3.2 INSTALLATION

A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Frameless Mirrors: Set mirrors in proper place with adhesive, applied in accordance with adhesive manufacturer's instructions.

3.3 CLEANING

A. Remove labels after work is complete.

B. Clean mirrors and adjacent surfaces.

3.4 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum wallboard.

F. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.3 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2017.

F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2016.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2016.

I. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

J. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014a.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

L. ASTM E413 - Classification for Rating Sound Insulation; 2016.

M. GA-216 - Application and Finishing of Gypsum Board; 2016.

N. UL (FRD) - Fire Resistance Directory; current edition.

1.4 SUBMITTALS

A. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

2.2 METAL FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf. All wall locations to recieve tiling, maximum wall deflection shall be L/360 at 5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E72 using assemblies specified by ASTM C754.
   2. Studs: "C" shaped with flat or formed webs.
   3. Runners: U shaped, sized to match studs.
   4. Ceiling Channels: C shaped.

B. Grid Suspension System for Gypsum Board Ceiling: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Corporation; Drywall Grid System.
      c. USG Corporation; Drywall Suspension System.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
   4. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
      b. Products:
         1) FireTrak Corporation; Posi Klip.
         2) Metal-Lite, Inc.; The System.

2.3 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com.
   3. National Gypsum Company: www.nationalgypsum.com.
   4. USG Corporation: www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   4. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   5. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

2.4 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: _____ inch.

B. Acoustic Insulation: Preformed glass fiber, friction fit type, unfaced, thickness as required to fill width of wall cavity.

C. Acoustic Sealant: As specified in Section 07 92 00.

D. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

E. Aluminum Reveal Trim: Extruded accessories of profiles and dimensions indicated.
   1. Acceptable Manufacturers:
      a. Fry Reglet.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, creased paper tape for joints and corners.

G. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.

H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

I. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.

C. Studs: Space studs at 16 inches on center unless otherwise indicated.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking specified in Division 6 Section "Rough Carpentry".

3.3 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place continuous bead at perimeter of each layer of gypsum board.

3.4 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Install panels with face side out. Butt panels together for a light contract as edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Cover both faces of support framing with gypsum in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

E. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Install sound attenuation blankets before installing gypsum panels. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Form control and expansion joints with space between edges of adjoining gypsum panels.

H. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

I. Installation on Metal Framing: Use screws for attachment of all gypsum board .

3.5 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

A. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.7 PROTECTION

A. Protect installed products from damage from weater, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.8 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Ceramic accessories.

E. Non-ceramic trim.

1.2 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.
   1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
   2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
   4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
   5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
   7. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
   8. ANSI A108.11> ANSI A108/A118/A136.1 - American National Standard for Interior of Cementitious Backer Units; 2010 (Revised).
   9. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
   10. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).

B. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2016.

1.3 DEFINITIONS

A. Construction Joints: The surface where two successive placements of concrete meet, across which it may be desirable to achieve bond and through which reinforcement may be made continuous.

B. Contraction Joints/Control Joints: Formed, sawed or tooled groove in a concrete structure to create a weakened plane and regulate the location of cracking resulting from the dimensional change of different parts of the structure.

C. Expansion Joints: (1) A separation provided between adjoining parts of a structure to allow movement where expansion is likely to exceed contraction; (2) a separation between pavement slabs on grade, filled with a compressible filler material; (3) an isolation joint intended to allow independent movement between adjoining parts.

D. Isolation Joints: A separation between adjoining parts of a concrete structure, usually a vertical plane, at a designated location such as to interfere least with performance of the structure, yet such as to allow relative movement in three directions and avoid formation of cracks elsewhere in the concrete and through which all or part of the bonded reinforcement is interrupted.

1.4 SUBMITTALS

A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Wall Tile: 1 box (10 pieces) of each color of wall tile.
   2. Extra Floor Tile: 3 percent percent of each size, color, and surface finish combination.

1.5 QUALITY ASSURANCE

A. Maintain one copy of The Tile Council of North America Handbook and ANSI A108 Series/A118 Series on site.

B. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 TILE

A. Interior Wall Tile: Refer to Drawing Sheet A602 for Finish Material Specification.

B. Interior Floor Tile: Refer to Drawing Sheet A602 for Finish Material Specification.

2.2 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of floor tile.
      b. Applications as indicated on drawings.

2.3 MORTAR MATERIALS

A. Mortar Bond Coat Materials:
   1. Latex-Portland Cement type: ANSI A118.4.
      a. Provide mortars mixed with liquid latex admixture.
      b. Basis-of-Design: Bostik, Single-Flex FS.

2.4 GROUTS

A. Urethane Grout: Water-based, urethane grout (modified ANSI 118.3-UG).
   1. Colors: To be selected by Architect from manufacturer's full range.
   2. Products:
      a. Basis-of-Design: Bostik, TruColor Pre-Mixed Grout.

2.5 ACCESSORY MATERIALS

A. Crack Isolation Membrane: Comply with ANSI 118.12.
   1. Products:
      a. Basis-of-Design: Bostik, GoldPlus Waterproofing and Antifracture Membrane.

B. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.6 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

D. Verify that joints and cracks in tile substrate are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.3 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interuptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without distupting pattern or joint alignments.

E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

F. Form internal angles square and external angles bullnosed.

G. Install ceramic accessories rigidly in prepared openings.

H. Install non-ceramic trim in accordance with manufacturer's instructions.

I. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
   1. Tile floors composed of tiles 8 by 8 inch or larger.
   2. Tile floors composed of rib-backed tiles.

J. Sound tile after setting. Replace hollow sounding units.

K. Keep control and expansion joints free of mortar, grout, and adhesive.

L. Install construction joints, perimeter joints and movement joints, as detailed on drawings and as otherwise directed by Architect, in accordance with The Tile Council of North America Handbook "Movement Joint Design Essentials EJ171."

M. Expansion Joints: Locate expansion joints and other sealant-filled joints during installation of setting materials and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.

N. Allow tile to set for a minimum of 48 hours prior to grouting.

O. Grout tile joints to comply with requirements of ANSI A108.10, unless otherwise indicated.

P. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrate, install in accordance with TCA Handbook Method F115 (modified), latex-portland cement mortar and urethane grout.

B. Where cracks occur in new or existing concrete floors, provide crack isolation in accordance with The Tile Council of North America Handbook Method F125 & F125A.

3.5 INSTALLATION - WALL TILE

A. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202 with latex-portland cement mortar and urethane grout.

3.6 CLEANING

A. Clean tile and grout surfaces.

3.7 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.2 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.4 SUBMITTALS

A. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Acoustical Units: Provide 2 boxes of each type and size panel provided on project. Provide full size panels.

1.5 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product, approved prior to bid, by one of the following:
      a. Armstrong World Industries, Inc.
      b. Chicago Metallic Corporation.
      c. USG Interiors, Inc.
   2. Acoustical Panel (ACP) Products: Refer to drawing sheet A602 for Finish Material Specification.

2.2 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with clips, splices, and perimeter moldings as required.
   1. Intermediate duty system with main and cross runners roll formed from cold-rolled steels sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized.
   2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product, approved prior to bid, by one of the following:
      a. Armstrong World Industries, Inc.
      b. Chicago Metallic Corporation.

c. USG Interiors, Inc.

3. Suspension System: Refer to drawing sheet A602 for Finish Material Specification.

2.3 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
   1. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   2. Wire Hangers, Braces and Ties: Zinc-coated carbon-steel wire; ASTM C641, Class 1, zinc coating, soft temper.
      a. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 inch diameter wire.
   3. Provide acoustic type hangers where indicated on drawings.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Perimeter Trim: Extruded aluminum trim, height as indicated on drawings, white.
   1. Acceptable Products:
      a. Armstrong, Axiom Classic Perimeter Trim.
      b. Alpro, Aviar Perimeter Trim.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636/C 636M and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths. Use longest practical lengths
   2. Overlap and rivet corners.

3.3 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.
   2. Double cut and field paint exposed reveal edges.

3.4 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.2 REFERENCE STANDARDS

A. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2015.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

C. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.3 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

B. Verification Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each resilient flooring product specified.

C. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Flooring Material: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
   2. Extra Wall Base: 10 linear feet of each type and color.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store all materials off of the floor in an acclimatized, weather-tight space.

B. Protect roll materials from damage by storing on end.

C. Do not double stack pallets.

PART 2 PRODUCTS

2.1 TILE FLOORING

A. Rubber Tile: Type I- Homogeneous, color and pattern throughout thickness; Type II- Heterogeneous, laminated.
   1. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
   2. Basis-of-Design Refer to Finish Material Specification on Drawing Sheet A602. Provide the basis-of-design product or a comparable product approved prior to bid.

2.2 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set as indicated on drawings.
   1. Height: 4 inch.
   2. Thickness: 0.125 inch thick.
   3. Length: Roll.
   4. Basis-of-Design Refer to Finish Material Specification on Drawing Sheet A602. Provide the basis-of-design product or a comparable product approved prior to bid.

2.3 ACCESSORIES

A. Primers and Adhesives, and Seaming: Waterproof; types recommended by resilient flooring manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified

1. Provide adhesives recommended by manufacturer for installation on cementitious sub-floor surface moisture and pH levels present at time of installation.
2. Provide floor sealers for surfaces that test over adhesive manufacurer's maximum recommended moisture/pH levels. Follow adhesive manufacturer's recommendations for sealer products and application as required to meet manufacturer's warranty requirements.

B. Moldings, Transition and Edge Strips: Same material as flooring. Refer to Drawings for profiles.

C. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Test moisture emission rates and alkalinity levels in accordance with ASTM F710.

3.2 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is fully cured.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints and butt seams tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

G. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

H. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

J. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

K. Install flooring in recessed floor access covers, maintaining floor pattern.

3.4 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.5 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.6 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.7 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 65 68

RESILIENT ATHLETIC FLOORING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Supply and installation of the indoor resilient multipurpose surfacing

B. Application of the game lines

1.2 STANDARDS

A. ASTM F2170 “Standard Test Method for Determining Relative Humidity In Concrete Floor Slabs Using In-Situ Probes”

B. ASTM F710 “Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring”

C. ACI 302.2R-06 “Guideline for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials”

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer’s promotional brochures, specifications and installation instructions

B. B. Manufacturer Certifications:
   1. Provide certification that accurately identifies the Original Equipment Manufacturer (OEM) of flooring furnished for this project including manufacturer’s name, address and factory location.
   2. Suppliers of private label flooring for this project must identify themselves as such and fully disclose the OEM information listed above.
   3. All “manufacturer” requirements in these specifications must be complied with by the OEM, including warranties, certifications, qualifications, product data, test results, environmental requirements, performance data, etc.

C. Samples:
   1. Submit for selection and approval three (3) sets of the indoor resilient multipurpose surfacing, manufacturer’s brochures, samples or sample boards of all of the available colors, textures and styles.
   2. Submit color samples of all the available game line paint colors for selection and approval.

D. Closeout Submittals:
   1. Submit three (3) copies of the indoor resilient multipurpose surfacing and manufacturer’s maintenance instructions.
   2. Submit three (3) copies of the material and installation warranties as specified.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. The indoor resilient multipurpose surfacing shall be manufactured in an ISO 9001 certified plant.
   2. 2. The indoor resilient multipurpose surfacing shall be manufactured in an ISO 14001 certified plant.
   3. The indoor resilient multipurpose surfacing supplier shall be an established firm experienced in the field and appointed as a distributor by the manufacturer of the indoor resilient multipurpose surfacing.
   4. The installer of the indoor resilient multipurpose surfacing shall have a minimum of five (5) years experience in the field installing indoor resilient multipurpose surfacing and have worked on at least five (5) projects of similar size and complexity.

B. Certifications:
   1. Installer to submit the indoor resilient surfacing manufacturer’s or distributor’s certification attesting that they are an approved installer of the indoor resilient multipurpose surfacing.
   2. The indoor resilient multipurpose surfacing manufacturer to submit official ISO 9001 certification for the facility in which the indoor resilient multipurpose surfacing is manufactured.
   3. The indoor resilient multipurpose surfacing manufacturer to submit official ISO 14001 certification for the facility in which the indoor resilient multipurpose surfacing is manufactured.

C. Testing:

D. Tests shall be relative for multi-purpose use with certificates from independent testing resources to be made available upon request. Test results shall be no more than 5 years old and performed according to ASTM and/or EN standard testing procedures.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Material shall not be delivered until all related work is in place and finished and/or proper storage facilities and conditions can be provided and guaranteed stable according to the manufacturer's recommendations.

1.6 PROJECT/SITE CONDITIONS

A. It is the responsibility of the general contractor/construction manager to maintain project/site conditions acceptable for the installation of the indoor resilient multipurpose flooring.

B. The area in which the indoor resilient multipurpose surfacing will be installed shall be dry and weather tight. Permanent heat, light and ventilation shall be installed and operable.

C. All other trades shall have completed their work prior to the installation of the resilient multipurpose flooring. The general contractor or Construction Manager shall maintain a secure and clean working environment before, during and after the installation. Suspension of other trades' work may be authorized providing their work will not damage the new flooring.

D. Maintain a stable room temperature of at least 65°F for a minimum of one (1) week prior to, during, and thereafter installation.

E. An effective low-permeance vapor barrier is placed directly beneath the concrete subfloor. For "on" or "below grade" installations, it is recommended to provide a permanent vapor barrier resistant to long term hydrostatic pressure/moisture exposure. Protrusions should be sealed to prevent moisture migration into the slab. Moisture should not be allowed to enter the slab after the completed construction.

F. Concrete subfloor surface pH level within the 7 to 10 range dependent upon installation type. Concrete subfloor should be no greater than 1/8" within a 10 ft diameter. This tolerance can be measured in accordance with ASTM E1155.

G. Concrete subfloor must be clean and free of all foreign materials or objects including, but not limited to, curing compounds and sealers.

H. Fill cracks, grooves, voids, depressions, and other minor imperfections with Ardex (or equal) cement-based patching/leveling compounds. Follow the manufacturer's directions. Moveable joints must be treated utilizing specific transitioning joint devices depending upon the architect's recommendations. Follow current ASTM F710 guidelines for the preparation of concrete slabs to receive resilient flooring.

I. Refer to ACI 302.2R "Guidelines for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials" for concrete design and construction.

J. Concrete slab shall be fortified with continual steel reinforcement. Fiber reinforcement alone shall not be considered adequate fortification.

1.7 WARRANTY

A. Materials:
   1. The indoor resilient multipurpose surfacing shall be covered by the manufacturer against product defects for 8 years. The manufacturer of the indoor resilient multipurpose surfacing must provide this warranty upon request.

B. Installation:
   1. The installation of the indoor resilient multipurpose surfacing shall be covered against poor workmanship and faulty installation by a two (2) year written, limited warranty provided by the contractor performing/overseeing the installation.

1.8 ADDITIONAL MATERIALS

A. Furnish to the owner additional materials containing a total of at least 1% of each different color or design of the indoor resilient multipurpose surfacing used on the project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of Design: EcoPure as manufactured by FieldTurf, USA, Inc.

2.2 MATERIALS.

A. Prefabricated 4.6 mm foam backed linoleum sports surfacing with marbled design and slightly textured surface as supplied by FieldTurf USA, Inc. Product to be naturally bacteriostatic and will not contribute to the proliferation of bacteria or fungus. The material's surface shall be protected with XF X-treme performance finish or equivalent for ease of maintenance. Floor covering requiring waxes or other restorative treatments shall not be considered. Welding rod shall also incorporate the XF X-treme finish or equivalent.
   1. Color: As selected by Architect from manufacturer's full range.
   2. Physical properties of the indoor resilient athletic surfacing shall conform to the following minimums:

Width		6'-6"
Length		85' (25.9m) approx.
Total Thickness		4.6 mm
Vertical Deformation	PASSED	0.6 (EN 14809)
Rolling Load	PASSED	0.30 (EN 1569 11/1999)
Friction	PASSED	83 (EN 13036-4)
Sanitization	Excellent	Naturally Bacteriostatic
Sound Insulation	Excellent	+/= 19 dB (ISO 717/2)
Recycled Content		22%
Surface Finish Effect	PASSED	ASTM F2772 (80 – 110)
Vertical Deformation	PASSED	ASTM F2772
Ball Rebound	PASSED	ASTM F2772 > 90%
Shock Absorption	PASSED	ASTM F2772 Category 1

B. Welding Rod:
   1. As supplied by the indoor resilient surfacing manufacturer or supplier. Color to blend with the indoor resilient surfacing color or design. All seams shall be heat welded. Welding rod shall also incorporate the XF X-treme finish or equivalent.

C. Adhesive:
   1. Multi-Poxy adhesive. Follow adhesive manufacturer's recommendations.

D. Game Line Paint Primer:
   1. As approved by the indoor resilient surfacing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It is the responsibility of the general contractor/construction manager to ensure that project/site conditions are acceptable for the installation of the indoor resilient flooring.

B. Verify that the area in which the indoor resilient surfacing will be installed is dry and weather tight. Verify that permanent heat, light and ventilation is installed and operable.

C. Verify that all other work that could cause damage, dirt and dust or interrupt the normal pace of the indoor resilient flooring installation is completed or suspended.

D. Verify that there is a stable room temperature of at least 65°F.

E. Verify that there are no foreign materials or objects on the subfloor and that the subfloor is clean and ready for installation.

F. Direct Full Spread Adhering to Concrete Subfloor Multi-Poxy Adhesive: moisture content less 80 % RH when tested per ASTM F2170.

G. Do not average the results of the tests. Report all field test results in writing to the General Contractor, Architect, and End User prior to installation.

H. Verify that the concrete subfloor surface pH level is within the 7 - 10 range.

I. Document the results indicating the slab is within manufacturer's tolerances for slab deviation.

3.2 PREPARATION OF SURFACES

A. Sand the entire surface of the concrete slab.

B. Sweep the concrete slab so as to remove all dirt and dust. If a sweeping compound is to be used it must be a sweeping compound that does not contain oil or other items that may inhibit the adhesive bond.

C. Slab must be dust free. In the event that dust impairs adhesive bond, priming the slab prior to application of adhesive may be necessary. Follow installation guidelines.

3.3 INSTALLATION

A. The installation area shall be closed to all traffic and activity for a period to be set by the indoor resilient surfacing installer. The indoor resilient surfacing installation shall not begin until the installer is familiar with the existing conditions.

B. All necessary precautions should be taken to minimize noise, smell, dust, the use of hazardous materials and any other items that may inconvenience others.

C. Install the indoor resilient surfacing in strict accordance with the indoor resilient surfacing manufacturer's written instructions.

D. Install the indoor resilient surfacing minimizing cross seams. Provide a seam diagram during the submittal process for approval prior to installation.

E. Paint game lines using approved game line paint primer and game line paint in strict accordance with the game line paint manufacturer's instructions.

F. Install appropriate threshold plates or transition strips where necessary.

3.4 CLEANING

A. Remove all unused materials, tools, and equipment and dispose of any debris properly. Clean the indoor resilient surfacing in accordance with the manufacturer's instructions.

3.5 PROTECTION

A. If required, protect the indoor resilient surfacing from damage using coverings approved by the manufacturer until acceptance of work by the customer or their authorized representative.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. High-solids flooring system with epoxy primer and light-stable, chemically resistant, satin, urethane topcoat applied over interior concrete floors.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. ASTM C 413 - Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   2. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
   3. ASTM D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
   4. ASTM D 2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
   5. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness.
   6. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
   7. ASTM D 2370 - Standard Test Method for Tensile Properties of Organic Coatings.
   8. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
   9. ASTM D 4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
   10. ASTM D 4366 - Standard Test Methods for Hardness of Organic Coatings by Pendulum Damping Tests.
   11. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
   12. ASTM D 7234 - Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
   13. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   14. ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
   15. ASTM G 154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

B. National Floor Safety Institute (NFSI) (www.nfsi.org):
   1. ANSI/NFSI B101.1 - Test Method for Measuring Wet SCOF of Common Hard-Surface Floor Materials.

1.4 PREAPPLICATION MEETINGS

A. Convene preapplication meeting 2 weeks before start of application of flooring system.

B. Require attendance of parties directly affecting work of this Section, including Contractor, Architect, applicator, and manufacturer's representative.

C. Review materials, moisture testing of concrete, protection of in-place conditions, surface preparation, application, protection, and coordination with other work.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including surface preparation and application instructions.

B. Samples:
   1. Colorants Added to Materials: Submit manufacturer's samples of colorants.
   2. Flooring Surface: Submit manufacturer's samples of flooring surface showing texture and sheen.

C. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

D. Manufacturer's Project References: Submit manufacturer's list of successfully completed resinous flooring system projects, including project name and location, name of architect, and type and quantity of flooring systems furnished.

E. Applicator's Project References: Submit applicator's list of successfully completed resinous flooring system projects, including project name and location, name of architect, and type and quantity of flooring systems applied.

F. Care and Maintenance Instructions: Submit manufacturer's care and maintenance instructions, including cleaning instructions.

G. Warranty Documentation: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer regularly engaged, for a minimum of 10 years, in the manufacturing of resinous flooring systems of similar type to that specified.

B. Applicator's Qualifications:
   1. Applicator regularly engaged, for a minimum of 5 years, in application of resinous flooring systems of similar type to that specified.
   2. Employ persons trained for application of resinous flooring systems.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, and batch number.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer's instructions.
   2. Keep materials in manufacturer's original, unopened containers and packaging until application.
   3. Store materials in clean, dry area indoors between 65 and 90 degrees F (18 and 32 degrees C).
   4. Store materials out of direct sunlight.
   5. Keep materials from freezing.
   6. Protect materials during storage, handling, and application to prevent contamination or damage.

1.8 AMBIENT CONDITIONS

A. Apply flooring system under the following ambient conditions:
   1. Ambient, Concrete Floor, and Material Temperatures: Between 65 and 90 degrees F (18 and 32 degrees C).
   2. Relative Humidity: Maximum 80 percent.
   3. Dew Point: Floor temperature more than 5 degrees over dew point.

B. Do not apply flooring system under ambient conditions outside manufacturer's limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Tennant Company, www.tennantco.com <http://www.tennantco.com>. info@tennantco.com <mailto:info@tennantco.com>.

2.2 RESINOUS FLOORING SYSTEM

A. Resinous Flooring System: Tennant HTS.
   1. Description: High-solids flooring system with epoxy primer and light-stable, chemically resistant, satin, urethane topcoat applied over interior concrete floors.

B. System Components:
   1. Primer: Eco-MPE epoxy.
      a. Application Thickness: 3 to 5 wet/dry mils.
      b. Color: Manufacturer's colorants selected by Architect.
   2. Build Coat: Eco-MPE epoxy.

a. Application Thickness: 17 to 19 wet/dry mils.
b. Color: Manufacturer's colorants selected by Architect.

3. Topcoat: Eco-HTS 100 light-stable satin urethane.
   a. Application Thickness: 3 wet/dry mils.
   b. Color: Manufacturer's colorants selected by Architect.

C. Nominal System Thickness: 25 mils.

D. System Properties:
1. VOC Content, ASTM D 3960, Mixed A+B+C: 0.05 lbs per gal (6 g/L).
2. Abrasion Resistance, ASTM D 4060, CS-17 wheel, 1,000-g load, 1,000 revolutions, Eco-HTS: 18 mg loss.
3. Adhesion to Concrete:
   a. ASTM D 4541: 450 psi, concrete failed.
   b. ASTM D 7234: 732 psi, concrete failed.
4. Coefficient of Friction, ASTM D 2047: 0.63.
5. Wet Static Coefficient of Friction, BOT 3000, ANSI/NFSI B101.1: 0.94.
6. Compressive Strength, Epoxy, ASTM D 695: 13,500 psi.
7. Flammability, ASTM D 635: 182 mm/min.
8. Resistance to Yellowing, measured using ASTM D 2244, 1,000 hours UV exposure in QUV, ASTM G 154: Less than 10 increase of yellow units if pigmented topcoat.
9. Tensile Strength, ASTM D 2370: 6,250 psi.
10. Elongation, ASTM D 2370: 6 percent.
11. Hardness, Konig Test, 3 mil/0.08 mm film, topcoat resin, ASTM D 4366: 171.3.
12. Shore D Hardness, Epoxy, ASTM D 2240:
    a. 0 Seconds: 80 to 85.
    b. 15 Seconds: 75 to 80.
13. Water Absorption, 24-Hour Immersion, ASTM C 413: 0.2 percent weight increase.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine concrete surface to receive flooring system.

B. Verify concrete is structurally sound.

C. Moisture Testing of Concrete: Perform at least one of the following two tests to determine moisture in concrete.
1. Calcium Chloride Test:
   a. Measure moisture vapor emission rate of concrete in accordance with ASTM F 1869.
   b. Application of flooring system can start only if test results are below 3 pounds per 1,000 square feet over a 24-hour period.
   c. If test results are above limits, notify Architect and flooring system manufacturer.
2. In-Situ Probe Test:
   a. Measure relative humidity in concrete in accordance with ASTM F 2170.
   b. Application of flooring system can start only if test results are below 75 percent relative internal concrete humidity.
   c. If test results are above limits, notify Architect and flooring system manufacturer.

D. Notify Architect of conditions that would adversely affect application or subsequent use.

E. Do not begin surface preparation or application until unacceptable conditions are corrected.

3.2 PREPARATION

A. Protection of In-Place Conditions: Protect adjacent surfaces and adjoining walls from contact with flooring system materials.

B. Surface Preparation:
1. Prepare concrete surface in accordance with manufacturer's instructions.
2. Remove dirt, dust, debris, oil, grease, curing agents, bond breakers, paint, coatings, sealers, silicones, and other surface contaminants which could adversely affect application of flooring system.
3. Patch depressions, divots, and cracks in concrete in accordance with manufacturer's instructions.

4. Mechanically remove loose, delaminated, and damaged concrete and repair in accordance with manufacturer's instructions.
5. Joints: Fill joints in accordance with manufacturer's instructions.

3.3 APPLICATION

A. Apply flooring system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Ensure concrete is dry, clean, and prepared in accordance with manufacturer's instructions.

C. Allow concrete to cure a minimum of 30 days before applying flooring system.

D. Mixing:
1. Mix material components together in accordance with manufacturer's instructions.
2. Mix only enough material that can be applied within working time.
3. Add and mix colorants with materials in accordance with manufacturer's instructions to achieve uniform color.

E. Apply flooring system materials to obtain consistent mil thickness and smooth, uniform appearance and texture.

F. Primer:
1. Apply primer in accordance with manufacturer's instructions.
2. Apply primer to prepared concrete to ensure proper adhesion of flooring system.

G. Build Coat:
1. Apply build coat in accordance with manufacturer's instructions.
2. Apply build coat over primer.

H. Topcoat:
1. Apply topcoat in accordance with manufacturer's instructions.
2. Apply topcoat over build coat.
3. Apply topcoat to match approved samples submitted in accordance with the Submittals Article of this Section.

3.4 PROTECTION

A. Allow flooring system to dry in accordance with manufacturer's instructions before opening to traffic.

B. Allow flooring system to dry a minimum of 1 week before cleaning by mechanical means.

C. Protect completed flooring system from damage during construction.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Carpet tile, loose laid with self-adhesive spot adhered.

1.2 SUBMITTALS

A. Shop Drawings: Indicate the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.
   2. Self-Adhesive Spot Stickers: Provide roll of one hundred sticker spots.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
      a. Review delivery, storage, and handling procedures.
      b. Review ambient conditions and ventilation procedures.
      c. Review subfloor preparation procedures.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum five years documented experience.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.5 FIELD CONDITIONS

A. Comply with CRI 104.

1.6 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Carpet Tile : Products: Refer to Drawing Sheet A602 Finish Material Specification for carpet types and products..

2.2 ACCESSORIES

A. Sub-Floor Filler: Pre-mix latex; type recommended by flooring material manufacturer.

B. Self-Adhesive Spot Stickers: Manufacturer's pressure sensitive, self-adhesive spot stickers.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

C. Test moisture emission rates and alkalinity levels in accordance with ASTM F710.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

D. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

E. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 Section 14 "Carpet Modules".

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set in directions and patterns indicated on drawings.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Apply self-adhesive spot stickers to back of carpet tiles with number and pattern as recommended by manufacturer.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING AND PROTECTION

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

C. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

D. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 09 72 10

CUSTOM DIGITAL WALL COVERINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Custom digital wall covering.

1.2 SUBMITTALS

A. Product Data: For each type of digital wallcovering proposed for use on the project, submit certified copies of reports of tests specified, together with complete description of each wallcovering, including: pattern, total weight, fabric backing, tensile strength, tear strength, and fire hazard classification.

B. Architect will provide custom digital wall covering manufacturer with digital graphic file for custom digital wallcovering.

C. Submit samples of all materials specified. Do not order materials until approval is received.
   1. Submit "mini-mural" of complete finished image printed on actual substrate specified.
   2. Submit sample section of final image at 100% resolution printed on actual substrate specified.

D. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.

E. Manufacturers' product data for adhesives, including printed statement of VOC content.

F. Maintenance data.

1.3 QUALITY ASSURANCE

A. Submittals other than the specified material shall match the appearance and color of the selected material, and equal or exceed the quality, total weight, fabric backing, tensile and tear strength, fire ratings and mildew resistance of the specified product(s). The decision of the Architect/Designer shall be final.

B. Imperfections such as engraving roller die marks, roller repeat marks or other features deemed not in conformance with the specified materials, will be cause for rejection by the Architect/Designer, if evidenced in either the submitted samples, or the manufactured material delivered to the job.

C. Tests: All tests shall be performed in accordance with Federal Specification CCC-T-191b, except as follows:
   1. Adhesion of vinyl coating to the fabric backing shall be tested in accordance with ASTM D 751.
   2. Materials shall have a zone inhibition rating of "0" on face, and "1" on backing to resist the growth of mildew and bacteria, as determined by test method ASTM G 21.

D. Applicators Qualifications: Work of this section shall be performed by a firm regularly engaged in the installation of vinyl wall coverings of the types and qualities specified, and acceptable to the custom digital wall covering manufactuer and Architect/Designer.

1.4 PROJECT SITE CONDITIONS

A. Temperatures
   1. Maintain substrate surface and ambient temperatures above 65 degrees F, unless required otherwise by manufacturer's instructions.
   2. Do not apply adhesive when substrate surface temperature or ambient temperature is below 65 degrees F.
   3. Maintain these conditions 72 hours before, during, and after installation of vinyl wallcovering.

B. Lighting: Provide not less than 80 foot-candles per square foot minimum, on the surfaces to receive wallcoverings.

C. Wall Condition:
   1. The wall surface should be clean, dry, structurally sound, and free of mildew, grease, dust, or other stains.
   2. Plaster and masonry wall surfaces should not exceed 5.5% moisture when measured by a moisture meter. Gypsum board wall surfaces should not exceed 16% moisture.
   3. Room humidity should not exceed 90%.
   4. Wall surfaces should be primed with a good quality wallcovering primer. Wall surfaces with significant color variation should be primed with a good quality pigmented wallcovering primer.
   5. New plaster should age 60-90 days before painting or installing wallcovering.

1.5 WARRANTY

A. Submit manufacturer's written five year warranty against manufacturing defects.
   1. All wallcovering materials when adhered to a sound surface with the manufacturer's recommended procedures and adhesive, shall be warranted.

PART 2 PRODUCTS

2.1 CUSTOM DIGITAL WALL COVERING

A. Custom Digital Wallcovering as provided by MDC Wallcoverings. Digital wallcovering shall be printed on 53"/54" vinyl wallcovering substrate using piezo drop-on-demand technology incorporating eight colors, CYMK and half density CYMK. Printed image shall be dried from both front and back using combinations of IR and platen heaters to prevent media distortion.
   1. Texture: Digital Stipple.

B. Vinyl wallcovering substrate: supported vinyl material, consisting of a through-pigmented, mildewinhibitorized polyvinyl chloride, adhered to cotton, cotton/blend fabric backing, or a cellulose polyester nonwoven backing. All materials shall be Cadmium and Mercury free, and shall conform to the CFFA-W-101-B, using test methods as outlined in FedSpec CCC-T-191b, except as otherwise specified.
   1. Total Weight: minimum 13 ounces per square yard, 19.5 ounces per linear yard.
   2. Backing Weight: minimum 2 ounces per square yard.
   3. Fabric backing and content: cotton, cotton/blend fabric, or a cellulose polyester non-woven.
   4. Adhesion of coating to fabric: 3 pounds per 1 inch strip (ASTM D751)
   5. Tensile strength: 97 X 92 (W x F).
   6. Tear strength: 55 X 40 (W x F).
   7. Flame Spread (UL): 10 (ASTM E84) or UL 723.
      a. Smoke Developed (UL): 25 (ASTM E84) or UL 723
      b. Tested on reinforced cement board.
   8. Mildew resistance: Zone inhibition rating of "0" on face, "1" on backing (ASTM G21).
   9. Staphylococcus resistance: 100 percent reduction within 24 hours. 1006 NYS Quantitative Bacteria Resistance
   10. Accepted by the City of New York Department of Building MEA 310-89-M.
   11. Meet the State of Washington Purchase Specification for Product Emissions (Formaldehyde and TVOC's) 7 days after installation.
   12. Meet the EPA Headquarters Procurement specification for Product Emission (Total Aldehydes) within 7 days.
   13. Meets Heavy Metal Solubility Requirements of ASTM F-963.
   14. Contains bactericides and mildew inhibitors to protect the product from microbiological and mildew growth, consistent with 40 C.F. R. ß152.25.
   15. Provide the benefit of advanced notice of smoke or fire when used in conjunction with ionized smoke detectors.

2.2 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall-covering manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 9 Section "Painting" and recommended in writing by wall-covering manufacturer for intended substrate.

C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Examine surface for any imperfections, do not begin installation until imperfections have been corrected.

B. Install digital wall covering in accordance with the manufacturer's instructions using heavy-duty vinyl wall covering adhesive recommended by the manufacturer (Wheat paste shall not be used).

C. Before cutting, lay out panels in numeric order and examine each panel for color consistency, accuracy and proper image dimension.

D. Install each panel in numerical sequence hanging first panel to a vertical line. Overlap subsequent panels to match crop lines and double cut on the wall. Selvage (excess trimmed edge) should be removed from the wall and the seam closed within one hour.

E. Re-inspect after the application each panel. Request inspection by the Architect/Designer if there are variations in color or pattern that are considered to be excessive. The wall covering distributor or manufacturer's representative shall then be notified for their inspection, before any further wall covering is installed.

F. The wall covering shall be smoothed to the hanging surface, using a stiff bristled sweep brush or a flexible broad-knife to eliminate air bubbles.

G. Remove excess adhesive along finished seams immediately after each wall covering strip is applied. Use clean warm water, a natural sponge and clean towels. Change water often to maintain water cleanliness.

3.2 CLEAN-UP COMPLETION

A. Upon completion of the work, remove surplus materials, rubbish and debris resulting from the wallcovering installation. Leave areas in neat, clean and orderly condition.

END OF SECTION

SECTION 09 84 00

FABRIC WRAPPED PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabric-covered fiberglass core panels and mounting accessories.

1.2 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.3 SUBMITTALS

A. Product Data: Manufacturer's printed data sheets for products specified.

B. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

C. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation.

B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.

C. Protect panel edges from damage.

PART 2 PRODUCTS

2.1 TACKABLE WALL PANELS

A. Panels: Prefinished, factory assembled fabric-covered panels.

B. Tackable Panels:
   1. Products: Basis-of-Design: Conwed, Respond TK/AC panels. Subject to compliance with requirements, provide basis-of-design product or a comparable product by one of the following:
      a. Golterman & Sabo.
      b. Panel Solutions, Inc.
   2. Density: 6 - 7 lb/cu ft nominal core density and laminated with 1/8 inch tackable face layer.
   3. Panel Width and Height: As indicated on Drawings.
   4. Panel Thickness: 3/4 inch.
   5. Edges: Perimeter edges reinforced by an aluminum frame or a galvanized steel frame.
   6. Corners: Radiused.
   7. Mounting: Back mounting.

C. Fabric Covering: Seamless fabric facing material, for stretched covering of core material.
   1. Fabric: Refer to Drawing Sheet A602 for Finish Material Specifications. Panel manufacturer must be able to provide panels wrapped with the specified fabric.

2.2 ACOUSTIC WALL PANELS

A. Panels: Prefinished, factory assembled fabric-covered panels.

B. Acoustic Panels:
   1. Products: Basis-of-Design: Conwed, Respond ACT Acoustical Panels. Subject to compliance with requrirements, provide basis-of-design product or a comparable product by one of the following:
      a. Golterman & Sabo.
      b. Panel Solution, Inc.
   2. Density: 6-7 lb/cu ft nominal core density.
   3. Panel Width and Height: As indicated on Drawings.
   4. Panel Thickness: 2 inches.

5. Edges: Perimeter edges reinforced by a formulated resin hardener.
6. Corners: Square.
7. Mounting: Back mounting.
8. Fabric Covering: Seamless fabric facing material, for bonded covering of core material.
    a. Fabric: Refer to Drawing Sheet A602 for Finish Material Specifications. Panel manufacturer must be able to provide panels wrapped in specified fabric.

2.3 FABRICATION

A. General: Fabricate panels to sizes and configurations indicated, with fabric facing stretched straight, on the grain, tight, square and installed without sagging, ripples, wrinkles, sags, blisters, or visible seams.
    1. Provide double thickness of overlay at panel edges.
    2. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.4 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
    1. Z-clip hanger and magnet system with magnets recessed into panel frame and designed to engage steel mounting plates secured to substrate with screws.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install acoustical panels in locations indicated, following installation recommendations of panel manufacturer. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

B. Install panels to construction tolerances of plus or minus 1/16 inch for the following:
    1. Plumb and level.
    2. Flatness.
    3. Variation of Panel Joints from Hairline: Not more than 1/32 inch wide.

3.2 CLEANING

A. Clip loose threads, remove pills and extraneous materials.

B. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

C. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

3.3 PROTECTION

A. Provide protection of installed acoustical panels until completion of the work.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.
   8. Data cable.
      a. Painter shall be aware that any amount of paint or overspray of paint on data cable will void the warranty of the data cable. Attempts to remove paint by chemical or physical means from data cable is not allowed. All data cable with paint/overspray shall be required to be fully replaced. Entire run of cable will be replaced. No splicing is allowed.

1.2 REFERENCE STANDARDS

A. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

1.3 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   3. Manufacturer's installation instructions.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

C. Maintenance Data: Submit data including care and cleaning instructions, touch-up procedures, and repair of painted and finished surfaces.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Paint and Coating: 1 full quart of each color and sheen.

1.4 QUALITY ASSURANCE

A. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required.
   1. Wall Surfaces: Provide samples on at least 100 sq. ft.
   2. Final approval of colors will be from benchmark samples.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.3 PAINT SYSTEMS - EXTERIOR

A. Exterior Galvanized Metal Indicated to be Painted:
   1. Pimer:
      a. Diamond Vogel: Mult-E-Prime 500 Hi-Build Epoxy Primer
      b. Pittsburg Paints; 95-245 Series Pitt-Guard DTR Polymide Epoxy Coating.
      c. Sherwin-Williams: Tile-Clad High Solids.
      d. Tnemec; Series 27 WB Typoxy Polymide Epoxy.
   2. Intermediate Coat:
      a. Diamond Vogel: Mult-E-Poxy 180 Epoxy Mastic.
      b. Pittsburg Paints; 95-8800 Series Pitthane High-Build Urethane Enamel.
      c. Sherwin-Williams; Macropoxy 646.
      d. Tnemec; None required.
   3. Topcoat:
      a. Diamond Vogel; Multi-Thane 330 High Solids Acrylic Polyurethane.
      b. Pittsburg Paints; 95-8800 Series Pitthane High-Build Urethane Enamel.
      c. Sherwin-Williams: Acrolon 218.
      d. Tnemec; Series 1075 Endura-Shield II.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Galvanized Surfaces:
   1. Prepare surface according to SSPC-SP 3.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's written instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23

INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Elevator pit ladders.
   3. Prime surfaces to receive wall coverings.
   4. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
   5. Stenciling at Fire/Smoke Walls and Partitions: Provide identification for all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions. Such identifications shall:
      a. Be located in accessible concealed floor, floor-ceiling or attic spaces;
      b. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
      c. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording as indicated on drawings.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Ceramic and other tiles.
   7. Glass.
   8. Concealed pipes, ducts, and conduits.
   9. Data cable.
      a. Painter shall be aware that any amount of paint or overspray of paint on data cable will void the warranty of the data cable. Attempts to remove paint by chemical or physical means from data cable is not allowed. All data cable with paint/overspray shall be required to be fully replaced. Entire run of cable will be replaced. No splicing is allowed.

1.2 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

B. SSPC-SP 1 - Solvent Cleaning; 2015.

C. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

D. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

E. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015); 2003.

1.3 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

3. Manufacturer's installation instructions.

B. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

C. Manufacturer's Instructions: Indicate special surface preparation procedures.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   2. Label each container with color in addition to the manufacturer's label.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.3 PAINT SYSTEMS - INTERIOR

A. Interior Gypsum Board Surfaces to be Painted:
   1. Two top coats and one coat primer.
   2. Top Coats for Walls: Interior Eggshell Latex.
      a. Products:

1) Diamond Vogel, Vantage Plus Interior Latex Eggshell Enamel
2) PPG Paints Ultra-Hide 150 Interior Low Sheen Paint, 1410-XXXXV, Eggshell.
3) Pratt & Lambert Pro-Hide Gold Ultra Interior Latex, Eggshell.
4) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel.

3. Top Coats for Ceilings: Interior Flat Latex.
   a. Products:
      1) Diamond Vogel, Vantage Plus Interior Latex Flat Enamel.
      2) PPG Paints Ultra-Hide 150 Interior Paint, 1210-XXXXV, Flat.
      3) Pratt & Lambert Pro-Hide Gold Ultra Interior Latex, Flat.
      4) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Concrete and Concrete Masonry Units: Interior Semi-Gloss Latex.
   1. Products:
      a. Diamond Vogel, Vantage Plus interior Latex Semi-Gloss Enamel.
      b. PPG Paints Ultra-Hide 150 Interior Paint, 1416-XXXXV, Semi-Gloss.
      c. Pratt & Lambert Pro-Hide Gold Interior Latex, Semi-Gloss.
      d. Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss.

C. Ferrous and Galvanized Metal Surfaces to be Painted: For surfaces subject to frequent contact by occupants, including metals:
   1. Medium duty applications include doors, door frames, railings, handrails, guardrails, balustrades, and miscellaneous metals.
   2. Two top coats and one coat primer.
   3. Top Coat(s): Interior Light Industrial Coating, Water Based.
      a. Products:
         1) Diamond Vogel, Finium DTM-AT Acrylic Semi-Gloss.
         2) PPG Paints Pitt-Tech Plus, 90-1210 Series, Semi-Gloss.
         3) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss.

D. Interior Epoxy Coating: Including gypsum board and concrete masonry units.
   1. Primer for gypsum wallboard: As recommended by manufacturer.
   2. Primer for concrete masonry: Masonry filler.
   3. Finish Coatings: Two coats. Provide one of the following:
      a. Diamond Vogel, Eas-E-Poxy Pre-Catalyzed Waterborne Epoxy Semi-Gloss.
      b. Pittsburgh Paints; PITT-GLAZE Water Based Acrylic Epoxy Semi-Gloss.
      c. Pratt & Lambert Acrylic Waterborne Epoxy, Semi-Gloss.
      d. Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss.

E. Dry Fall: Metals; exposed structure and overhead-mounted services, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
   1. One top coat.
   2. Top Coat: Latex Dry Fall.
      a. Products:
         1) Diamond Vogel, Luminance 300 Latex Dri-Mist Flat.
         2) PPG Paints Speedhide Super Tech Water Based Interior Dry-Fog, 6-725XI, Flat. (MPI #118)
         3) Pratt & Lambert Waterborne Dry Fall, Flat.
         4) Sherwin-Williams Waterborne Acrylic Dryfall, Flat.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

F. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

H. Galvanized Surfaces:
   1. Prepare surface according to SSPC-SP 3.

I. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Include areas visible when permanent or built-in fixtues, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
   1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
4. Finish doors on tops, bottoms, and side edges the same as exterior faces.

F. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

G. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

H. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

I. Sand wood and metal surfaces lightly between coats to achieve required finish.

J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

L. Concrete Floor Sealer: Follow manufacturer’s instructions for preparation and installation.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. At end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

C. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting

D. Provide "Wet Paint: signs to protect newly painted finishes.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 11 01

VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Markerboards and Tackboards.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

1.3 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2009a (Reapproved 2016).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's data on markerboard, tackboard, trim, and accessories.

B. Shop Drawings: Indicate wall elevations, dimensions, joint locations.

C. Maintenance Data: Include data on regular cleaning, stain removal .

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 WARRANTY

A. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Visual Display Boards:
   1. AJW Architectural Products, www.ajw.com
   2. Best-Rite Manufacturing.
   3. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
   4. Marsh Industries: www.marsh-ind.com.
   5. W. E. Nea Slate Company: www.nealslate.com.

2.2 VISUAL DISPLAY BOARDS

A. Markerboards: Porcelain enamel on steel, laminated to core.
   1. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
   2. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
   3. Backing: Aluminum foil, laminated to core.
   4. Size: As indicated on drawings.
   5. Frame: Extruded aluminum, with concealed fasteners.
   6. Frame Profile: 1-1/2 inch wide, rectangular trim.
   7. Frame Finish: Anodized, natural.
   8. Accessories: Provide chalk tray and map rail.

B. Tackboards: Composition cork.
   1. Cork Thickness: 1/8 inch.
   2. Color: As selected from manufacturer's full range.

3. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
5. Size: As indicated on drawings.
6. Frame: Extruded aluminum, with concealed fasteners.
7. Frame Profile: 1-1/2 inch wide, rectangular trim.
8. Frame Finish: Anodized, natural.

2.3 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).

C. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

2.4 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall, full width of frame.

B. Chalk Tray: Aluminum, manufacturer's standard profile, one piece full length of chalkboard, molded ends, concealed fasteners, same finish as frame.

C. Mounting Brackets: Concealed.

D. Marker Sets: Provide a four (4) marker set (blue, red, green, black) and a dry eraser for each room where marker boards are installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Install visual display surfaces in locations and at mounting heights indicated on Drawings.

C. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

D. Secure units level and plumb.

3.3 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Building signage.

B. Flag holders.

1.2 SUBMITTALS

A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

B. Samples: Submit one sample of one letter, of size similar to that required for project, illustrating sign style, font, and method of attachment.

C. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

PART 2 PRODUCTS

2.1 SIGNAGE APPLICATIONS

A. Exterior Letter Signage and Cutout Graphic:
   1. Use individual cut metal letters and graphics.
   2. Mounting: Flush mount.

2.2 DIMENSIONAL LETTERS

A. Exterior Cut Metal Letters:
   1. Metal: Aluminum, cut sheet.
   2. Finish: Clear anodized.
   3. Color: Match Architect's sample.
   4. Letter Depth: 1/4 inch.
   5. Letter Style and Height: As indicated on drawings.
   6. Basis-of-Design: ASI, Cut Metal Letters.

B. Exterior Cut Metal Graphics:
   1. Metal: Aluminum, cut sheet.
   2. Finish: Clear anodized and baked enamel colors as indicated on drawings.
   3. Graphic Depth: 1/4 inch.
   4. Design: As indicated on drawings.
   5. Basis-of-Design: ASI, Custom Metal Cut Graphics.

2.3 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

2.4 FABRICATION - GENERAL

A. General: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.

C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

D. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

E. Create signage to required sizes and layout. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 22 13

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wire mesh system for walls.

1.2 SUBMITTALS

A. Product Data: Provide data for screen materials, finishes.

B. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, anchorage, and type and location of fasteners.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wire Mesh Partitions:
   1. Acorn Wire and Iron Works, Inc; 130A: www.acornwire.com.
   2. Central Wire and Iron Works; Partition Type 135.

2.2 WIRE MESH PARTITIONS

A. Wire Mesh Partitions: Factory-fabricated modular assemblies of wall panels, doors, anchors, and accessories as required to provide a complete system.
   1. Duty Rating: Heavy.

2.3 MATERIALS

A. Framing Members: ASTM A500/A500M, Grade B cold-formed steel tubing, square and rectangular shaped.

B. Metal Fabric: 1.5 inch diamond mesh galvanized steel wire, interwoven, 10 gage thick, knuckled at top and bottom selvages with wire securelty clinched to framing.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.4 FASTENERS

A. Bolts, Nuts and Washers: Hot dip galvanized.

B. Anchorage Devices: Provide power driven, powder actuated, and drilled expansion bolts.

C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of structure.

2.5 ACCESSORIES

A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

C. Post Caps: Manufacturer's standard.

D. Floor and Ceiling Pilaster Shoe: Manufacturer's standard.

E. Floor Base: Manufacturer's standard.

F. Shop and Touch-Up Primer:
   1. Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.6 COMPONENTS

A. End and Corner Posts: 1-1/4 x 1-1/4 inch x 1/8 inch angle.

B. Vertical Frames: 1-1/4 x 5/8 inch "C" type, cold rolled channel.

C. Horizontal Frames: 1 x 1/2 x 1/8 inch channel mortised and tenoned at intersections.

D. Top Rail: 2-1/4 x 1 inch cold rolled channel with 1/4 inch "U" bolts approximately 24" O.C.

E. Center Reinforcement: 2- CR channel, 1 x 3/8 inch bolted each side of mesh.

F. Door Frames: 1-1/4 inch x 1/2 inch x 1/8 inch channel with 1-1.4 inch x 1/8 inch cover plate on four sides.

G. Gate: Comply with ASTM F 654 and the following:
   1. Sliding doors to have: two, 4-wheel trucks hung in enclosed box track and bottom guide channel. Provide hasp at door for user provided padlock.

2.7 FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Galvanizing: In accordance with requirements of ASTM A123/A123M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that substrate surfaces and required openings are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. Anchor partitions to floor with 3/8-inch- diameter, postinstalled expansion anchors through floor shoes located at each post and corner.
   1. Shim anchor clips as required to achieve level and plumb installation.
   2. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.

D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567. Install braces at end and gate posts and at both sides and corner and pull posts.

F. Top Rail: Install according to ASTM F 567.

G. Bottom Rails: Install, spanning between posts.

H. Wire Mesh Fabric: Apply fabric to enclosing framework.

I. Gate Installation: Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary.

3.3 TOLERANCES

A. Maximum Variation From Plumb or Level: 1/4 inch.

B. Maximum Misalignment From True Position: 1/4 inch.

3.4 ADJUSTING

A. Adjust hinged doors to achieve free movement.

3.5 CLEANING

A. Remove temporary protection to prefinished surfaces.

END OF SECTION

SECTION 10 22 43

SLIDING GLASS PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing a top-hung sliding-folding aluminum-framed glass door or storefront system that includes:
   1. Aluminum frame
   2. Threshold
   3. Panels
   4. Sliding-folding and locking hardware
   5. Weatherstripping
   6. Glass and glazing
   7. Insect screen
   8. Accessories as required for a complete working installation.

B. Related Documents and Sections:
   1. Section 06 10 00, Rough Carpentry: Wood framing R.O. and blocking.

1.2 REFERENCES

A. Reference Standards in accordance with Division 01 and current editions from the following:
   1. AAMA. American Architectural Manufacturers Association; www.aamanet.org
      a. AAMA 503, Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
      b. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum
      c. AAMA 920, Operation / Cycling Performance
      d. AAMA 1303.5, Voluntary Specification for Forced Entry Resistant Aluminum Sliding Glass Doors
      e. AAMA 2604, Voluntary Specifications, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
      f. AAMA 2605, Voluntary Specifications, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
   2. ANSI. American National Standards Institute; www.ansi.org
      a. ANSI Z97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used In Buildings
   3. ASTM. ASTM International; www.astm.org
      a. ASTM C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
      b. ASTM E413, Classification for Rating Sound Insulation
      c. ASTM E1332, Standard Classification for Rating Outdoor-Indoor Sound Attenuation
   4. CPSC. Consumer Product Safety Commission; www.cpsc.gov
      a. CPSC 16CFR-1201, Safety Standard for Architectural Glazing Materials

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s printed product literature for each Folding Glass Storefront system to be incorporated into the Work. Show performance test results and details of construction relative to materials, dimensions of individual components, profiles and colors.

B. Shop Drawings: Indicate Folding Glass Storefront system component sizes, dimensions and framing R.O., configuration, swing panels, direction of swing, stacking layout, typical head jamb, side jambs and sill details, type of glazing material, handle height and field measurements.

C. Manufacturers' Instructions: Submit manufacturer's installation instructions.

D. Operation and Maintenance Data: Submit Owner’s Manual from manufacturer. Identify with project name, location and completion date, and type and size of unit installed.

E. Submit calculations or measurements for occupant spaces to meet sound transmission class ratings between adjacent spaces and reverberation time requirements within a room.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer capable of providing complete, precision built, engineered, pre-fitted units with a minimum twenty-five (25) years' experience in the sale of folding-sliding door systems for large openings in the North American market.

B. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar products for large openings. Installer to provide reference list of at least three (3) projects of similar scale and complexity successfully completed in the last three (3) years.
   1. Installer to be trained and certified by manufacturer.

C. Single Source Responsibility: Furnish Folding Glass Storefront system materials from one manufacturer for entire Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions and recommendations, Section 01 60 00 requirements, and as follows:
   1. Deliver materials to job site in sealed, unopened cartons or crates.
      a. Upon receipt, inspect the shipment to ensure it is complete, in good condition and meets project requirements.
   2. Store material under cover in a clean and dry location, protecting units against weather and defacement or damage from construction activities, especially to the edges of panels.

1.6 FIELD CONDITIONS

A. Field Measurements: Contractor to field verify dimensions of rough openings (R.O.) and threshold depressions to receive sill. Mark field measurements on shop drawing submittal.

1.7 WARRANTY

A. Manufacturer Warranty: Provide Folding Glass Storefront system manufacturer's standard limited warranty as per manufacturer's published warranty document in force at time of purchase, subject to change, against defects in materials and workmanship.
   1. Warranty Period beginning with the earliest of 120 days from Date of Delivery or Date of Substantial Completion:
      a. Rollers and Glass Seal Failure: Ten (10) years
      b. All Other Components Except Screens: Ten (10) years

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: NanaWall SL45 by NANA WALL SYSTEMS, INC.

2.2 PERFORMANCE / DESIGN CRITERIA

A. Performance Criteria (Lab Tested):
   1. Structural Loading (ASTM E330): DP-40 DP-45
      a. Load Structure: At 1.5 times design wind pressure with no glass breakage or permanent damage to fasteners or storefront components.
      b. Design Pressure w/ Reinforced Locking Unit: Positive and Negative at 35 psf (1675 Pa)
   2. Forced Entry (AAMA 1303.5 and AAMA CAWM 300): Meets requirements.
   3. Swing Panel - Operation / Cycling Performance (AAMA 920): 500,000 cycles

B. Design Criteria:
   1. Sizes and Configurations: As indicated by the Drawings for selected number and size of panels, location of swing panels, and location of tracks and stacking bays.
   2. Unit Operation: Adjustable sliding and folding hardware with top and bottom tracks;
      a. inswing type.
      b. outswing type.
      c. center pivot type.
      d. inswing and outswing type.

3. Panel Configuration:
   a. Straight
   b. Segmented curve
   c. 90º angle turn
   d. 135º angle turn.
   e. Window/ door combination.
4. Stack Storage Configuration:
   a. Inside
   b. Outside
   c. Center pivot
   d. Foldflat® against Wall
5. Mounting Type: Top hung
6. Panel Type: Hinged Unhinged
   a. Primary swing panel of paired swing panels, looking from inside, to be on the left right.
   b. Entry/Egress panel hinged to side jamb.
7. Panel Pairing Configuration: See drawings.

2.3 MATERIALS

A. Sliding-Folding Glass Storefront Description: Monumental top-hung system designed for straight runs, segmented angle changes, center pivot, and capable of folding flat against adjacent walls. Manufacturer's standard frame and panel profiles, with head and floor tracks, side jambs and panels with dimensions as shown on Drawings.
   1. Panels:
      a. Single lite.
      b. Horizontal mullion(s) at specified height(s) from the bottom of the panel.
      c. Simulated divided lites in pattern as shown on Drawings.
   2. Panel Size (W x H): As indicated.
   3. Rail Depth: 1-3/4 inch
   4. Head Width: 4-7/8 inch
   5. Head and Jamb Rail Width: 2-1/8 inch
   6. Bottom Rail Width:
      a. 3-9/16 inch overall with 2-1/16 inch rail for standard sill
      b. 2-1/16 inch for Saddle Sill, Flush Sill and Surface mounted Interior Sill
      c. Manufacturer's standard kickplate with height indicated.
   7. Aluminum Extrusion: AlMgSi0.5 alloy, 6063-T5 (F-22 - European standard)
      a. Thickness: 0.078 inch (2.0 mm) nominal
   8. Aluminum Finish (including head track covers):
      a. Anodized (AAMA 611):
         1) Clear
      b. PVDF Coat (AAMA 2605): Fluoropolymer Kynar with color to match custom finish.

B. Glass and Glazing:
   1. Safety Glazing: In compliance with ANSI Z97.1 and CPSC 16CFR 1201.
      a. Glass Acoustical Performance (DIN 52210-3,4):
         1) STC 28; 1/4 inch (6 mm) single, tempered glass
   2. Manufacturer's tempered glass lites dry glazed with glass stops on the inside.
      a. Glass Lite:
         1) Single: 1/4 inch (6 mm) thick.
      b. Glass Treatment:
         1) Standard

C. Locking Hardware and Handles:
   1. Main Entry Panel For Models WITH a Pair of Swing Panel(s): Provide lever handles on the inside and outside with single action, emergency egress, interconnected lock.
   2. Flat Handle - Finish:
      a. Brushed satin stainless steel
   3. Handle Height: 41-3/8 inch centered from bottom of panel or as otherwise indicated.

4. Stainless steel (impact) locking rods with standard fiberglass reinforced polyamide end caps at the top and bottom. Rods to have a stroke of 15/16 inch.

D. Sliding- Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top and bottom tracks.
   1. For each pair of folding panels, provide independent cardanic suspension for four (4) wheeled rollers coated with fiberglass reinforced polyamide upper running carriage and lower guide carriage.
   2. Swing Panel Hinges:
      a. Zinc die cast with finish closest match to finish of frame and panels and stainless steel security hinge pins with set-screws.
   3. Adjustment: Provide 1/16 inch in width per hinge adjustments without removing panels from tracks and without needing to remove panels from tracks.
   4. Sill Type:
      a. Standard flush sill (thermally broken)
      b. Alternate flush sill (not thermally broken)
      c. Low profile saddle sill (thermally broken)
      d. Surface mounted interior sill (not thermally broken)
      e. Finish: Aluminum with
         1) a clear anodized finish.
         2) a dark bronze anodized finish.
         3) finish to match panel.
      f. Cover plate over sill NOT acceptable.

E. Weatherstripping: Manufacturer's double layer EPDM between panels, EPDM gasket and Q-lon gasket, or brush seal between panel and frame, or brush seals with a two-layer fiberglass reinforced polyamide fin attached at both inner and outer edge of bottom of door panels with a recessed sill or on frame for sealing between panels and between panel and frame.

F. Fasteners: Stainless steel screws for connecting frame components.

2.4 FABRICATION

A. Extruded aluminum frame and panel profiles, corner connectors and hinges, sliding and folding hardware, locking hardware and handles, glass and glazing and weatherstripping components needed to construct a folding glass wall.
   1. Each unit factory pre-assembled and shipped with all components and installation instructions.
   2. Exposed work to be carefully matched to produce continuity of line and design with all joints.
   3. No raw edges visible at joints.

2.5 ACCESSORIES

A. Provide sidelights, transoms, corner posts, or single or double doors as indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions
   1. Carefully examine rough openings with Installer present, for compliance with requirements affecting Work performance.
      a. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square with no unevenness, bowing, or bumps on the floor; and other conditions as required by the manufacturer to receive Work.
      b. Verify the structural integrity of the header for deflection with live and dead loads limited to the lesser of L/720 of the span or 1/4 inch. Provide structural support for lateral loads, and both wind load and eccentric load when the panels are stacked open.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install Folding Glass Storefront system in accordance with the Drawings, approved submittals, manufacturer's recommendations and installation instructions, and as follows:
   1. Properly flash, waterproof and seal around opening perimeter.

2. Securely attach anchorage devices to rigidly fit frame in place, level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work
3. When lower track is designed to drain, provide connections to allow for drainage.
4. Install panels, handles, lockset, screens and other accessories in accordance with manufacturer's recommendations and instructions.

3.3 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Verify the Folding Glass Storefront system operates and functions properly. Adjust hardware for proper operation.

B. Non-Conforming Work: Repair or replace non-conforming work as directed by the Architect; see General and Supplementary Conditions, and Division 01, General Requirements.

3.4 CLEANING AND PROTECTION

A. Keep units closed and protect Folding Glass Storefront installation against damage from construction activities.

B. Remove protective coatings and use manufacturer recommended methods to clean exposed surfaces.

END OF SECTION

SECTION 10 26 01

CORNER GUARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Corner guards.

1.2 SUBMITTALS

A. Product Data: Indicate physical dimensions.

B. Manufacturer's installation instructions.

C. Manufacturer's cleaning instructions.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Corner Guards - Surface Mounted:
   1. Material: Type 304 stainless steel, No. 4 finish, 16 gage, 0.06 inch thick.
   2. Width of Wings: 2-1/2 inches.
   3. Corner: Square.
   4. Length: One piece. Height as indicated on drawings.
   5. Mounting: Adhesive.
   6. Product:
      a. Koroseal, GS25 Stainless Steel Corner Guard.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Corner Guards:
   1. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

3.2 CLEANING

A. Clean corner and wall bumpers in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Toilet accessories.

B. Shower and bath accessories.

1.2 RELATED REQUIREMENTS

A. Section 09 30 00 - Tiling: Ceramic washroom accessories.

B. Section 10 21 13.19 - Plastic Toilet Compartments.

1.3 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM C1036 - Standard Specification for Flat Glass; 2016.

D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

1.5 SUBMITTALS

A. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. All items of each type to be made by the same manufacturer.

2.2 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide six keys for each accessory to Owner; master key all lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269, Type 304 or 316.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Adhesive: Two component epoxy type, waterproof.

G. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.

2.3 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

2.4 Toilet Accessories

A. Toilet Paper Dispenser:
   1. Product: Owner furnished, contractor installed

B. Surface Mounted Toilet Paper Dispenser:
   1. Product: Owner furnished, contractor installed

C. Waste Receptacle: Stainless steel, freestanding style with swing top.
   1. Liner: Removable, heavy-duty vinyl liner, attached at a minimum of 3 points with stainless steel grommets and hooks.
   2. Minimum capacity: 10 gallons.

D. Soap Dispenser: Owner Furnished, Contractor Installed.

E. Framed Mirrors: Stainless steel framed, 6 mm thick float glass mirror.
   1. Size: As indicated on drawings.
   2. Frame: 0.05 inchchannel shapes, with mitered corners, and tamperproof hanging system; No.4 finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.

F. Grab Bars: Stainless steel, nonslip grasping surface finish.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.
      d. Product: Bobrick, B-6806.

G. Surface Mounted Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door with full-length stainless steel piano-type hinge.

2.5 SHOWER ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1-1/4 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for concealed mounting.

B. Shower Curtain: Manufacturer's standard shower curtain with stainless steel grommets for hook attachment to curtain rod
   1. Material: , 0.006 inch thick, matte finish, flameproof and stain-resistant.
   2. Size: Minimum 12 inches wider than opening by 72 inches high.
   3. Shower curtain hooks: Chrome-plated or stainless steel spring wire designed for snap closure. Provide one hook per curtain grommet.

C. Robe Hook: Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguisher cabinets.

B. Accessories.

1.2 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.3 QUALITY ASSURANCE

A. Confirm keying for emergency key cabinet with fire department having jurisdiction prior to final purchase of unit.

1.4 SUBMITTALS

A. Product Data: Provide extinguisher operational features.

B. Shop Drawings: Indicate cabinet physical dimensions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers:
   1. JL Industries, Inc.
   2. Larsen's Manufacturing Co.
   3. Potter-Roemer.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Class: A:B:C.
   2. Finish: Baked enamel, color as selected.

2.3 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed and surface mounted types as required by wall construction. Use semi-recessed cabinets in metal stud wall construction.
   1. Size to accommodate accessories.
   2. Trim for Semi-Recessed: Rolled return with 2-1/2 inch projection.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

D. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Finish of Cabinet Exterior Trim and Door: Stainless Steel No. 4.

F. Finish of Cabinet Interior: White colored enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers in cabinets and on wall brackets.

END OF SECTION

SECTION 10 51 10

TURNOUT GEAR LOCKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Design, fabrication and installation of wall mounted turnout gear lockers as specified herein.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

B. Shop Drawings: Submit manufacturer's shop drawings for each individual run of lockers.

C. Samples: Submit manufacturer's standard color samples.

D. Owner's Manual: Provide maintenance manual at closeout.

E. Warranty: Submit manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of fifteen years experience in the direct manufacture of lockers.

B. Installer Qualifications: Installer shall have experience necessary to assure lockers are installed properly and according to manufacturer's instructions.

C. Reference:
   1. ASTM A513 – Minimum properties of Electric-Resistance-Welded Carbon Allow Steel Mechanical Tubing
   2. ASTM A510 – Minimum properties of Wire Rods and Coarse Round Wire, Carbon Steel and Alloy Steel

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers with labels identifying product and manufacturer's name.

B. Storage: Store materials in a clean dry area.

C. Handling: Protect materials and finish during installation and handling to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design:
   1. GearGrid Corporation, GEARGRID Wall Mounted Storage System.

2.2 TURNOUT GEAR LOCKER FABRICATION

A. C. Locker Sizes:
   1. Standard 20": Overall dimension- 74.5" high x 21.25" wide x 20" deep.
      a. Clear Opening Width: 18.75"

B. Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.

C. Vertical Dividers:
   1. Outer Frames: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
   2. Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
   3. Inner Grid wires must be full length and width of inside vertical divider frame. Wires not running full length or width, thus creating exposed wire ends will not be acceptable.
   4. Inner Grid wires must run horizontally and vertically creating a square or rectangular grid pattern only. Grid wires not creating a square or rectangular grid pattern will not be acceptable.
   5. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.

D. Back Panel:

1. Required on each locker to protect the locker contents and wall substrate, as well as provide an additional panel for accessory attachment.
2. Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
3. Back panel must engage and be secured to vertical dividers via horizontal wires which extend into mounting holes pre-drilled in vertical dividers. Back panels are sandwiched between vertical dividers, preventing them from being removed after assembly is complete.
4. Inner Grid wires must be full length and width of inside vertical divider frame. Wires not running full length or width, thus creating exposed wire ends will not be aeptable.
5. Inner Grid wires must run horizontally and vertically creating a square or rectangular grid pattern only. Grid wires not creating a square or rectangular grid pattern will not be acceptable.
6. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.

E. Shelves: (1) Upper, (1) Lower. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Upper shelf shall include an integrated 20 gauge steel bracket to accept a 2" x 16" name placard, unless doors are selected as an option, in which case the name placard will be integrated into the door.

F. Apparel Hooks: (3) per locker opening. .192" diameter ASTM 510 cold drawn steel wire resistance welded, cold formed and powder coated. Apparel hooks must securely engage and snap onto side or back grid, to prevent unintentional disengagement of hook.

2.3 ACCESSORIES

A. Hang Bar (Optional)
1. Hang Bars must be manufactured to allow each locker user to install at their desired height. Hang Bars that span multiple locker openings are not acceptable.
2. Tube: 1.25"O.D. x 16 gauge 304 stainless steel tubing.
3. Brackets: Allow Hang Bars to be securely attached to each vertical divider, powder coated.

B. Heavy Hanger (optional):
1. .25" diameter 304 stainless steel wire cold formed and resistance welded.
2. Black vinyl coating on hook end.

C. Gear Dryer Hanger (optional):
1. 1. .25" diameter 304 stainless steel wire cold formed and resistance welded. Includes formed loops to prop open sleeves on jackets to promote better circulation throughout the garment.
2. 2. Black vinyl coating on hook end.

D. Glove Drying Hanger (optional):
1. .25" diameter 304 stainless steel wire cold formed and resistance welded.
2. Black vinyl coating on hook end.

E. Helmet Holder (optional, not recommended when Door and Top Cover option or Top Side Storage option is also selected):
1. .25" diameter ASTM 510 cold drawn steel wire resistance welded. Powder coated finish in specified color.

F. Secure Box (optional):
1. 6" wide x 6" high x 12" deep 6061 Aluminum enclosure with hinged, lockable door at outer end. Design shall include an integrated mail slot. Powder coated finish in specified color.

G. Power Bar (optional on 20" and 24"):
1. 16 gauge steel chase integrated into the upper framework of the locker assembly allowing provision for the installation of a 120VAC duplex outlet at each locker location. Powder coated finish in specified color.
   a. a. No outlets or electrical connections included with Power Bars.

H. Top Side Storage (optional):
1. Shelf spanning across the top of the lockers for additional gear storage above lockers. .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern. Powder coated finish in specified color.

2.4 FINISH

A. General: All system components excluding assembly and mounting hardware and stainless steel components are to receive the standard finish.

B. Standard Finish: Components to be cleaned using a phosphatized bath, clear water rinse and electro-statically coated with a durable and UV-stable TGIC powder coating process. Thickness of applied finish shall be 3 – 4 mm for added protection.

C. Color: As selected by Architect from manufacturer's standard colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine area to receive lockers. Notify architect if area are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Install lockers in accordance with manufacturer's instructions.

B. Use manufacturer's hardware for assembly.

C. Anchor to mounting surface with proper hardware.

END OF SECTION

SECTION 10 51 13

WELDED METAL LOCKERS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Personal Storage Lockers, Personal Storage Lockers with built-in bench drawers, Personal Storage Lockers with built-in external access drawers and Personal Storage Lockers in Multi-tier Configuration

1.2 REFERENCES

A. American National Standards Institute (ANSI) Standards:
   1. Applicable standards for fasteners used for assembly.

B. American Society for Testing and Materials (ASTM) Standards:
   1. Applicable standards for steel sheet materials used for fabrication
   2. Applicable standards for the testing of electrostatically applied Powder Coat Paint

C. American Institute Of Steel Construction (AISC) Standards:
   1. Applicable standards for steel materials used for fabrication.

1.3 PERFORMANCE REQUIREMENTS

A. Design Requirements:
   1. Limit overall width not to exceed specified nominal width; locker width designed for zero growth.

B. Seismic Performance: Provide Welded Metal Lockers capable of withstanding the effects of earthquake movement when required by applicable building codes.

C. ADA Requirements: Personal Storage Lockers with nominal height of 72 inches meet ADA requirements.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and installation instructions for each type of welded metal locker required. Include data substantiating that products to be furnished comply with requirements of the contract documents.

B. Shop Drawings: Show fabrication, assembly, and installation details, including descriptions of procedures and diagrams. Show complete locker installation layout, including quantities, locations and types of accessory units required. Include notations and descriptions of all installation items and components.
   1. Show installation details at non-standard conditions, if any.
   2. Provide layout, dimensions, and identification of each unit, corresponding to sequence of installation procedures.
   3. Provide installation schedule and procedures to ensure proper installation.

C. Samples: Provide minimum 3 inches square example of each color and texture on actual substrate for each component to remain exposed after installation.

D. Maintenance Data: Provide written documentation of the manufacturer’s statement, claiming the maintenance free nature of the product.

E. Reference List: Provide a list of recently installed welded metal lockers to be visited by owner, architect, and contractor. Intent of list is to aid in verifying the suitability of manufacturer's products and comparison with materials and product specified in this section. Include contact name, address, and phone numbers.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage an experienced manufacturer who is ISO 9001:2008 certified for the design, production, installation and service of welded metal lockers. Furnish certification attesting ISO 9001:2008 quality system registration.

B. Installer Qualifications: Engage an experienced installer who is the manufacturer's authorized representative for the specified products for installing welded metal lockers.

1. Minimum Qualifications: 1-year experience installing welded metal lockers of comparable size and complexity to specified project requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify quantities of welded metal locker units before fabrication. Indicate verified measurements on shop drawings. Coordinate fabrication and delivery to ensure no delay in progress of the work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating welded metal lockers units without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.8 SEQUENCING AND SCHEDULING

A. Sequence welded metal lockers with other work to minimize possibility of damage and soiling, during remainder of construction period.

B. Schedule installation of specified welded metal lockers after finishing operations, including painting, have been completed.

C. Provide components, which must be built in at a time, which causes no delays in the general progress of the work.

D. Pre-installation Conference: Schedule and conduct conference on project site to review methods and procedures for installing welded Metal Lockers including, but not limited to, the following:
   1. Recommended attendees include:
      a. Owner's Representative.
      b. Prime Contractor or representative.
      c. The Architect.
      d. Manufacturer's representative.
      e. Subcontractors or installers whose work may affect, or be affected by, the work of this section.

1.9 WARRANTY

A. Provide a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units, which fail in materials or workmanship within the established warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have under General Condition's provisions of the Contract Documents.

B. Limited Lifetime Warranty: Subject to the terms in the written warranty, warrant the original purchaser exclusively that the locker frames manufactured by it will be free from defects in materials and workmanship for the lifetime of the locker.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Spacesaver Corporation, FreeStyle Personal Storage with built-in bench drawers.

2.2 DESCRIPTION

A. General: Welded Metal Lockers only with end-user reconfigurable interior. Specialized lances to provide the flexibility of on-site, end-user reconfiguration/addition of internal components anytime, anywhere, now or in the future.

B. Finishes:
   1. Fabricated Metal Components and Assemblies: All components to be painted with an electro-statically applied Powder Coat paint that can meet or exceed test requirements set out by ASTM standard D3451-06 Standard Guide for Testing Coating Powders and Powder Coatings.

C. Sizes:
   1. Personal Storage Lockers with built-in bench drawers: nominal heights of 84 inches respectively; Built-in bench drawer nominal height of 18 inches and nominal depth of 36 inches.

2.3 MANUFACTURED COMPONENTS

A. Welded Frame:
1. The welded frame must consist of top, bottom, back, and sides constructed of a minimum of 18-gauge steel. All frame components shall be joined using resistance welding. Riveting of structural members will not be permitted.
2. Horizontal front flanges will be a minimum of 2 inches. Vertical front flanges will be a minimum of 1 inch. Horizontal and vertical flanges will overlap and be secured with a minimum two (2) resistance welds per corner.
3. Corner gussets shall be MIG and spot welded in each of the four front corners of the locker for increased stiffness and rigidity.
4. Provide side panel lances evenly spaced on 3 inch centers. Lances to provide the flexibility of on-site, end-user reconfiguration/addition of internal components anytime, anywhere, now or in the future.
5. Bench Housing for built-in bench drawer
   a. Welded frame construction shall consist of top, bottom, and side components joined by using resistance welding. Riveting of bench housing structural members will not be permitted.
   b. Corner gussets shall be welded in the two (2) front bottom corners of the bench housing for increased stiffness and rigidity.
   c. Horizontal front flanges will be a minimum of 1 inch.
   d. Vertical front flanges will be a minimum of 1 inch.
   e. Horizontal and Vertical front flanges will overlap and shall be secured with minimum of one (1) resistance weld per corner.
   f. Side panels – Lances symmetric and evenly spaced to provide optimum component locations (standard based on 3 inch on center vertical placement to match mating locker lance design).
   g. Return flanges on housing to securely fasten housing to welded frame of locker.
   h. Base of bench housing shall include four (4) 3/8”-16 UNC threaded weld-nuts and corresponding leveling feet.
   i. Top of bench housing shall include hole pattern for mating bench seat.
   j. Sides of bench housing shall include mounting holes in the event lockers are ganged together.
   k. Lockers with built-in bench drawer and built-in external access drawer shall have intermediate base shelf with interlocking mechanism for securing drawer when locker door is closed.
   l. Provide four (4) 0.875 inch diameter electrical knock-outs per locker, two (2) located on top of the locker in both right and left rear corners, and two (2) located in the back of locker centered at a distance no greater than 24 inches from the top and bottom. Knock-outs allow end-user flexibility of adding electrical capability to lockers.
   m. Provide a minimum of four (4) duplex receptacle electrical knock-outs per locker; to be used with a UL listed manufactured electrical wiring system as required. This manufactured electrical wiring system is a simple, unique, flexible, and cost effective method of providing electrical capability to the lockers. This electrical system can be added in the future.
      1) Top of the locker shall have four (4) duplex electrical knock-outs.
      2) Top of locker shall have electrical duplex receptacle knock-outs located on both right and left side of locker.
      3) Back panel of locker shall have a minimum of two (2) duplex electrical knock-outs.
      4) Back of locker shall have electrical duplex receptacle knock-outs located on both right and left side of locker and no farther than 24 inches from the top of the locker.
   n. Provide ventilation holes in top of locker to allow mechanically extracted air to be pulled up through the locker system as required. Ventilation shall be controlled by eight (8) evenly spaced 0.625 inch diameter holes. Proper ventilation system ensures unpleasant odors are removed from locker system.
   o. Lockers shall be prepared with mounting holes for attaching necessary trim components
   p. Locker shall be prepared with mounting holes for ganging lockers back-to-back or side-by-side
   q. Base of lockers shall include four (4) 3/8”-16 UNC threaded weld-nuts and corresponding leveling feet.
   r. Base shelf for lockers with built-in external access drawers and bench drawers shall have holes to accommodate double-door lock rod and door stop bracket.
   s. End Panels: End Panels with no exposed fasteners shall be provided on the end of each locker run; thus providing a clean and aesthetically pleasing appearance.
   t. Locker size:

1) Width:
   (a) Personal Storage Locker with built-in bench drawer: 36 inches.
2) Height:
   (a) Personal Storage Locker with built in bench drawer or external access drawer: 84 inches.
3) Depth:
   (a) All lockers 24 inches.
   (b) Bench drawers: 36 inches.
      (1) Bench seat depth 13.0 inches.
      (2) Leading edge of bench seat to extend 1.125 inches from front of bench drawer

B. Ventilation:
   1. Provide ventilation holes in top of locker to allow mechanically extracted air to be pulled up through the locker system as required. Ventilation shall be controlled by eight (8) evenly spaced 0.625 inch diameter holes. Proper ventilation system ensures odors are removed from locker system.
   2. Provide an adjustable air baffle for system balancing when mechanical air extraction is used. Upon balancing system, air baffle shall be secured with a fastener to maintain ventilation setting.
   3. Provide louvered air vents in bottom of the main locker door/s to allow mechanically extracted air to be pulled up through the locker system.
   4. Provide louvered air vents in drawer front when built-in bench drawer or built-in external access drawer models are required.
   5. Minimum 0.500 inch gap between back of shelving components and back of locker to provide uninterrupted air flow up the rear of the locker system.
   6. Minimum 2.00 inches gap between front of shelving and locker door to provide uninterrupted air flow up the front of the locker system.
   7. Provide Multi-Tier ventilation thru door panels.

C. Electrical
   1. Shall provide four (4) electrical knock-outs per locker. This feature provides the end-user the opportunity for hard wire electrical connection points for each locker.
   2. Shall provide a minimum of four (4) duplex receptacle electrical knock-outs per locker.
   3. Shall provide UL Listed manufactured electrical wiring system as required. This manufactured electrical wiring system provides connection for a maximum of 78 receptacles per hardwired power in-feed.

D. Drawers:
   1. Drawer body wrapper shall have welded frame construction. Riveting of structural members will not be permitted.
   2. Drawers for locker with built-in bench drawers and built-in external access drawers shall have box-formed drawer front.
   3. Provide interlock system for securing drawer when main locker doors are closed and provide access only when main locker door/s is opened.
   4. Built-in bench drawer shall have a nominal 36 inches depth.
   5. Provide a flush mounted pull handle.
   6. Drawer Slides: Provide 200 lbs maximum load capacity and pass 50,000 cycle performance testing (Max. load, uniform distribution)
   7. Drawer base minimum 21 inches drawer extension
   8. Bench drawer minimum 26.5 inches drawer extension
   9. Provide louvered air vents in drawer fronts.

E. Bench Seat:
   1. Provide 13.0 inches deep laminated kiln dried maple bench seat; material thickness 1.25 inches.
   2. Front (leading edge) of bench seat to have .625 inch radius bull nose.
   3. Finish of bench seat shall be sanded smooth and have two (2) coats of catalyzed varnish applied.

F. Single-Piece Welded Doors:
   1. Shall be formed from two (2) pieces of minimum 18-gauge cold rolled steel box formed and welded together using modern GMAW techniques. Single-piece door with inner and outer door panels shall have a combined steel thickness of no less than 0.096 inches thick. Welded door design with inner panel optimizes structural integrity of locker door system over and above any single frame door design.
   2. Exterior door panel shall be constructed with formed flanges and return flanges to add stiffness.
   3. Internal door panel shall be constructed with formed flanges for added stiffness.

4. All inner door panel heights shall be minimum 70% of external door height.
5. Single-piece welded door frame shall consist of internal door panel nested inside exterior door panel and welded per the following requirements:
    a. Top / bottom. Exterior and Interior panels to be welded in a minimum of three (3) places with weld spacing not to exceed 6 inches between adjacent welds and 1 inch from any corner.
    b. Sides. Exterior and interior panels to be welded with spacing not to exceed 12 inches between adjacent welds and 1 inch from any corner.
    c. Inner door panel to have peg board style hole pattern, allowing the attachment of Document Holder and any standard peg board accessory.
    d. Inner door panel to have 4 inch rectangular slot centered towards the top of the locker.
    e. External door panel shall have louvers to provide adequate air circulation throughout locker system.
        1) Louvered air vents shall be located at the bottom of the locker door to enhance circulation of mechanically extracted air from the bottom of the locker out of the top.
        2) Louvered air vents shall be approximately 3 inches in width and 0.75 inches in height and spaced on 1 inch centers.
    f. Double door designs shall consist of the following:
        1) Primary door located on the right and the secondary door located on the left-hand side of the locker.
        2) Secondary door locking mechanism shall consist of the following:
            (a) Return flange for supporting primary door.
            (b) Catch bracket.
            (c) One lower lock rod.
    g. All doors shall have neoprene silencers on each door for noise reduction
    h. Door torsional deflection shall not exceed 0.1875 inch with a 20 lb point load.
        1) Provide 16-gauge full length hinge for increased strength and security of locker system.
        2) Hinges to be welded to door frame with spot welds not to exceed 6 inch separation.
    i. Door assembly to be riveted to door frame on factory pre-established hole pattern.
    j. Locking Mechanism.
        1) Provide protective stainless steel cover plate for durability and scratch resistance):
            (a) Combination lock with master and padlock hasp.
        2) Locking mechanisms shall have the capability of locking automatically.
        3) Locking mechanisms shall have master key override.
        4) Combination locking mechanism shall have user changeable preset combinations.
        5) Single door models: Provide three locking options as listed above.
        6) Double door models: Provide three locking options on the primary door and simple secure lift latch mechanism with 0.3125 inch lock rod for secondary door.

G. Interior/Accessory components:
1. All interior components must be constructed of minimum 18-gauge steel.
2. For added security, internal component can be secured utilizing blind rivets, threaded fasteners, or bending specially designed tab.
3. All interior components available at time of order and as post-installation upgrades in the future.
4. Shelves:
    a. Shelf with integral hanger bracket
        1) Size specified by locker width
        2) Hanger bracket designed with perforations on approximately 3 inch centers to insure clothing separation for optimum ventilation.
        3) Performance: Uniform load rating 300 lbs.
        4) Heavy Duty
            (a) Size specified by locker width
            (b) Performance: Uniform load rating 300 lbs.
        5) Shelf rear return flange stops minimum 0.50 inch short of locker back panel on order to allow air circulation throughout entire locker assembly
    b. Modular Shelf:
        1) Provides storage compartment for smaller items.
        2) Approximate compartment size: 9 inches wide and 12 inches high.
        3) Modular shelves to have tabs to interlock with frame side panel lances.

4) Modular shelves vertical sides to have lances that match with opposing side panel lances.
5) Modular shelves shall have two (2) locations on vertical side panel for attaching hooks, and one (1) location on bottom for attaching double hook accessories.
6) Shelf rear return flange stops approximately 1 inch short of locker back panel on order to allow air circulation throughout modular shelf.
7) Provide modular shelf with slots for connection with file dividers and shelf back stop. File dividers will aid in maintaining a neat and orderly locker system.

c. Provide lockable compartment for small valuables.
1) Lockable compartment shall be integral to modular shelf accessory.
2) Provide a 14-gauge padlock-able compartment door.
3) Provide 0.188 inch or diameter zinc plated steel hinge rod.
4) Door to be mounted with zinc plated steel hinge rod and two shoulder washers for smooth, quiet operation.
5) Provide an 18-gauge hasp bracket for securing lockable compartment door.

d. Hooks
1) Single Hooks – shall have the ability to attach single hooks on the side of the Modular Shelf and on the side panel lances
2) Double Hook – shall have the ability to attach a double hook to the underside of the Modular Shelf

H. Electrical system
1. UL listed manufactured electrical wiring system with plug-in-play component design.
2. Receptacles – standard 20 amp duplex receptacles and 20 amp GFCI duplex receptacles.

I. HVAC
1. All lockers shall be equipped with mechanical air extraction capabilities and adjustable air balancing capabilities.
2. When mechanical air extraction is required, manufacturer shall provide locker system HVAC guidelines and recommendations to aid in overall locker and building system integration. It is the General Contractor and HVAC Contractors' responsibility to establish/balance air flow through locker system according to building HVAC constraints.

J. Locker Tag Numbers
1. Provide locker numbers on each locker.

K. ACCESSORIES:
1. ZeeBase System: Provide manufacturer's standard.
2. Individual Welded Base: Provide manufacturer's standard.
3. Trim and Fillers: Provide manufacturer's standard.
4. Continuous Sloped Top. Provide manufacturer's standard.

2.4 FABRICATION

A. General: Coordinate fabrication and delivery to ensure no delay in progress of the work.

2.5 FINISHES

A. Colors: Selected by Architect from manufacturer's standard available colors.

B. Paint Finish: Provide factory applied electrostatic powder coat paint.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine Lockers scheduled to receive accessories with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of specified accessory items.

B. Proceed with accessory installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Follow manufacturer's written instructions for installation of each type of accessory item specified.

3.3 FIELD QUALITY CONTROL

A. Verify accessory unit alignment and plumb after installation. Correct if required, following manufacturer's instructions.

B. Remove components that are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 ADJUSTING

A. Adjust all accessories to provide smoothly operating, visually acceptable installation.

3.5 CLEANING

A. Immediately upon completion of installation, clean components and surfaces. Remove surplus materials, rubbish and debris, resulting from installation, upon completion of work and leave areas of installation in neat, clean condition.

3.6 DEMONSTRATION/TRAINING

A. Schedule and conduct demonstration of installed accessory items and features with Owner's personnel.

B. Schedule and conduct maintenance training with Owner's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end-user personnel would normally perform.

3.7 PROTECTION

A. Protect system against damage during remainder of construction period. Advise owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum Flagpoles.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete foundation construction.

1.3 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2016.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

F. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2016.

G. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.4 SUBMITTALS

A. Product Data: Provide data on pole, accessories, and configurations.

B. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

C. Operation Data: Provide operating instruction literature..

D. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed the State in which the Project is located.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Flagpoles - Basis of Design Product:
   1. American Flagpole; www.americanflagpole.com

2.2 FLAGPOLES

A. Flagpoles: Aluminum.
   1. Design: Step tapered.
   2. Mounting: Ground mounted type.
   3. Outside Butt Diameter: 6 inches.
   4. Outside Top Diameter: 3.5 inches.

5. Nominal Wall Thickness:.188 inches.
6. Nominal Height: 35 ft; measured from nominal ground elevation.
7. Halyard: Interior, with removable winch handle.

B. Performance Requirements:
1. Flagpole With Flags Flying: Resistant without permanent deformation to 120 mph miles/hr wind velocity; non-resonant, safety design factor of 2.5.
2. Flagpole Without Flags: Resistant without permanent deformation to 195 mph miles/hr wind velocity; non-resonant, safety design factor of 2.5.

2.3 POLE MATERIALS

A. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper.

2.4 ACCESSORIES

A. Finial Ball: Clear anodized, 6 inch diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Flags: Provided by owner
1. US Flag, 5' x 8'
2. City of Madison Flag, 4' x 6'

D. Halyard: 5/16 inch diameter stainless steel aircraft cable.

E. Spun Aluminum Collor: Standard

F. Counterbalance: Counterweight with beaded retainer sling.

2.5 OPERATORS

A. Manually Operated Winch: Postive locking at any position, removable winch handle

B. Flush Access Door: Reinforced door frame, compression lock

2.6 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36M, corrugated 16 gage, 0.0598 inch steel, galvanized, depth of 36" inches as indicated.

B. Steel Plate Welded to Sleeve: 3/16"

C. Lightning Spike: 3/4" diameter

2.7 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Concealed Steel Surfaces: Galvanized to ASTM A123/A123M requirements.

C. Aluminum: Satin finish

D. Finial: Clear anodized finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.2 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.3 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

B. Install Owner provided flags.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

3.5 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 12 24 13

ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes roller shades.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, details of installation, operational clearances, and relationship to adjoining Work.
   1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

C. Samples: Provide 8" x 8" fabric samples for each type and color of shade fabric.

D. Window Treatment Schedule: Use same designations indicated on Drawings.

E. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Fire-Test-Response Characteristics: Provide products passing flame-resistance testing according to NFPA 701 by a testing agency acceptable to authorities having jurisdiction.

C. Comply with WCMA A 100.1.

PART 2 PRODUCTS

2.1 ROLLER SHADES

A. Acceptable Products:
   1. Manual Shades:
      a. Lutron, Manual Roller Shades.
   2. Motorized Shades:
      a. Lutron, Sivoia QED.

B. Shade Fabric:
   1. Shade Fabric: Refer to Drawing Sheet A602 for Finish Material Specification.

C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets. Provide capacity for one roller shade band(s) per roller.

D. Direction of Roll: As indicated on drawings.

E. Mounting Brackets: Powder coated steel.

F. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type.

G. Mounting: Bracket mount as indicated on drawings, permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

H. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure as indicated on drawings.
   1. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than height indicated on Drawings.
   2. Endcap Covers: To cover exposed endcaps.

I. Shade Operation:
   1. Manual; with continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.
   2. Motorized, with Wall Switch Controls: Operator size as required for operation and size of shade.

2.2 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of roller, a means of supporting roller, flexible sheet or band of material carried by roller, a means of attaching material to roller, bottom bar and operating mechanism that lifts and lowers the shade.

B. Provide side channels at sloped windows.

C. Unit Sizes: Obtain units fabricated in sizes to cover window and other openings as indicated on drawings.

D. Provide mounting as indicated on drawings.

E. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting roller, and operating hardware and for hardware position and shade mounting method indicated.

F. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

2.3 MOTORIZED ROLLER SHADE OPERATORS

A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

B. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

D. Electrical Characteristics: If electrical requirements for a manufacturer's motorized roller shades differ from those indicated on the drawings, the roller shade provider shall be responsible for all electrical modifications, additional transformers, wiring, equipment, etc. required for installation and operation of that manufacturer's products.
   1. Lutron: Single phase, 110 V, 60 Hz.

E. Remote Controls: As indicated on drawings.
   1. Wall Switch Control: Electric controls with NEMA ICS 6, Type 1 enclosure recessed mounting. Rocker-style, group-control wall switch.
      a. Group all shades in room to a single control.
      b. Wall switch color shall be selected by Architect from manufacturer’s full range of colors.
      c. Wall switch shall have:
         1) Wall Switches, unless noted otherwise: “Open”, 3 Programmable Presets, “Close” and Raise/Lower buttons.

F. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.

PART 3 EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions. Allow clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

D. Connections: Connect motorized operators to building electrical system.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION

SECTION 12 31 00

MANUFACTURED METAL CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Stainless steel cabinets .

B. Stainless steel counter tops .

C. Service fittings and outlets.

1.2 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.3 SUBMITTALS

A. Product Data: Provide component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements and locations.

B. Shop Drawings: Indicate casework locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required.

1.4 MOCK-UP

A. Provide full size base cabinet complete with drawers, door, adjustable shelf and counter top.

B. Locate where directed.

C. Approved mock-up may remain as part of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept casework on site. Inspect on arrival for damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Casework:
   1. Basis-of-Design: Stainless Steel Kitchens, Inc., Designer MP-Series Steel and Marine Plywood Cabinets and Countertops.

2.2 MATERIALS

A. Stainless Steel Sheet: ASTM A666 Type 304.

B. Plastic Laminate Finish: NEMA LD 3, HGP; acid resistant, grey color.

C. Plywood: Heavy duty marine grade plywood.

2.3 HARDWARE

A. Drawer and Door Pulls: Stainless Steel Rod Handles.

B. Drawer Slides: Blumotion full extension drawer slides, with stainless steel drawer sides. Soft close feature.

C. Hinges: Blumotion “clip top” (removable without tools). Concealed, 125 degree open.
   1. All metal (nickel plate)
   2. Adjustable X, Y, Z axis.
   3. Rated 200,000 cycles
   4. Soft close feature.

2.4 FABRICATION - GENERAL

A. Fabricate casework, assembled and welded.

B. Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.

C. Cabinet Style: Frameless, with full overlay doors and drawers.

D. Cabinet Body/Cores: Fabricate from heavy duty 5/8" marine plywood, with laminate finish.

E. Cabinet Doors, Drawers and Exposed Surfaces: 18 ga, 304 #4 stainless steel.

F. Interior Shelves: Marine grade plywood with laminate finish.

G. All components securely assembled using stainless steel fasteners and corner stiffeners. Very rigid cabinet. Fully assembled and ready to install. Dimensions and quantity per drawings.

H. Countertops:
   1. Fabricate from 16 ga., 304 #4 (brushed) finish stainless steel (with protective PVC plastic that will be removed) backed with 5/8" marine plywood.
   2. Thickness: 1-1/2"
   3. Edges: Non-drip. 90 degree corners.
   4. Sinks: Integrated, welded into countertop, undermount, SINGLE bowl, brushed finish, 18 gauge 304 SS. Full undercoating and insulation pad. Content: 18% Chrome/ 10% Nickel.Provide two sinks per plans Nominal Size: 31"X18"X11"
   5. Provide 4" integral backsplash where backsplash are indicated on drawings.

I. Finish all welds, grounded and blended to a satin finish.

J. Install fixtures and fittings built into or part of casework. Provide access panels for maintenance of utility service and mechanical and electrical components.

2.5 FINISHES

A. Stainless Steel: No. 4 finish.

B. Shop finish all components.

C. Coat metal surfaces in contact with cementitious materials with bituminous paint.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install casework, components and accessories in accordance with manufacturer's instructions.

B. Use anchoring devices to suit conditions and substrate materials encountered.

C. Set casework items plumb and square, securely anchored to building structure.

3.2 ADJUSTING

A. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.3 CLEANING

A. Clean casework, counters, shelves, legs, hardware, fittings and fixtures.

3.4 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

SECTION 12 36 00

COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

C. Sinks molded into countertops.

1.2 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

B. refer to section 12 31 00 for stainless steel countertops in kitchen areas

1.3 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

E. IAPMO Z124 - Plastic Plumbing Fixtures; 2017.

F. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

H. PS 1 - Structural Plywood; 2009.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

B. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

C. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

D. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

A. Fabricator of this section must also provide work specified in Division 6 Section "Wood-Veneer Paneling".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Laminate Core Color: Same as decorative surface.
      b. Surface Color and Pattern: Refer to drawing sheet A602 for Finish Specification.
   2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
   3. Back and End Splashes: Same material, same construction.
   4. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.
   5. Use exterior grade plywood at sink locations.

C. Solid Surfacing Countertops and Shower Surround Sheets: Solid surfacing sheet or plastic resin casting.
   1. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with IAPMO Z124 and ADA size and clearance requirements.
   2. Other Components Thickness: 1/2 inch, minimum.
   3. Back Splashes: Same sheet material, square top; minimum 4 inches high unless otherwise indicated on drawings.

2.2 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade with no added urea formaldehyde, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

B. Particleboard for Supporting Substrate: ANSI A208.1 Grade M-2 with no added urea formaldehyde, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.

C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2, Grade 130 with no added urea formaldehyde; 3/4 inch thick; join lengths using metal splines.

D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.3 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
   1. Where sinks are indicated in solid surface countertops, provide integral bowls.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.3 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.4 CLEANING

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION