

SPECIFICATIONS - BID DOCUMENTS

**CITY OF MADISON
NAKOOSA TRAIL FLEET/FIRE/RADIO SHOP FACILITY**

4151 Nakoosa Trail
Madison, Wisconsin 53714

Volume 1 of 4: Divisions 00 - 01

Volume 2 of 4: Divisions 02 - 14

Volume 3 of 4: Divisions 21 - 30

Volume 4 of 4: Divisions 31 - 45



Contract No. 7528

Munis No. 10305

Prepared by:



1600 Wilson Boulevard, Ste. 360

Arlington, VA 22209

Project No.: 376603

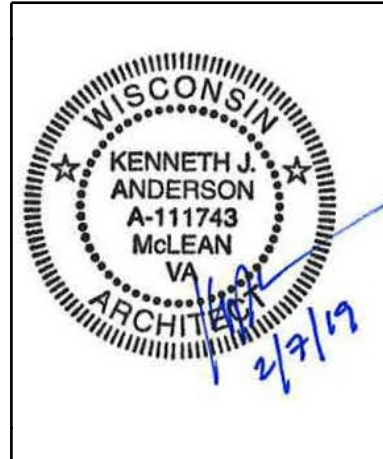
SECTION 00 01 07

SEALS PAGE

DESIGN PROFESSIONALS OF RECORD

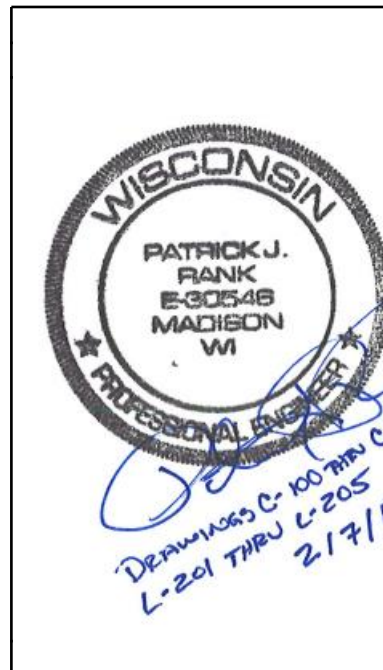
Architect: Stantec Architecture, Inc. [SAI]

Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record.



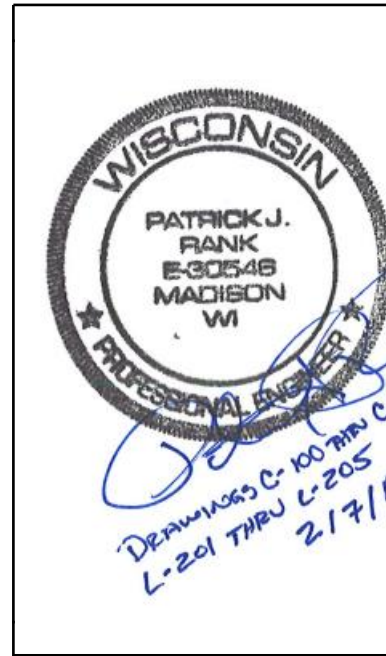
Civil Engineer: Strand Associates [SA]

Responsible for those Sections appended with "[SA]" on Table of Contents.



Landscape Architect: Strand Associates [SA]

Responsible for those Sections appended with "[SA]" on Table of Contents.



Structural Engineer: Mead & Hunt [M&H]

Responsible for those Sections appended with "[M&H]" on Table of Contents.



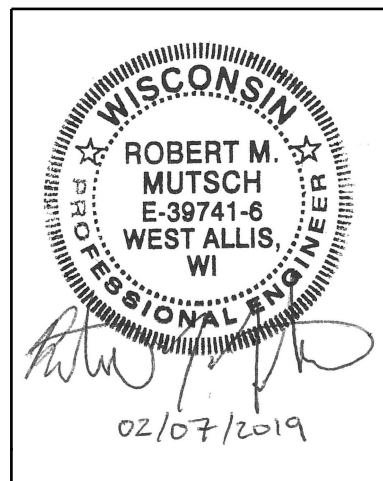
Fire-Protection Engineer: Mead & Hunt [M&H]

Responsible for those Sections appended with "[M&H]" on Table of Contents.



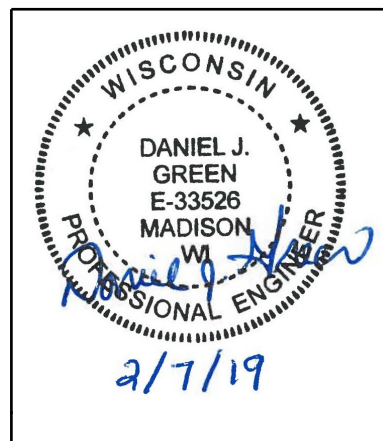
Plumbing Engineer: Mead & Hunt [M&H]

Responsible for those Sections appended with "[M&H]" on Table of Contents.



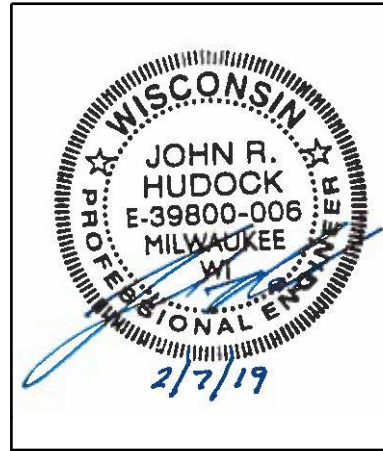
HVAC Engineer: Mead & Hunt [M&H]

Responsible for those Sections appended with "[M&H]" on Table of Contents.



Electrical Engineer: Mead & Hunt [M&H]

Responsible for those Sections appended with "[M&H]" on Table of Contents.



Vehicle Maintenance Equipment Engineer: HDR | MDG [HDR]

Responsible for those Sections appended with "[HDR]" on Table of Contents.



END OF SECTION 00 01 07

SECTION 00 01 09

PROJECT DIRECTORY

1.1 PROJECT TEAM

A. Owner:

1. City of Madison [COM].
2. Department of Public Works.
3. 210 Martin Luther King Jr. Blvd.
4. Madison, WI 53703.
5. Primary Contact(s):
 - a. Jim Whitney, JWhitney@cityofmadison.com.
6. Phone: 608-266-4563.
7. City Construction Manager:
 - a. Dave Schaller
 - b. Phone: 608-243-5891
 - c. dschaller@cityofmadison.com
8. Website: www.cityofmadison.com .

B. Architect:

1. Stantec Architecture, Inc. [SAI]
2. 1600 Wilson Blvd., Ste. 360.
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4. Primary Contact(s):
 - a. Maybell Laluna, maybell.laluna@Stantec.com .
 - b. Ken Anderson, AIA, ken.j.anderson@stantec.com
5. Phone: 571-290-7679.
6. Website: www.stantec.com .

C. Civil Engineer:

1. Strand Associates [SA].
2. 910 West Wingra Drive.
3. Madison, WI 53715.
4. Primary Contact(s):
 - a. Pat Rank, patrick.rank@strand.com .
5. Phone: 608-251-4843.
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D. Stormwater Engineer:

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- 7.
- 8.

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 4. Primary Contact(s):
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 5. Phone: 608-251-4843.
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- F. Structural Engineer:
1. Mead & Hunt [M&H].
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 3. Middleton, WI 53562.
 4. Primary Contact(s):
 - a. David Cockrum, David.Cockrum@meadhunt.com .
 5. Phone: 608-273-6380.
 6. Website: www.meadhunt.com.
- G. Fire-Protection Engineer:
1. Mead & Hunt [M&H].
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 3. Middleton, WI 53562.
 4. Primary Contact(s):
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 6. Website: www.meadhunt.com.
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 5. Phone: 608-443-0569.
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- J. Electrical Engineer:
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 5. Phone: 608-273-6380.
 6. Website: www.meadhunt.com.
- K. Communications and Audio/Visual Consultant:
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4. Primary Contact(s):
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5. Phone: 608-273-6380.
6. Website: www.meadhunt.com.
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 3. Middleton, WI 53562.
 4. Primary Contact(s):
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 5. Phone: 608-273-6380.
 6. Website: www.meadhunt.com.
- M. Vehicle Maintenance Equipment Consultant:
 1. HDR | MDG [HDR].
 2. 70 Xenia Avenue S, Ste. 600.
 3. Minneapolis, MN 55416.
 4. Primary Contacts:
 - a. Jared Weismantel, Jared.Weismantel@hdrinc.com .
 5. Phone: 626-389-2444.
 6. Website: www.hdrinc.com .
- N. Geotechnical Consultant:
 1. Construction - Geotechnical Consultants, Inc. (CGC) [CGC].
 2. 2921 Perry Street.
 3. Madison, WI 53713.
 4. Primary Contact(s):
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 5. Phone: 608-288-4100.

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- SECTION 28 13 00 – ACCESS CONTROL SYSTEM (KEYSCAN) [COM]
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SECTION 31 10 00

SITE CLEARING AND STRIPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
1. Removal of surface debris.
 2. Removal of paving, curbs, and sidewalks.
 3. Removal of trees, shrubs, and other plant life.
 4. Strip and stockpile topsoil.

1.2 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- B. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 PREPARATION

- A. CONTRACTOR shall coordinate with OWNER and identify existing plant life to remain and shall tag accordingly.

3.2 PROTECTION

- A. CONTRACTOR shall protect from damage utilities and structures that are to remain.
- B. CONTRACTOR shall protect trees, plant growth, and features designated to remain as final landscaping.

3.3 CLEARING AND GRUBBING

- A. Clearing and grubbing shall consist of cutting and disposing of trees, brush, windfalls, logs, and other vegetation, and the removing and disposing of roots, stumps, stubs, grubs, logs, and other timber from within the clearing limits as defined on the drawings, designated to be removed on the drawings or in the specifications, or fall within the excavation, embankment, or improved areas of the site.
- B. All roots and stumps shall be removed to a depth of not less than 12 inches below the original ground surface in embankment areas. In cut areas, such material shall be removed to a depth of not less than 12 inches below the subgrade.

3.4 REMOVALS

- A. CONTRACTOR shall remove from the site all trees, brush, and other vegetation, debris, and rocks that fall within the excavation and grading limits, as well as any paving, curb and gutter, sidewalks, retaining walls, and the existing commercial building shown on the drawings to be removed or as required because of construction.
- B. All obstructions, including asphaltic concrete pavement, shall be removed in proper sequence for maintenance of traffic, drainage, and continued use of related facilities. Obstructions shall be removed to the neat lines shown on the Drawings by sawcutting or other means necessary so as not to reduce the quality or function of the remaining material. Holes remaining after removal of all obstructions shall be backfilled with acceptable material, compacted, and the ground shall be restored to approximately its original contour.

3.5 STRIPPING

- A. Excavate topsoil from areas to be built upon, cut or filled, or to have surface improvements, including roadways and walks.
- B. Stockpile topsoil on-site and protect from erosion. CONTRACTOR shall provide additional topsoil as required.
- C. Excess topsoil, if any, shall be removed from the site and disposed of at CONTRACTOR's expense.

END OF SECTION 31 10 00

SECTION 31 23 00

EXCAVATION, FILL, BACKFILL, AND GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Excavating, filling, backfilling, and grading for this work includes, but is not necessarily limited to:
 - 1. Excavating for footings, foundations, roads, utilities, and detention basins.
 - 2. Placing and compacting all fill and backfill.
 - 3. Rough and finish grading prior to paving, seeding, etc.
- B. Payment: All Work shall be included in the Lump Sum Bid.
- C. The following geotechnical and environmental reports are available to assist CONTRACTOR in excavation operations.
 - 1. Results for the Phase II Environmental Site assessments (ESAs), Five Adjacent Parcels-Nakoosa Trail and Commercial Avenue, Madison, WI, TRC Environmental Corporation, July 23, 2013.
 - 2. Geotechnical Exploration, Nakoosa Trail Fleet Service Facility, Madison, WI, CGC, Inc., August 4, 2016.
 - 3. Geotechnical Memorandum, Wet Detention Basin Clay Liner, Nakoosa Trail Fleet Service Facility, Madison, WI, CGC, Inc., February 9, 2017.

1.2 REFERENCES

- A. ASTM C33—Standard Specification for Concrete Aggregates.
- B. ASTM D698—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- C. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- D. Standard Specifications: Unless otherwise indicated, Standard Specifications within this section shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- E. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.3 SUBMITTALS

- A. CONTRACTOR shall submit samples of materials proposed for use as fill to soils testing laboratory for analysis of their suitability and for recommendations on moisture content during compaction, compaction methods, or other appropriate information.
- B. CONTRACTOR shall submit sufficient samples of each different type or classification of soil to obtain representative values.

1.4 JOB CONDITIONS

- A. The elevations shown for existing work and ground are reasonably correct, but are not guaranteed to be absolutely accurate. No extras will be allowed because of variations between drawings and actual grades.
- B. Soil borings were made and the soils information is included in an appendix to these Specifications. The information contained is not guaranteed to be indicative of conditions to be encountered during construction. It is CONTRACTOR's responsibility to make its own investigations to determine physical conditions at the site, which may affect the work.

PART 2 - PRODUCTS

2.1 COMPACTED FILL

- A. All fill and backfill material designated to be compacted fill shall be granular with no stones larger than 4 inches and shall be reasonably well-graded throughout the particle size range. Of that portion of the material passing the No. 4 sieve, not more than 25% shall pass the No. 200 sieve, and material shall have less than 5% clay content. When placing fill during wet weather or in wet areas, this requirement shall be modified to not more than 5% passing the No. 200 sieve. Adequately dewatered areas are not defined as wet areas.
- B. All fill necessary on site to bring the proposed grade to the bottom of the proposed base course for all paved areas and areas within 10 feet of paved areas shall be compacted fill.
- C. Native material may be used as compacted fill if it meets the above specification. CONTRACTOR shall determine whether native material meets the above specification. CONTRACTOR shall provide all needed fill material whether from on-site or off-site at no additional cost to OWNER.

2.2 COMPACTED GRANULAR FILL

- A. Compacted granular fill shall be dense graded base 3/4-inch meeting the requirements of Section 305 of the Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, Current Edition.
- B. Compacted granular backfill shall be provided as backfill for all utility trenches under paved surfaces or within 10 feet of paved surfaces. Compacted granular backfill shall be placed from the cover material of the proposed utility pipe to the bottom of the proposed base course.

2.3 EMBANKMENT FILL

- A. Embankment fill shall contain no stumps, brush, rubbish, or other perishable material. The top 12 inches of the earth embankment shall be earthy material free from large stones.

2.4 CLAY FILL

- A. Clay fill shall contain at least 25% clay minerals (material finer than 0.002 mm).

2.5 CLAY LINER

- A. CONTRACTOR shall provide a 2-foot thick Clay Liner at both wet detention pond locations shown on the drawings.
- B. Clay Liner shall consist of reuse of suitable on-site clay or hauled-in clay meeting the requirements of a Class A clay liner per the WDNR Technical Standard 1001. Shop drawings for on-site clay and/or hauled-in clay must be submitted for approval prior to their use. OWNER will allow potential bidders to dig test pits at the project site.
- C. Geotechnical and Environmental borings and report are included herein to assist CONTRACTOR in determining the potential availability of on-site clay for reuse as Clay Liner and its location relative to contaminated groundwater. Any on-site clays within contaminated groundwater shall not be re-used on-site.
- D. Clay liner shall conform to the following.
 - 1. A minimum of 50 percent of the particles passing the No. 200 sieve.
 - 2. Plasticity index of equal to or greater than 12 (ASTM D4318) as tested by Atterberg Limits.
 - 3. Average Liquid Limit of equal to or greater than 25, with no value less than 20.
 - 4. Recomacted in-place hydraulic conductivity shall be no greater than 1×10^{-7} cm/sec after compaction with suitable equipment.
- E. Clay materials shall contain no sod, brush, roots, frozen soil, or other perishable materials. Rock particles larger than 3 inches shall be removed prior to compaction of the clay. Pond surfaces shall be graded to remove surface irregularities and shall be scarified or otherwise acceptably scored or loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the clay liner, and the surface materials shall be compacted and bonded with the first layer of the clay liner as specified for subsequent layers of clay liner.
- F. On-site clays intended for reuse as clay liner shall be selectively stockpiled and separated from overlying fill and underlying soils with higher sand content.

PART 3 - EXECUTION

3.1 GENERAL

- A. Prior to all excavating, CONTRACTOR shall become thoroughly familiar with the site and site conditions.

3.2 PROTECTION

- A. CONTRACTOR shall provide all necessary sheeting, shoring, or other soil retention systems including all labor, material, equipment, and tools required, or as necessary to maintain the excavation in a condition to provide safe working conditions, to permit the safe and efficient installation of all items of Contract work, and to protect adjacent property. CONTRACTOR shall be held liable for any damage which may result to property from excavation or construction operations. Sheeting, shoring, and other soil retainage systems shall be withdrawn or removed in a manner so as to prevent subsequent settlement of structures, utilities, and other improvements.
- B. Design of sheet piling and other soil retaining systems shall be the sole responsibility of CONTRACTOR. Where such systems are shown on the drawings, no parameters such as embedment depth, section profile, presence or lack of walers, etc., nor system type or suitability shall be inferred. CONTRACTOR is responsible for designing and providing a fully functional system compatible with construction and site requirements.
- C. Nothing in this specification shall be deemed to allow the use of protective systems less effective than those required by the Occupational Safety and Health Administration (OSHA) and other applicable code requirements.

3.3 UTILITIES

- A. Before starting excavations, CONTRACTOR shall locate existing underground utilities in all areas of the work.
- B. If utilities are to remain in place, CONTRACTOR shall provide adequate means of protection during earthwork operations.
- C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions.
- D. Cooperate with OWNER and utility companies in keeping respective services and facilities in operation, and repair any damaged utilities to satisfaction of utility owner.
- E. CONTRACTOR shall not interrupt existing utilities serving facilities occupied and used by OWNER or others except when permitted in writing by OWNER.
- F. CONTRACTOR shall demolish and completely remove from the site existing underground utilities indicated to be removed after utility has been capped and sealed.
- G. CONTRACTOR shall accurately locate and record abandoned and active utility lines rerouted or extended on project record drawings.

3.4 FINISH ELEVATIONS AND LINES

- A. CONTRACTOR is responsible for setting and establishing finish elevations and lines.

3.5 EXCAVATION

- A. After the site has been cleared and stripped, the site shall be cut and filled to the indicated subgrade as shown or specified. Cut shall include excavation to allow for placement of 6 inches of topsoil in all areas to be restored.
- B. All excavated material that does not meet the specification for compacted fill, embankment fill, or clay liner, or meets the specification but is not required for backfill, fill, or clay liner shall be classified as excess material and shall be removed from the site and disposed of at CONTRACTOR's expense at location determined by CONTRACTOR and approved by OWNER.
- C. Off-site disposal area(s) for excess material disposal shall be appropriately stabilized with seed, mulch, and appropriate erosion control.
- D. All material other than suitable bearing soil, as determined by the Project Soils Engineer, shall be removed from under concrete to be poured on ground.
- E. Excavations scheduled to extend below groundwater shall not be started until the area has been dewatered.
- F. CONTRACTOR shall backfill and compact all overexcavated areas.

3.6 PREPARATION OF SUBGRADE

- A. After the site has been cleared, stripped, and excavated to subgrade, thoroughly compact subgrade to the requirements specified for compacted fill below. Scarify and moisture condition the subgrade as recommended by the Project Soils Engineer or OWNER's representative.
- B. Remove all ruts, hummocks, and other uneven surfaces by surface grading prior to placement of fill.
- C. All slab-on-grade, road subgrades, parking lot subgrades, or areas to receive fill shall be proofrolled with a fully loaded tri-axle truck to check for soft or yielding areas in the presence of the Project Soils Engineer or OWNER's representative.
- D. If loose, soft, or yielding areas are detected, they shall be undercut/removed. Grade shall be reestablished using granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) with 3-inch dense graded base compacted into the subgrade until no further deflection is evident.

3.7 COMPACTED FILL AND BACKFILL

- A. All fill and backfill, except as otherwise specified, shall be compacted fill placed to within 4 inches of the bottom of the topsoil or to the bottom of the structure, bottom of base course, or other improvement.
- B. In fill areas above existing grade around structures, compacted fill shall be placed within a minimum of 10 feet from the structure.
- C. No fill shall be placed under water or over unsuitable subgrade conditions.
- D. All fill and backfill, except embankment fill, shall be compacted as follows:
 - 1. Class 1 Compaction: This class of compaction shall apply to all fill areas under buildings, structures, piping, bituminous roadway and parking areas, curb and gutter, and backfill within 10 feet of structure walls. All compacted material shall be placed in uniform layers not exceeding 8 inches in loose thickness prior to compaction. Each layer shall be uniformly compacted to a dry density at least 95% of the maximum dry density as determined by a laboratory compaction test at the optimum moisture content (ASTM Test Designation D1557). Compaction shall be obtained by compaction equipment appropriate for the conditions.
 - 2. Class 2 Compaction: This class of compaction shall be used in excavated areas beyond 10 feet of structures without any piping or adjacent foundations. Material for backfill shall be granular material as specified above. The material shall be deposited, spread, and leveled in layers generally not exceeding 10 inches in thickness before compaction. Each layer of the fill shall be compacted to at least 95% of the maximum dry density as determined by a laboratory compaction test at the optimum moisture content (ASTM Test Designation D1557). Compaction shall be obtained by compaction equipment appropriate for the conditions.
- E. No frozen material shall be placed nor shall any material be placed on frozen ground.
- F. All fill shall be placed at a moisture content capable of achieving the desired compaction level.

3.8 EMBANKMENT FILL

- A. Embankment fill may be placed in fill areas to be seeded or sodded if no piping exists in the fill and the areas are at least 10 feet from any structure.
- B. Embankment fill shall be deposited, spread, and leveled in layers generally not exceeding 10 inches in thickness before compaction. Each layer of the fill shall be compacted to a dry density at least 90% of the maximum dry density as determined by a laboratory compaction test at the optimum moisture content (ASTM Test Designation D 1557). Compaction shall be obtained by compaction equipment appropriate for the conditions.

3.9 GRADING

- A. CONTRACTOR shall perform all rough and finish grading required to attain the elevations shown on the drawings.
- B. Grading Tolerances:
 - 1. Rough Grade: Buildings, parking areas, and sidewalks—±0.10 feet.
 - 2. Finish Grade: Granular cushion or crushed stone mat under concrete slabs—±0.03 feet.
 - 3. Lawn areas away from buildings, parking areas, and sidewalks—±0.10 feet.

3.10 CLAY LINER

- A. Clay Liner shall be installed per WDNR Technical Standard 1001 which references NRCS Wisconsin Construction Specifications 300 (Clay Liner).
- B. Placement/Compaction Requirements:
1. The clay liner shall not be placed until the required foundation preparation has been completed and the foundation has been observed by ENGINEER. The clay liner shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the clay liner.
 2. The clay liner shall be placed in maximum 6-inch (loose) lifts. The thickness of each lift before compaction (loose) shall not exceed the length of the teeth of the footed compactor used. Compaction shall be accomplished with a footed compactor weighing at least 25,000 pounds, operated continuously.
 3. The distribution of materials throughout the clay liner shall be essentially uniform, and the clay liner shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material.
 4. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified to a depth of not less than 2 inches before the next layer is placed.
 5. During placement and compaction of the clay liner, the moisture content of the clay being placed shall be maintained above optimum moisture as determined by the Standard Proctor Test (ASTM D-698) or Modified Proctor Test (ASTM D-1557).
 6. The application of water to the clay shall be accomplished at the borrow areas insofar as practicable.
 7. Water may be applied by sprinkling the clay after placement and before compaction of the liner, if necessary. Uniform moisture distribution shall be obtained by disking.
 8. The clay liner shall be compacted to a minimum of 95% of Standard Proctor dry density (ASTM D-698) or to a minimum of 90% of Modified Proctor dry density (ASTM D-1557), at a moisture content above optimum moisture. Reuse of on-site clays as clay liner may require moisture conditioning.
 9. Clay placed at densities lower than the specified minimum density or at moisture contents lower than optimum moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the specifications or removed and replaced by acceptable clay. The replacement clay and the foundation and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control, and compaction.
- C. Testing and Documentation shall consist of the following:
1. Liner construction shall be tested and documented as specified below. Copies of the documentation report, including test locations and test results, shall be provided to ENGINEER.
 2. Field and laboratory soil tests shall be completed on the clay liner for on-site reused clay and/or hauled-in clay, by a third party engineering firm retained by CONTRACTOR, to document compliance with this specification. Testing shall be completed as the liner is being placed. The following tests shall be completed at the specified frequency.
 - a. Standard Proctor test: ASTM D-698 - 1 per 500 cubic yards of clay liner or
 - b. Modified Proctor Test: ASTM D-1557 - 1 per 500 cubic yards of clay liner.
 - c. Field Density Tests: ASTM D-2922, D-2167, D-1556, or D-2937- 1 test per 100 square foot of clay liner per each foot of installed thickness.
 - d. Atterberg Limit tests: ASTM D-4318- 1 per 500 cubic yards of clay liner.
 - e. Grain Size Distribution: ASTM D-422 - 1 per 500 cubic yards of clay liner.
 - f. Permeability: ASTM D-5084 - 1 per 500 cubic yards of clay liner (minimum of 2).
 3. Atterberg limits, grain size distribution, and permeability tests shall be completed on undisturbed samples obtained from the constructed clay liner. A minimum of one of each of the laboratory tests specified above shall be completed per clay liner.
 4. All test holes shall be backfilled using powdered bentonite mixed with clay soil used in liner construction and compacted by hand tamping. The clay shall be broken down into clods less than 1/2 inch in diameter. A minimum of 25% of the backfilled test hole volume shall be occupied by powdered bentonite after backfilling.

- D. No additional compensation will be provided to CONTRACTOR if on-site clay material is partially or wholly not suitable for use as a clay liner or is partially or wholly not sufficient in quantity to construct the clay liner. CONTRACTOR is responsible for excavation and excess material disposal necessary to construct the clay liner, regardless of source of clay material.
- E. After construction of west wet detention basin clay liner, the west wet detention basin shall be filled with water to elevation 852.00 prior to ceasing dewatering operations.
- F. After construction of the east wet detention basin clay liner, the east wet detention basin shall be filled with water to elevation 854.00 prior to ceasing dewatering operations.

3.11 COMPACTION TESTING

- A. Compaction tests shall be done by the Project Soils Engineer. Location and frequency of the tests shall be as recommended by the Project Soils Engineer.

3.12 EXCAVATED SOLID WASTE FILL MATERIALS TO BE LANDFILLED

- A. If any solid waste fill materials are encountered, they shall be excavated and removed to a licensed sanitary landfill. Solid waste fill material is defined as any construction or demolition debris, household refuse, glass, metal, plastic, or similar material not native to the site, but having been placed on-site during past filling operations and mixed with soil.

3.13 POTENTIALLY HAZARDOUS WASTE

- A. If CONTRACTOR encounters during excavation or trenching activities any potentially hazardous waste as defined in this section, and the materials are within the limits of the site excavation or trenching work, the materials shall be handled as specified in this section. Potentially hazardous waste are defined as any drums, containerized waste, or organic liquid waste or surrounding impacted material. Such materials have not been found during investigations performed to date but could potentially be encountered.
- B. Should potentially hazardous waste be encountered, excavation activities in that portion of the site shall be placed on standby pending removal of the material, receipt of test results, and determination by the DNR and OWNER on whether work may proceed. It is anticipated that this standby time will be approximately 48 hours per occurrence, exclusive of weekends and holidays.
- C. Potentially hazardous waste defined above shall be carefully excavated, stockpiled, and tested to determine if they exhibit the characteristics of a hazardous waste as defined by the Wisconsin Administrative Code NR 500, 600, and 700 Series. Such materials shall be handled according to applicable DNR, USEPA, and OSHA regulations and shall be stockpiled in a "Temporary Excavated Material Storage Area." Stockpiling shall meet the requirements of NR 700.

END OF SECTION 31 23 00

SECTION 31 23 05

EXCAVATION, LOADING AND HAULING OF PETROLEUM CONTAMINATED SOIL

PART 1 - GENERAL

1.1 GENERAL

- A. Suspected petroleum-contaminated soil is expected to be encountered near the former Lil Bear Gas Station. Review the following geotechnical and environmental reports for a description of potential petroleum contamination:
 - 1. Phase I Environmental Site Assessment of the Former Cub Foods Site along Nakoosa Trail and Commercial Avenue, Madison, Wisconsin 53714, May 31, 2013.
 - 2. Results for the Phase II Environmental Site Assessments (ESAs), Five Adjacent Parcels-Nakoosa Trail and Commercial Avenue, Madison, Wisconsin, TRC Environmental Corporation, July 23, 2013.
 - 3. Geotechnical Exploration, Nakoosa Trail Fleet Service Facility, Madison, WI, CGC, Inc., August 4, 2016.
 - 4. Geotechnical Memorandum, Wet Detention Basin Clay Liner, Nakoosa Trail Fleet Service Facility, Madison, WI, CGC, Inc., February 9, 2017.
- B. Work shall be performed in accordance to standard spec 205 and with pertinent parts of Chapters NR 700-754 of the Wisconsin Administrative Code, as supplemented herein. Per NR 718.07, a solid waste collection and transportation service-operating license is required under NR 502.06 for each vehicle used to transport contaminated soil.
- C. If contaminated soils—based on unusual odor or staining—are encountered, notify the Owner or Owner’s Environmental Consultant. Excavated contaminated soils may be temporarily stockpiled on site. WDNR stockpile requirements for contaminated materials are specified in NR 718.05. Place contaminated soil on base material impervious to the contaminant and to water, such as concrete, asphalt, or plastic sheeting. Cover piles with impervious material, such as plastic sheeting, to prevent infiltration of precipitation and to inhibit volatilization of soil contaminants.
- D. Use loading and hauling practices that are appropriate to prevent any spills or releases of contaminated soils or residues. If spills or releases occur, immediately notify the Owner or Owner’s Environmental Consultant. Immediately recover all contaminated soil, residue, and any new contamination that was caused by the spill or release. Prior to transport, sufficiently dewater soils designated for off-site disposal so as not to contain free liquids.
- E. Dispose of petroleum-contaminated soil at a WDNR-licensed landfill.
- F. Applicable provisions of specification section 31 23 00 Excavation, Fill, Backfill and Grading shall apply.

1.2 MEASUREMENT AND PAYMENT

- A. Excavation, hauling, and disposal of petroleum-contaminated soil shall be incidental to this project.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION 31 23 05

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Removal of groundwater to allow belowgrade construction.
 - 2. Site grading to prevent surface water from entering the excavation.
- B. Payment: All work shall be included in the Lump Sum Bid.
- C. The following geotechnical and environmental reports are available to assist CONTRACTOR:
 - 1. Results for the Phase II Environmental Site assessments (ESAs), Five Adjacent Parcels-Nakoosa Trail and Commercial Avenue, Madison, WI, TRC Environmental Corporation, July 23, 2013.
 - 2. Geotechnical Exploration, Nakoosa Trail Fleet Service Facility, Madison, WI, CGC, Inc., August 4, 2016.
 - 3. Geotechnical Memorandum, Wet Detention Basin Clay Liner, Nakoosa Trail Fleet Service Facility, Madison, WI, CGC, Inc., February 9, 2017.

1.2 REFERENCES

- A. Wisconsin Administrative Code Chapter NR 141 and NR 811.
- B. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- C. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.3 SYSTEM REQUIREMENTS

- A. CONTRACTOR shall, at its own expense, keep the excavation clear of water while structures, mains, and appurtenances are being built, utilities are being installed, and fill and backfill are being compacted. Under no conditions shall the work be laid in or under water. No water shall flow over the work until the joints are complete or the concrete has set.
- B. Dewatering shall be sufficient to lower the piezometric level to at least 2 feet below the bottom of the excavation. Additional lowering shall be provided as necessary to create a stable subgrade.
- C. In areas where rock is encountered, the water level shall be kept at or below top of rock, but at least 6 inches below bottom of concrete. Additional rock shall be removed as needed to provide clearances.
- D. The control of groundwater shall be such that softening or heaving of the bottom of excavations or formation of "quick" conditions or "boils" shall be prevented.
- E. Dewatering systems shall be designed and operated so as to prevent the migration or removal of soils.
- F. Geotechnical borings and report are provided herein to assist CONTRACTOR in determining what methods are required to dewater the site.
- G. Environmental borings and report are provided herein to assist CONTRACTOR in determining the makeup of the contaminated groundwater.

1.4 QUALITY ASSURANCE

- A. All dewatering shall be done in accordance with applicable federal, state, and local code requirements.
- B. In particular, groundwater observation wells shall be provided and subsequently abandoned in accordance with NR 141. CONTRACTOR shall complete all observation well construction and abandonment forms as required by NR 141 and shall submit the forms to OWNER within 15 days of construction or abandonment activities.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 DEWATERING

- A. Dewatering shall be started, and the water level shall be lowered as specified herein prior to beginning excavation and shall be continued until structure, main, or appurtenance has been completed and fill has been placed and compacted to final grade.
- B. CONTRACTOR shall provide at least two groundwater observation wells near each area to be excavated to aid CONTRACTOR in determining whether the minimum specified requirements have been met prior to excavation. The observation well shall be a minimum 2-inch-diameter slotted PVC pipe. The observation well shall be installed and backfilled in such a way as to allow an accurate determination of actual groundwater levels. The observation well shall be properly abandoned after use unless specified otherwise.
- C. CONTRACTOR shall provide all necessary materials and equipment to keep the excavation free from water during construction. CONTRACTOR shall at all times have on hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies, including power outages, and shall have available at all times competent workers for the operation of the pumping equipment. The dewatering systems shall not be shut down between shifts, on holidays or weekends, or during the work stoppages.
- D. CONTRACTOR shall obtain and meet all requirements of applicable WDNR permits for construction pit or trench dewatering for high capacity well dewatering.
- E. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted fill or backfill, and prevent floatation or movement of all structures and pipelines.
- F. Dewatering at both stormwater basins shall lower the groundwater level to 2 feet below the bottom of the excavation. Additional lowering shall be provided as necessary to create a stable subgrade. Dewatering shall continue throughout construction until the clay liners have been constructed and the stormwater basins have been filled with water. Damage to or uplift of the clay liners due to inadequate dewatering operations or failure to fill the stormwater basin with water prior to ceasing dewatering operations is not acceptable and any and all damage shall be repaired at CONTRACTOR's expense.

3.2 PROTECTION

- A. CONTRACTOR shall take all necessary precautions during the dewatering operation to protect adjacent structures against subsidence, flooding, or other damage. The dewatering system shall be installed and operated so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property. Any such facilities and structures damaged shall be repaired or replaced to the satisfaction of their owner.
- B. In areas where continuous operation of dewatering pumps is required, CONTRACTOR shall avoid noise disturbance to nearby residences to the greatest extent possible by using electric-driven pumps, or intake and exhaust silencers or housing to minimize noise from engine-driven generators or engine-driven pumps.

END OF SECTION 31 23 19

SECTION 31 23 25

DEWATERING CONTAMINATED GROUNDWATER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes dewatering the site during construction or working with the water on-site in a manner that allows the project to be constructed in accordance with the plans and specifications. This item includes the dewatering of potentially contaminated groundwater, surface water runoff, and trench dewatering.
- B. CONTRACTOR is responsible for all work, materials and equipment required to comply with permit conditions to dewater the site. At a minimum, pump water into a settling tank to settle solids prior to discharge into the storm sewer for clean water and into the designated sanitary sewer for potentially contaminated water.
- C. Potentially contaminated zones of groundwater may be encountered on the southwesterly half of the project site and as shown on the drawings. Conform with the requirements of Section 205 of the latest version of the City of Madison Standard Specifications for Public Works Construction, pertinent parts of the Wisconsin Administrative Code (Department of Natural Resources Environmental Investigation and Remediation of Environmental Contamination, Chapters NR 700-736), as shown on the construction plan set, and as supplemented herein. Comply with all permit requirements and applicable regulations, and monitor the discharge volume of potentially contaminated water generated as necessary to meet the permit requirements.
- D. The following geotechnical and environmental reports are available to CONTRACTOR.
 - 1. Results for the Phase II Environmental Site Assessments (ESAs), Five Adjacent Parcels-Nakoosa Trail and Commercial Avenue, Madison, WI, TRC Environmental Corporation, July 23, 2013.
 - 2. Geotechnical Exploration, Nakoosa Trail Fleet Service Facility, Madison, WI, CGC, Inc., August 4, 2016.
 - 3. Geotechnical Memorandum, Wet Detention Basin Clay Liner, Nakoosa Trail Fleet Service Facility, Madison, WI, CGC, Inc., February 9, 2017.

1.2 GENERAL

- A. Discharge potentially contaminated water to the sanitary sewer. For the purposes of this project suspended solids shall not be considered a type of contamination. Do not discharge contaminated groundwater without prior approval from the City of Madison Environmental Consultant. The City of Madison Environmental Consultant is:

Brynn Bemis
City of Madison Engineering
210 Martin Luther King, Jr. Blvd., Rm 115
Madison, WI 53703
608.267.1986
bbemis@cityofmadison.com

- B. Obtain a City of Madison Permit to Discharge to the Sanitary Sewer compliant with all local ordinances and state statutes. The permit will require that CONTRACTOR monitor the volume of total water discharged into the sanitary sewer and will determine the necessary reporting frequency. The contact for obtaining this permit is:

Megan Eberhardt
City of Madison Engineering
608.266-6432
meberhardt@cityofmadison.com

- C. The City of Madison Environmental Consultant will be responsible for obtaining the necessary approvals from the Madison Metropolitan Sewerage District (MMSD) for disposal of potentially contaminated groundwater. This approval will be issued at the same time as the Permit to Discharge to the Sanitary Sewer. Submit a dewatering plan to the City of Madison for approval with the application for Permit to Discharge to the Sanitary Sewer.

- D. If free phase petroleum product, such as gasoline floating on the water, is observed during dewatering activities, terminate dewatering activities and notify the City of Madison's designated representative and the City of Madison Environmental Consultant.

1.3 CONSTRUCTION

- A. Work shall be performed in accordance to the latest version of the City of Madison Standard Specifications for Public Works Construction, Subsection 205.3, supplemented with the following:
 - 1. Water shall not be allowed in trenches while pipe is being laid.
 - 2. No concrete shall be installed in water nor shall water be allowed to rise over concrete if there is danger of flotation or of setting up unequal pressures in the concrete until the concrete has set at least 24 hours and any danger of flotation has been removed.
 - 3. Dewatering shall be done in a manner that provides safe working conditions and provides stable trench side slopes and trench bottom for adequate support of the pipe and appurtenances. Dewater sufficiently to minimize or eliminate groundwater pressures below the proposed trench bottom which otherwise may tend to cause boiling or a "quick" condition at the trench bottom. Where silty sands or other impervious soils are encountered at and/or below the pipe zone, the dewatering equipment must be adequate to relieve the groundwater pressure below the impervious soil layer and accomplish sufficient drainage of the impervious soils to provide a stable trench bottom.
 - 4. Dewatering at both stormwater basins shall lower the groundwater level to 2 feet below the bottom of the excavation. Additional lowering shall be provided as necessary to create a stable subgrade. Dewatering shall continue throughout construction until the clay liners have been constructed and the stormwater basins have been filled with water. Damage to or uplift of the clay liners due to inadequate dewatering operations or failure to fill the stormwater basin with water prior to ceasing dewatering operations is not acceptable and any and all damage shall be repaired at CONTRACTOR's expense.
 - 5. Pump water from the dewatering operations directly to a minimum 1,500-gallon holding tank to allow for settlement of large solids. Periodically pump clean water from the top of the settling tank into the storm sewer system. Periodically pump potentially contaminated water from the top of the settling tank into the approved sanitary sewer. Provide a meter to measure the volume of potentially contaminated water discharged to the sewer system.
 - 6. If free phase petroleum product, such as gasoline floating on the water, is observed during dewatering activities, terminate dewatering activities and notify the City of Madison's designated representative and the City of Madison Environmental Consultant.
 - 7. Notify the City of Madison's designated representative at least three days in advance of any proposed changes to the dewatering plan.
 - 8. Any flooding or erosion damage caused by dewatering operations is the responsibility of CONTRACTOR. If flooding or erosion damage occurs, take immediate steps to eliminate those conditions and to correct any damage. The control of all surface and subsurface water, ice, and snow are considered part of the dewatering. Erosion control shall be exercised at all times, including the placement of silt fences, sedimentation basins and any other devices necessary for proper control.
 - 9. Dispose of all water removed so as not to endanger public health, private and public property or completed work. Only electrically driven pumps shall be used for dewatering. Provide sufficient mufflers or other noise reduction devices necessary to minimize the noise of the equipment. If requested by ENGINEER, reduce noise to an acceptable level (as determined by ENGINEER) or supply an alternate system capable of meeting the noise requirements. This shall apply to any equipment utilized as part of the dewatering system.
 - 10. Provide stand-by equipment to maintain continuous dewatering in the event of mechanical breakdown to part of the system.
- B. CONTRACTOR shall obtain and meet all requirements of applicable WDNR permits for construction pit or trench dewatering and high capacity well dewatering.
- C. CONTRACTOR is responsible for removal and/or abandonment of dewatering wells. Removal and/or abandonment shall conform to all state and local regulations.

1.4 MEASUREMENT

- A. Dewatering of clean water will not be measured. Measure dewatering of potentially contaminated water in gallons and provide this information to the City of Madison's designated representative at the frequency determined by the Permit to Discharge to the Sanitary Sewer. This information will not be used as a basis for payment.

1.5 PAYMENT

- A. Dewatering is incidental to the contract. Dewatering includes all work necessary for pumping, settling, and discharging water; for any permit fees required; for elimination and correction of any flooding or erosion damage caused by dewatering operations; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.
- B. No disposal fees are required by the City of Madison for discharge to the storm sewer system. The City of Madison will pay for any disposal fees for the discharge of water to the sanitary sewer system.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION 31 23 25

SECTION 31 25 00

SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Erosion control devices.
- B. This work may include, but is not limited to, erecting fence, excavation, placing posts, backfilling, attaching woven wire and geotextile fabric; ditch checks; sediment traps; sediment basins; removing the fence at completion of project; cleaning and repairing; removing or spreading accumulated sediment to form a surface suitable for seeding; replacing silt fence and damages caused by overloading of sediment material or ponding of water adjacent to silt fence; and furnishing labor, tools, equipment, and incidentals necessary to complete the work in accordance with the Contract.

1.2 REFERENCES

- A. Wisconsin Department of Natural Resources Conservation Practice Standards-Construction Site Erosion and Sediment Control (Conservation Practice Standards).
- B. Erosion Control Product Applicability List (PAL) for Multi-Modal Applications (PAL) Wisconsin Department of Transportation.
- C. Dane County Erosion Control and Stormwater Management Manual (http://www.danewaters.com/pdf/manual/ecsm_manual.pdf).
- D. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- E. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.3 REGULATORY REQUIREMENTS

- A. Land disturbance greater than one acre and OWNER obtains NOI.
 - 1. OWNER has prepared a Storm Water Management and Erosion Control Plan in conjunction with the development of the Contract Documents and has submitted a "Notice of Intent" (NOI) for Storm Water Discharges Associated with Land Disturbing Activities. The NOI is included as an attachment to the Contract Documents. CONTRACTOR as designated operator of activities at the construction site shall be responsible for compliance with all permit conditions. This includes but is not limited to the following:
 - a. Implement erosion and sediment control practices necessary to meet federal, state, and local performance standards.
 - b. Receive required approvals from OWNER and regulatory agencies for any modifications to the erosion control plan necessitated by site conditions or CONTRACTOR's operations.
 - c. Provide a "qualified" inspector to inspect erosion control and sediment controls. Inspector shall have prior experience with and knowledge of installation and maintenance of erosion and sediment controls. Inspector shall be identified to OWNER.
 - d. Perform all inspection, maintenance, and record keeping activities required by the permit. This shall include inspecting erosion and sediment control facilities weekly and within 24 hours after a precipitation event of 0.5 inches or greater. CONTRACTOR shall maintain weekly written reports of all inspections.
 - e. CONTRACTOR shall respond within 24 hours to all corrective measures noted on the inspection report to address pollution issues.
 - f. CONTRACTOR shall submit to OWNER a written notice stating the times, dates and actions taken to rectify the defective pollution and erosion controls.

- g. Pay any fines or other fees resulting from failure of CONTRACTOR to comply with the permit requirements.
 - h. Submit a "Notice of Termination" (NOT) to DNR at end of the Project.
- B. CONTRACTOR and its subcontractors shall execute and sign the following certification:

"I certify under penalty of law that I understand the terms and conditions of the General Pollutant Discharge Elimination System Permit that authorizes the storm water discharges associated with industrial activities from the construction site and as may be detailed in the Contract Documents. I agree to indemnify and hold OWNER harmless from any claims, demands, suits, causes of action, settlements, fines, or judgments and the costs of litigation, including, but not limited to, reasonable attorneys fees and costs of investigation and arising from a condition, obligation or requirement assumed or to be performed by CONTRACTOR for storm water pollution and erosion control."

- C. CONTRACTOR shall pay any fines or other fees resulting from failure of CONTRACTOR to comply with the permit requirements.
- D. Post WDNR certificate of permit coverage on site and maintain until construction activities have ceased, the site is stabilized, and a notice of termination is filed with WDNR.
- E. Keep a copy of the current erosion control plan on site throughout the duration of the project.
- F. When possible, preserve existing vegetation (especially adjacent to surface waters), minimize land-disturbing construction activity on slopes of 20% or more, minimize soil compaction, and preserve topsoil.

1.4 QUALITY CONTROL

- A. Construct and maintain erosion sediment control measures in accordance with the Conservation Practice Standards.
- B. Check facilities weekly and after any rainfall event, and make needed repairs within 24 hours.

PART 2 - PRODUCTS

2.1 EROSION CONTROL PRODUCTS

- A. Erosion control products shall be as listed in the *Erosion Control Product Acceptability List for Multi-Modal Applications (PAL)* of the Wisconsin Department of Transportation. Contractors may obtain copies of the PAL and PAL qualification procedures from the WisDOT Bureau of Highway Construction.

2.2 EROSION MATS

- A. Erosion mat products shall be selected from the PAL in conformance with criteria specified in Conservation Practice Standard 1052 (Nonchannel Erosion Mat) and 1053 (Channel Erosion Mat).
- B. Provide erosion mat urban Class I, Type B for all areas of disturbance that require seeding. All channel areas on site shall be provided with erosion mat Class II, Type B.
- C. A 300 mm by 300 mm sample of a product proposed for erosion mat may be required to verify that it is prequalified. When a sample is required, it shall be accompanied by the manufacturer's literature for the proposed product.
- D. All erosion mat staples shall be of biodegradable materials.

2.3 SILT FENCE

- A. Silt fence shall conform to Conservation Practice Standard 1056-Silt Fence. Silt fence shall conform to Table 2 of Conservation Practice Standard 1056.
- B. Furnish wrapping on each roll of fabric to protect the fabric from ultraviolet radiation and from abrasion during shipping and handling. Keep geotextile dry until installed.

2.4 SOIL STABILIZER

- A. Soil stabilizer shall be Type A or Type B. Type A is either a cementitious soil binder added to wood cellulose fiber mulch or a bonded fiber matrix. Type B is a water soluble anionic polyacrylamide meeting requirements specified in Conservation Practice Standard 1050-Land Application of Anionic Polyacrylamide. CONTRACTOR shall provide soil stabilizer products from the PAL.

2.5 INLET PROTECTION

- A. Inlet protection shall conform to Conservation Practice Standard 1060-Storm Drain Inlet Protection for Construction Sites. Manufactured bags shall conform to Table 1 of Conservation Practice Standard 1060.

2.6 STONE TRACKING PADS AND TIRE WASHING STATION

- A. Stone tracking pads and tire washing stations shall conform to Conservation Practice Standard 1057-Stone Tracking Pad and Tire Washing.

2.7 DITCH CHECKS

- A. Ditch checks shall conform to Conservation Practice Standard 1062-Ditch Check (Channel).

2.8 VEGETATIVE BUFFER FOR CONSTRUCTION SITES

- A. Vegetative buffer shall conform to Conservation Standard Practice 1054-Vegetative Buffer for Construction Sites.

2.9 TEMPORARY SEEDING

- A. Temporary seeding for construction site erosion control shall conform to Conservation Standard Practice 1059-Seeding for Construction Site Erosion Control.

2.10 BEDDING DIKE

- A. Where shown on the Drawings or requested by ENGINEER in the field, CONTRACTOR shall install clay bedding dikes to prevent groundwater from flowing continuously through the bedding material installed for the sanitary sewer. Bedding dikes shall be 4 feet long and shall extend from the bottom of the trench excavation to within 2 feet of the ground surface and 1 foot beyond the normal trench width on both sides of the trench.

2.11 SEDIMENT TRAPS AND SEDIMENT BASINS

- A. Sediment traps and sediment basins shall conform to WDNR Technical Standards Sediment Trap No. 1063 and Sediment Basin No. 1064.

2.12 CONCRETE WASHOUT FACILITY

- A. CONTRACTOR shall provide a temporary concrete washout facility in accordance with the National Pollutant Discharge Elimination System (NPDES). Concrete washout facility shall be located a minimum of 50 feet from any storm drain inlet, open drainage facility, water body, construction traffic, and access area. Provide appropriate signage to inform equipment operators of the washout location.

2.13 DUST CONTROL

- A. Dust per WDNR Technical Standard Dust Control on Construction Sites No. 1068.

2.14 PERIMETER CONTROL AND SLOPE INTERRUPTION PRODUCTS

- A. Provide Class III, silt sock, or equal per WDNR Technical Standard No. 1071.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install erosion control devices before construction activities begin.
- B. Proceed carefully with construction adjacent to stream channels to avoid washing, sloughing, or deposition of materials into the stream. If possible, the work area should be diked off and the volume and velocity of water that crosses disturbed areas be reduced by means of planned engineering works (diversion, detention basins, berms).

- C. Unless noted on drawings, do not remove trees and surface vegetation unless necessary for construction.
- D. Stage Construction grading activities to minimize the cumulative exposed area. Conduct temporary grading for erosion control per WDNR Technical Standard Temporary Grading Practices for Erosion Control No. 1067.
- E. Expose the smallest practical area of soil at any given time through construction scheduling. Make the duration of such exposure before application of temporary erosion control measures or final revegetation as short as practicable.
- F. CONTRACTOR shall provide a “qualified” inspector to inspect erosion control and sediment controls once in place. Inspector shall have prior experience with and knowledge of installation and maintenance of erosion and pollution controls. Unless stricter requirements are mandated by DNR or by any local permits, project site erosion control inspection shall be conducted every seven days and after each one-half-inch rainfall or greater. CONTRACTOR shall maintain hard copies of the inspection reports for the duration of the Project.
- G. Any necessary repairs to erosion and sediment control facilities shall be provided within 24 hours to all corrective measures noted on the inspection reports to address pollution issues. CONTRACTOR shall submit to OWNER a written notice stating the times, dates and actions taken to rectify the defective erosion and sediment controls.
- H. CONTRACTOR shall also make any necessary additions for erosion and sediment control as may result from on-site conditions or the progress of the Work or as may be required by DNR or OWNER.
- I. Disturbed areas shall be stabilized with temporary or permanent measures within 14 calendar days of the soil disturbance or redistribution.
- J. All temporary erosion and sediment control measures shall be removed within 30 days after final stabilization is achieved or after the temporary measures are no longer needed. All sediment accumulated in temporary and permanent facilities shall be removed and properly disposed of and the area restored.
- K. Expose the smallest practical area of soil at any given time through construction scheduling. Make the duration of such exposure before application of temporary erosion control measures or final revegetation as short as practicable.

3.2 EROSION MAT

- A. Erosion mats shall be installed in accordance with manufacturer’s requirements and with Conservation Practices Standards 1052 and 1053.
- B. Place erosion mats immediately after seeding operations have been completed. Before mat placement, remove all material or clods over 1 1/2 inches in diameter and all organic material or other foreign material which may interfere with the mat bearing completely on the soil.
- C. Any small stones or clods which prevent contact of the mat with the soil shall be pressed in the soil with a small lawn-type roller or by other means. The mat shall have its lateral edge so impressed in the soil so as to permit runoff water to flow over it.
- D. The matting strips shall be rolled on or laid in direction of flow. Spread mat evenly and smoothly in a natural position without stretching and with all parts bearing on soil. Place blanket with netting on top. Overlap adjacent strips at least 4 inches. Overlap strip ends at least 10 inches. Make overlaps with upgrade section on top.
- E. Bury upgrade end of each strip of fabric or blanket at least 6 inches in a vertical slot cut in the soil and press soil firmly against the imbedded fabric or blanket.
- F. Anchor mats in place with vertically driven staples, driven until their tops are flush with the soil. Space staples on 3-foot centers along mat edges and stagger space at 3-foot centers through the center. Place staples at 10-inch centers at end or junction slots.
- G. Reseed areas damaged or destroyed during erosion mat placing operations as specified for original seeding.
- H. Dispose of surplus excavated materials during erosion mat placing operation as specified for original seeding.
- I. Following mat placement, uniformly apply water to the area to moisten seed bed to 2-inch depth and in a manner to avoid erosion.
- J. Maintain erosion mat and make satisfactory repairs of damage from erosion, traffic, fires, or other causes until Work is accepted.

3.3 SILT FENCE

- A. Silt fence shall be constructed in conformance with the criteria specified in Conservation Practice Standard 1056–Silt Fence. Remove sediment from behind silt fences and sediment barriers before sediment reaches a depth that is equal to one-half of the fence and/or barrier height. Repair breaks and gaps in silt fence and barriers immediately.

3.4 SOIL STABILIZER

- A. Soil Stabilizer Type A shall be applied with conventional hydraulic seeding equipment. CONTRACTOR shall take care so that surrounding surfaces, structures, trees, and shrubs are not over-sprayed. Before Work is accepted any over-spray must be satisfactorily cleaned from surfaces. The finished application shall be 3/16 inches to 1/4 inch thick.
- B. Soil Stabilizer Type B shall be applied with conventional hydraulic seeding equipment or by dry spreading. CONTRACTOR shall apply material at the manufacturer’s recommended rate.

3.5 INLET PROTECTION

- A. All storm drains that are or will be functioning during construction within the contributing drainage area shall be provided with inlet protection. Inlet protection shall be provided in conformance with the criteria specified in Conservation Practice Standard 1060–Storm Drain Inlet Protection for Construction Sites.
- B. CONTRACTOR shall clean all sumps after restoration is complete per Section 210.1(g) of City of Madison Standard Specifications for Public Works Construction.

3.6 STONE TRACKING PADS AND TIRE WASHING

- A. Tracking pads and tire washing stations shall be installed in accordance with the criteria in Conservation Practice Standard 1057–Stone Tracking Pad and Tire Washing.
- B. Surface water must be prevented from passing through tracking pads. Flows shall be diverted away from tracking pads and conveyed under and around them such as with culverts.
- C. Any sediment tracked onto a road shall be removed before the end of each day. Flushing sediment shall not be allowed.

3.7 DITCH CHECKS

- A. Ditch checks shall be provided in conformance with the criteria specified in Conservation Practice Standard 1062–Ditch Checks.

3.8 VEGETATIVE BUFFER

- A. Vegetative buffer shall be provided in conformance with the criteria specified in Conservation Practice Standard 1060–Vegetative Buffer for Construction Sites.

3.9 SEEDING FOR EROSION CONTROL

- A. Temporary seeding for erosion control shall be provided in conformance with the criteria specified in Conservation Practice Standard 1059–Seeding for Construction Site Erosion Control.

3.10 SEDIMENT TRAPS AND SEDIMENT BASINS

- A. Sediment traps for erosion and sedimentation control during interim construction stages shall be installed in accordance with the criteria in Conservation Practice Standard 1063–Sediment Trap and sediment basins with the criteria in 1064–Sediment Basin. They shall be constructed prior to any disturbances and shall be placed so they function during all phases of the Work.

3.11 EROSION CONTROL NOTES

- A. Immediately stabilize stockpile and surround stockpiles as needed with silt fence or other perimeter control if stockpiles will remain inactive for 7 days or longer.
- B. Sweep and clean up all sedimentation and trash that moves off-site due to construction activity or storm events before the end of the same workday.

- C. Temporary restrooms are to be located a minimum of 50 feet away from any storm drain inlet, open drainage facility, or water body. The location of the temporary rest rooms must be approved by OWNER. Sanitary waste shall be collected from portable units provided by CONTRACTOR a minimum of two times per week to avoid overflowing and maintain sanitary conditions around the unit.
- D. All petroleum products stored on-site shall be stored in adequate containers. All fueling sources shall have spill kits immediately available. All hazardous storage areas must be placed in areas away from stormwater flow patterns and storm sewer basins and inlets.
- E. Concrete trucks shall not be permitted to wash out or discharge surplus concrete or drum wash water on the site. Specific areas for this activity shall be designated by CONTRACTOR and provided with adequate siltation basins and other facilities so that discharge is contained and cleansed before entering the site storm sewer system.
- F. The vegetative growth associated with temporary and permanent seeding, sodding, vegetative channels, etc. shall be maintained periodically and supplied with adequate water and fertilizer nutrients. If necessary, the vegetative cover shall be removed and reseeded as needed.
- G. The conditions of the construction site for the winter shut down period shall address proper sediment and erosion control early in the fall growing season so that slopes and other bare earth areas may be stabilized. Stabilization shall be land applied soil stabilizer Type B and/or erosion mat urban Class I, Type B for non-channel. Erosion mat Class II, Type B shall be used for channel use. Soil stabilizers and erosion mat shall be in accordance with the Wisconsin Department of Transportation erosion control and stormwater product acceptability lists to provide a stable, temporary, and/or permanent vegetative cover. All areas to be worked beyond the end of the growing season must incorporate soil stabilization measures.
- H. Disturbed areas and areas used for storage of materials and equipment that are exposed to precipitation shall be inspected for evidence of, or the potential for pollutants entering the drainage system. Erosion and sedimentation control measures shall be observed to see that they are operating correctly. Where discharge locations or points are accessible they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impact to receiving waters and adjacent properties. Locations where vehicles enter or leave the site shall be inspected for evidence of off-site sediment tracking.
- I. Make provisions for watering following seeding or planting of disturbed areas whenever more than 7 consecutive days of dry weather occur.

END OF SECTION 31 25 00

SECTION 31 32 19

GEOTEXTILES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Geotextiles for areas below base course and below riprap.

1.2 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- B. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Geotextile to be placed below riprap shall be Mirafi 180N, or equal.
- B. Geotextile to be placed below base course shall be Mirafi 600X, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Geotextile shall be installed in accordance with manufacturer's recommendations.
- B. Geotextile shall be lapped a minimum of 24 inches.
- C. CONTRACTOR shall protect the construction fabric from exposure to the sun until installation. Construction fabric shall be covered with stone or soil immediately upon placement.

END OF SECTION 31 32 19

SECTION 31 37 00

RIPRAP

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Furnishing and placing Riprap-Glacial Field Stone.

1.2 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- B. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Riprap-Glacial Field Stone shall conform to Article 212 of the City of Madison Standard Specifications for Public Works Construction, Standard Detail Drawings, details in the drawings, and as follows. Riprap-Glacial Field Stone size shall meet the sizing requirements defined in Article 212.2 of the City of Madison Standard Specifications for Public Works Construction and have an average stone size of 12 inches for medium riprap and 18 inches for heavy rip rap. The material shall be comprised of rounded, durable, glacial till that has been sorted for size and is not susceptible to freeze-thaw degradation. Crushed, blasted, or "made" stone will not be permitted on site.
- B. Prior to placement, CONTRACTOR shall submit sourcing information to ENGINEER. ENGINEER, or their representative, may choose to evaluate the material at the source prior to acceptance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. The bed for the riprap shall be properly trimmed and shaped before geotextile and stone is placed. Bed shall be minimum 6 inches thick.
- B. Geotextile shall be placed below riprap.
- C. Construction Methods: Riprap-Glacial Field Stone shall be installed in accordance with Article 212 of the City of Madison Standard Specifications for Public Works Construction. The stone shall be underlain with Riprap Filter Fabric, Type HR. The filter fabric shall be placed in a manner that prevents excess material from extending beyond the stone.

3.2 INSTALLATION

- A. Riprap shall be provided in areas as designated on the drawings.
- B. Stone placed above the water line shall be placed by hand. It shall be laid with close, broken joints and shall be firmly bedded into the slope and against the adjoining stones. The stones shall be laid perpendicular to the slope with ends in contact.
- C. The riprap shall be thoroughly compacted as construction progresses, and the finished surface shall present an even, tight surface.
- D. The large stone shall be placed in the lower courses. Interstices between stones shall be chinked with spalls firmly rammed into place.
- E. Unless otherwise shown or specified, riprap shall be at least 18 inches in thickness, measured perpendicular to the slope.

END OF SECTION 31 37 00

SECTION 32 11 00

AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Aggregate base course for roads and parking areas.
- B. CONTRACTOR is cautioned that existing private and public roads and shoulders may not hold up to typical construction traffic or activities. CONTRACTOR shall repair all roads, shoulders, and gravel areas damaged in accordance with this section. All paved areas shall also be repaired in accordance with Section 32 11 26–Hot Mix Asphalt Paving.

1.2 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- B. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.3 DEFINITIONS

- A. Street or road shall include streets, roads, driveways, and parking lots.

1.4 SUBMITTALS

- A. Submit sieve analysis for proposed materials.

1.5 DRAINAGE DURING CONSTRUCTION

- A. CONTRACTOR shall comply with the provisions of Section 205.3.3 of the Standard Specifications.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Aggregate for base course shall meet the requirements of Sections 301 and 305 of the Standard Specifications.
- B. Base course shall be uniformly graded and shall conform to the requirements of Base Aggregate Dense, 1 1/4 inch.

PART 3 - EXECUTION

3.1 PREPARATION

- A. The subgrade shall be graded and rolled to provide uniform density and shall comply with the elevations contained in the drawings. All street subgrade in cut areas and all areas to receive fill shall be proof-rolled in the presence of OWNER or ENGINEER with a heavily loaded triaxle dump truck or similar equipment prior to the placement of any fill materials or base course. The subgrade shall be prepared in accordance with Section 31 23 00–Excavation, Fill, Backfill, and Grading, and also with Section 211 of the Standard Specifications.

3.2 CONSTRUCTION

- A. Base course grade shall be set to allow placement of 5-inch thickness of asphaltic pavement.
- B. Depth of base course below asphaltic pavement shall be 12 inches.
- C. Each layer of base course shall be wetted and rolled to provide maximum compaction in accordance with Section 305 of the Standard Specifications.
- D. The finished base course shall be fine graded in preparation for paving.

- E. After final grading, CONTRACTOR shall maintain the base course until asphaltic paving work has been completed.

END OF SECTION 32 11 00

SECTION 32 11 26

HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work includes Hot Mix Asphalt (HMA) paving, tack coat, and casting adjustments.

1.2 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- B. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.3 DEFINITIONS

- A. Street or road shall include streets, roads, driveways, and parking lots.

1.4 SUBMITTALS

- A. Prior to the commencement of paving, mix designs and aggregate sieve analysis shall be submitted.

PART 2 - PRODUCTS

2.1 HMA PAVEMENT

- A. Asphaltic mix shall be LT 58-28 S for both lower layer and upper layer.
- B. Aggregate shall conform to the requirements of Section 460.2.2 of the Standard Specifications. Aggregate for the lower layer shall be nominal size of 12.5 mm. Aggregate for the upper layer shall be nominal size of 12.5 mm.
- C. Asphaltic pavement lower layer shall be 3 inches minimum. Asphaltic pavement upper layer shall be 2 inches minimum. Asphaltic pavement upper layer shall be 2 inches minimum at the milled asphaltic pavement on Nakoosa Trail.
- D. Materials for tack coat shall conform to the requirements of Section 455.2.5 and shall be MS-2, SS-1, SS-1h, CSS-1 or CSS-1h.
- E. Pavement markings shall be yellow and shall conform to Section 646. If not otherwise specified, pavement markings shall have a minimum width of 4 inches. Diagonal pavement markings shall be 4 inches wide and 36 inches on center.

PART 3 - EXECUTION

3.1 ALLOWABLE REMOVAL OF PAVEMENT

- A. CONTRACTOR shall remove asphalt pavement and road surface as a part of the general excavation. The width of pavement removed shall be the minimum possible and acceptable for convenient and safe installation of structures, utilities, and appurtenances.
- B. All asphalt pavement shall be cut on neat, straight lines and shall not be damaged beyond the limits of the excavation. Should the cut edge be damaged, a new cut shall be made in neat, straight lines parallel to the original cut encompassing all damaged areas. Pavement removal shall be extended to a seam or joint if seam or joint is within 3 feet of damaged pavement.

3.2 CASTING ADJUSTMENTS

- A. All new and existing manhole castings and valve boxes within the paving limits, which require adjustment, shall be adjusted to match the finished asphaltic surface. Adjustments shall not be made greater than 48 hours prior to the anticipated time of paving. CONTRACTOR shall furnish Class 1 barricades with flashers on all adjusted castings until

paving has been completed. Tops of castings and valve boxes shall be oiled or protected by other methods to prevent sealing of lids and filling of lift holes during paving. Upon completion of paving operations, CONTRACTOR shall check all castings and valve boxes to see that the lids are clean and operational. Manhole casting adjustment shall be included in the cost of other items of work, and no further compensation will be made. Valve box adjustment shall be considered an incidental item of work.

3.3 TACK COAT

- A. All work shall be in accordance with the Standard Specifications.
- B. If asphaltic upper layer is applied to an existing street or is not applied the same day as lower layer, the existing street or lower layer shall be tack coated prior to surface paving. Prior to placement of tack coat, the streets shall be thoroughly cleaned and broomed. Tack coat shall be applied at a rate of 0.10 gallons per square yard immediately prior to placement of asphaltic upper layer.
- C. In situations where traffic must be maintained, tack coat shall not be placed on the traveled half of the street until traffic can be switched to the new pavement.

3.4 JOINTS

- A. Joints between old and new pavements or between successive day's work shall be constructed and treated as to provide thorough and continuous bond between the old and new mixtures. Transverse construction joints shall be constructed by cutting the material back for its full depth so as to expose the full depth of the course. Where a header is used, the cutting may be omitted provided the joint conforms to the specified thickness. These joints shall be treated with tack coat material applied with a hose and spray nozzle attachment to fully coat the joint surface.
- B. The longitudinal joint shall be made by overlapping the screed on the previously laid material for a width of not more than 2 inches and depositing a sufficient amount of asphaltic mixture so that the finished joint will be smooth and tight. Longitudinal joints in the upper layer shall at no time be placed immediately over similar joints in the lower layer beneath. A minimum distance of 12 inches shall be permitted between the location of the joints in the lower layer and the location of similar joints in the upper layer above.
- C. All costs for furnishing and applying tack coat to butt joints as specified above shall be considered incidental.

3.5 FINISHING ROADWAY

- A. The finished base course shall be fine-graded in preparation for HMA paving. Base course ramps at all existing pavement shall be removed to provide a full depth butt joint. Base course around manhole castings and valve boxes shall be hand-trimmed and compacted with a vibratory plate compactor.
- B. This item shall include all of the following preparatory and finishing items and any other incidental items of work required for construction. Asphaltic ramps around manholes on existing lower layer to receive upper layer shall be removed. Asphaltic ramps shall be installed on all manholes and at all butt joints in areas to receive lower layer only.
- C. Finishing roadway shall be considered incidental to HMA paving.
- D. Paint all markings as shown on drawings with lines not less than 4 inches wide.

3.6 TESTING HOT MIX ASPHALT

- A. ENGINEER may require samples of HMA pavement for testing. CONTRACTOR shall cut samples from the finished pavement where marked by ENGINEER and patch the sample area.

3.7 HOT MIX ASPHALT PAVING

- A. HMA paving work shall include the construction of plant-mixed hot mix asphalt pavement in the areas shown on the drawings. All work shall be performed in accordance with Section 460 of the Standard Specifications.
- B. Prior to commencement of paving operations, CONTRACTOR shall examine the finished road bed. CONTRACTOR shall notify ENGINEER of any areas of suspected instability.

3.8 MILLED ASPHATIC PAVEMENT

- A. Mill the existing asphaltic pavement to a depth of 2 inches on Nakoosa Trail for the area as shown on the drawings.

END OF SECTION 32 11 26

SECTION 32 16 13

CONCRETE CURB AND GUTTER, SIDEWALKS, AND DRIVEWAY APRONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work includes concrete curb and gutter, sidewalks, and driveway aprons as shown on the drawings.

1.2 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- B. AASHTO M148 Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
- C. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.3 QUALITY ASSURANCE

- A. Unless otherwise specified, all curb and gutter, sidewalks, and driveway apron construction shall meet the requirements of the Standard Specifications.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. All concrete shall conform to Section 501 of the Standard Specifications for Grade A air entrained concrete.

2.2 CURING COMPOUND

- A. Liquid curing compounds shall conform to the requirements of the Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete, AASHTO Designation M148, Type 2, White Pigmented.

2.3 RUBBER PARKING CURB

- A. Rubber parking curb shall be 6 feet long, 6 inches wide at base, and 4 inches high. The rubber shall be resistant to extreme temperatures, oil, gas, moisture, and UV light. Curb shall be permanently installed with rebar spikes 1 foot from the edge of pavement in the center of parking stalls as indicated on the Drawings. Rubber parking curb shall be by Global Industries, or equal.

PART 3 - EXECUTION

3.1 BASE PREPARATION-CURB AND GUTTER

- A. The base course beneath the curb and gutter shall be trimmed or filled as necessary to provide a full depth of curb and gutter. Prior to placement of concrete, the base shall be thoroughly compacted and moistened. Curb and gutter shall be Type G as shown on Standard Detail drawing 3.08, unless otherwise indicated.

3.2 BASE PREPARATION-SIDEWALKS AND DRIVEWAYS

- A. The subgrade shall be thoroughly compacted and finished to a trim, firm surface. All soft or unsuitable material shall be removed and replaced with suitable material.
- B. A minimum 4-inch-thick layer of base course shall be placed under all sidewalks. A minimum 6-inch-thick layer of base course shall be placed under all sidewalks at driveways. This material shall be thoroughly moistened and compacted before the concrete is placed.

3.3 FORMS

- A. Forms shall be of metal and of sufficient strength to resist distortion or displacement. Metal forms shall be used to construct a curb and gutter cross section. Forms shall be full depth of the required work. Facing boards, if used, shall be built so as to obtain the cross section called for on the drawings. Forms shall be securely staked and held firmly to line and grade. Forms shall be cleaned thoroughly and oiled before reuse.
- B. All curved curb and gutter shall form smooth curves and shall not be a series of chords. Radius forms shall be used for all curved curb and gutter where the radius of curvature is 100 linear feet or less.

3.4 PLACING AND FINISHING CONCRETE

- A. Concrete shall be thoroughly tamped to remove all voids. The exposed surfaces of the curb and gutter shall be thoroughly troweled and finished with a brush at right angles to the line of the curb and gutter. The back edge of the curb, the edge of the gutter adjacent to the pavements, and edges adjacent to expansion joints shall be rounded with a 1/4-inch-radius edger. Honeycombed areas along the back of the curb shall be pointed with mortar.
- B. Before final finishing of curb and gutter, a 10-foot straight edge shall be used to check the surface. Any areas showing a variation of more than 1/4 inch from the straight edge shall be corrected. Final finishing shall be delayed a sufficient time so that excess water and grout will not be brought to the surface.
- C. Concrete for sidewalk shall be placed to a minimum thickness of 5 inches, except at driveway aprons and curb ramps, which shall have a minimum thickness of 8 inches. Driveway aprons shall have a minimum thickness of 8 inches. The concrete shall be thoroughly spaded and tamped to remove all voids. The surface of the driveway or sidewalk shall be thoroughly troweled and finished with a brush at right angles to the driveways or sidewalk line.

3.5 MACHINE FORMED CURB AND GUTTER

- A. CONTRACTOR may elect to use a machine for placing, forming, and consolidating concrete curb and gutter. If a machine is used, the resulting curb and gutter shall be of such a quality as to equal or exceed that produced by the method described above.

3.6 DRIVEWAY OPENINGS

- A. Driveway openings will be staked by ENGINEER or OWNER in the field. The details for curb and gutter through a driveway is shown on the Drawings.

3.7 REJECT SECTIONS

- A. At locations shown on the drawings, the curb and gutter shall be warped so as to reject the flow of water. The transition from a standard section to a reject section shall not be abrupt but shall be a minimum of 10 feet in length. The reject section shall conform to type D as shown on Standard Detail Drawing 3.08.

3.8 JOINTING—CURB AND GUTTER

- A. A 3/4-inch expansion joint filler shall be placed through the curb and gutter at the radius points of all intersection curbs. This expansion joint filler shall extend through the entire thickness of concrete and shall be perpendicular to the surface and at right angles to the line of the curb and gutter.
- B. At intervals of not more than 10 feet, a contraction joint shall be tooled to a depth of one-fifth of the total concrete thickness with a 1/4-inch-radius jointer. The contraction joint shall be at right angles to the line of the curb and gutter.
- C. If machine-formed curb and gutter is provided by CONTRACTOR, CONTRACTOR shall create a plane of weakness at all joints that is sufficient to cause contraction cracking at the joints.
- D. CONTRACTOR may saw contraction joints. The depth of cut shall be a minimum of one-fifth of the total concrete thickness. Sawing shall be done as soon as practicable after the concrete has set sufficiently to preclude raveling during the sawing and before any shrinkage cracking takes place in the concrete. If this method results in random cracking, CONTRACTOR will be required to tool the contraction joints as specified above.
- E. The use of steel separator plates will not be allowed.

3.9 JOINTING--SIDEWALKS AND DRIVEWAYS

- A. Concrete sidewalk shall be cut into rectangular blocks approximately 5 feet long. The cut must extend at least one-fifth of the total thickness of concrete. The edges of the sidewalk along forms and joints shall be rounded with an edging tool of 1/4-inch radius. All joints shall be at right angles to the centerline of the sidewalk.
- B. Concrete driveways shall be jointed in approximately square sections. The depth of the joint and the finishing of the edges shall be the same as for concrete sidewalk.

3.10 EXPANSION JOINTS

- A. A 1-inch-thick expansion joint filler shall be placed between curb ramps and back of curb.
- B. A 3/4-inch-thick expansion joint shall be placed at all sidewalk corners, between sidewalks and buildings, and between back of curb and sidewalk.

3.11 SLOPE

- A. Sidewalk cross slope shall be 1/4 inch per foot unless otherwise noted in the drawings or requested by ENGINEER.

3.12 CURB RAMP

- A. Curb ramps shall be constructed in accordance with Standard Detail Drawing No. 3.03.

3.13 INLET CASTING ADJUSTMENT

- A. Inlet casting shall be adjusted to grade as required for the installation of the new curb and gutter. Inlet casting backs shall be adjusted for a depressed flow line at all inlets in the low points (0.72 feet); all other inlet shall be adjusted for a normal flow line (0.50 feet).

3.14 CURING

- A. As soon after finishing operations as the free water has disappeared, the concrete surface shall be sealed by spraying on it a uniform coating of curing material in such a manner as to provide a continuous water impermeable film on the entire concrete surface.
- B. The material shall be applied to form a uniform coverage at the rate of not less than one-half gallon per 100 square feet of surface area.
- C. Within 30 minutes after the forms have been removed, the edges of the concrete shall be coated with the curing compound applied at the same rate as on the finished surface.

3.15 PROTECTION OF CONCRETE

- A. CONTRACTOR shall erect and maintain suitable barricades to protect the new concrete. Where it is necessary to provide for pedestrian traffic, CONTRACTOR shall, at his own cost, construct adequate crossings. Crossing construction shall be such that no load is transmitted to the new concrete.
- B. Any part of the work damaged or vandalized prior to final acceptance shall be repaired or replaced at the expense of CONTRACTOR in a manner satisfactory to ENGINEER.
- C. Pedestrian traffic shall not be permitted over new concrete prior to 72 hours after application of curing material. Vehicular traffic shall not be permitted over newly placed concrete within 7 days after completion when temperatures are 70°F or higher, 10 days when temperatures are not lower than 60°F and up to a maximum of 21 days when the temperatures are generally lower than 60°F.

END OF SECTION 32 16 13

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

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.

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences - CLF-1:
 - a. Fabric:
 - 1) Steel wire with metallic coating with polymer color coat.
 - b. Framework:
 - 1) Post Material:
 - a) Heavy-industrial-strength Group IA or IC round steel pipe posts.
 - 2) Horizontal Members:
 - a) Top rails.
 - b) Bottom rails.
 - 3) Brace rails.
 - 4) Coating:
 - a) Metallic coating and polymer color coat.
 2. Fittings.

B. Related Requirements:

 1. Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of gate operator.
3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.
5. <Insert requirement>.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Accessories: .

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. <Insert failure modes>.
 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
 1. Steel Wire for Fabric:
 - a. Wire Diameter: 0.192 inch.
 - b. Mesh Size: 2 inches.
 - c. Metallic Coating: Any of following:
 - 1) Aluminum-Coated Fabric: ASTM A 491, Type I, 0.30 oz./sq. ft..
 - 2) Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before weaving.
 - 3) Zn-5-Al-MM Aluminum-Mischmetal-Coated Fabric: ASTM F 1345, Type III, Class 1, 0.60 oz./sq. ft..
 - d. Polymer-Coating: Applied per ASTM F 668, Class 1 or Class 2a over metallic coated steel wire specified above.
 - 1) Color: Black, according to ASTM F 934.
 2. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMEWORK

- A. Heavy-Industrial-Strength Posts and Rails, Group IA or IC: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
 1. Fence Height: 72 inches.
 2. Material: Group IA, round steel pipe, Schedule 40 or Group IC, round steel pipe, electric-resistance-welded pipe.
 - a. Line Post: 1.9 inches in diameter.
 - b. End, Corner, and Pull Posts: 2.375 inches in diameter.
 - c. Horizontal Framework Members: Provide following rails according to ASTM F 1043.
 - 1) Top Rails: 1.66 inches in diameter.
 - 2) Bottom Rails: 1.66 inches in diameter.
 - d. Brace Rails: ASTM F 1043, 1.66 inches in diameter.
- B. Coatings:
 1. Metallic Coating for Steel Framework: Any of following:

- a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating according to ASTM A 653/A 653M.
 - b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc-pigmented coating.
 - d. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
2. Polymer Coating: Apply over metallic coating specified above.
 - a. Color: Black, according to ASTM F 934.

2.3 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Rail Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
 2. Rail Clamps: Line and corner boulevard clamps for connecting rails to posts.
- E. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- F. Finish:
 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
 - a. Apply polymer color coating over metallic coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
 1. Install fencing on established boundary lines inside property line.
- B. Post Setting:
 1. Posts Set in Concrete Footings: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - a. Excavation: Drill or hand-excavate holes for posts. Excavate holes to a diameter of not less than 4 times posts size and a depth of not less than 24 inches plus 3 inches for each footer fraction of a foot that fence height exceeds 4 feet.

- b. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete.
 - c. Extend posts to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
 - d. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - 1) Concealed Concrete: Place top of concrete 2 inches below grade [as indicated on Drawings] to allow covering with surface material.
 - C. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
 - D. Line Posts: Space line posts uniformly at 96 inches o.c.
 - E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
 - F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
 - G. Bottom Rails: Secure to posts with fittings.
 - H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
 - I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
 - J. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- 3.4 FIELD QUALITY CONTROL
- A. test reports.
- 3.5 ADJUSTING
- A. Lubricate hardware and other moving parts.

END OF SECTION 32 31 13

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Decorative metallic-coated-steel tubular picket fences, prefabricated.
 - 2. Swing gates.
 - 3. Horizontal-slide gates.
 - 4. Gate operators, including controls.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for concrete bases for gate operators, drives, and controls and post concrete fill.
 - 2. Section 28 13 00 "Access Control" for access control devices installed at gates and provided as part of a security system.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include diagrams for power, signal, and control wiring.
- C. Samples: For each fence material and for each color specified.
 - 1. Provide Samples 12 inches in length for linear materials.
 - 2. Provide Samples 12 inches square for [bar grating] [and] [sheet or plate materials].

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For gate operators to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 DECORATIVE METALLIC-COATED-STEEL TUBULAR PICKET FENCES, PREFABRICATED

- A. Decorative Metallic-Coated-Steel Tubular Picket Fences: Comply with ASTM F 2408 for industrial application (class) unless otherwise indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Fence; Montage Commercial, Majestic series or comparable product by one of the following:
 - a. BetaFence USA LLC.
 - b. Fortress Iron.
 - c. Hill & Smith Inc.
 - d. Iron Eagle Industries, Inc.

- e. Iron World Manufacturing, LLC.
- B. Posts:
 - 1. End and Corner Posts: Square tubes 2-1/2 by 2-1/2 inches formed from 14 ga, metallic-coated steel sheet or formed from 14 ga thickness steel sheet and hot-dip galvanized after fabrication.
 - 2. Posts at Swing Gate Openings: Square steel tubing 4 by 4 inches with 11 ga. wall thickness, hot-dip galvanized.
 - 3. Posts at Horizontal-Slide Gate Openings up to 12 Feet: Square steel tubing 4 by 4 inches with 11 ga. wall thickness, hot-dip galvanized.
 - 4. Posts at Horizontal-Slide Gate Openings Wider Than 12 Feet: Square steel tubing 4 by 4 inches with 11 ga. wall thickness, hot-dip galvanized.
- C. Post Caps: UV-resistant plastic.
- D. Rails: Square tubes.
 - 1. Size: 2 inches x 4 inches notched and plated for V-Track Wheels .
 - 2. Metal and Thickness: 0.079-inch nominal-thickness, metallic-coated steel sheet or 0.075-inch nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
- E. Pickets: Square tubes.
 - 1. Terminate tops of pickets at top rail for flush top appearance.
 - 2. Picket Spacing: 4 inches clear, maximum.
- F. Fasteners: Manufacturer's standard concealed fastening system.
- G. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components[with resilient polymer washers].
- H. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc, alloy-coated steel sheet.
- I. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior .
- J. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- K. Finish: Organic coating complying with requirements in ASTM F 2408.

2.2 SWING GATES

- A. Gate Configuration: As indicated.
- B. Gate Frame Height: As indicated.
- C. Gate Opening Width: As indicated.
- D. Automated vehicular gates shall comply with ASTM F 2200, Class IV.
- E. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 2-1/2 by 2-1/2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 014 ga. thickness steel sheet and hot-dip galvanized after fabrication.
- F. Steel Frames and Bracing: Fabricate members from square steel tubing 2-1/2 by 2-1/2 inches with 14 ga. wall thickness. Hot-dip galvanize frames after fabrication.
- G. Frame Corner Construction: Welded.
- H. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- I. Infill: Comply with requirements for adjacent fence.
- J. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - 1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence.
- K. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
- L. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.
- M. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
- N. Rim Locks: BHMA A156.5, Grade 1, suitable for exterior use.
 - 1. Material: Cast, forged, or extruded brass or bronze.
 - 2. Mounting Plate: Configuration necessary for mounting locks. Fabricate from 1/8-inch- thick, steel plate; galvanized.

- O. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail[-safe][-secure], and suitable for exterior use.
 - 1. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch- thick, steel plate; galvanized.
 - 2. Mounting: Mortise into post.
- P. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
- Q. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4-inch- diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.
- R. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- S. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- T. Metallic-Coated-Steel Finish: High-performance coating.
- U. Steel Finish: High-performance coating.
- V. Aluminum Finish: Baked enamel or powder coating.

2.3 HORIZONTAL-SLIDE GATES

- A. Gate Configuration: As indicated.
 - 1. Type: Cantilever slide, with internal roller assemblies.
- B. Gate Frame Height: As indicated.
- C. Gate Opening Width: As indicated.
- D. Automated vehicular gates shall comply with ASTM F 2200, Class IV.
- E. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing.
 - 1. Frame Members: Square tubes 2-1/2 by 2-1/2 inches formed from 14 ga. nominal-thickness, metallic-coated steel sheet or formed from 14 ga. nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - 2. Bracing Members: Square tubes 2-1/2 by 2-1/2 inches formed from 14 ga. nominal-thickness, metallic-coated steel sheet or formed from 14 ga. nominal-thickness steel sheet and hot-dip galvanized after fabrication.
- F. Steel Frames and Bracing: Fabricate members from square tubing. Hot-dip galvanize frames after fabrication.
 - 1. Frame Members: Steel tubing 2-1/2 by 2-1/2 inches with 14 ga. wall thickness.
 - 2. Bracing Members: Steel tubing 2-1/2 by 2-1/2 inches with 14 ga. wall thickness.
- G. Frame Corner Construction:
 - 1. Welded frame and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.
- H. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- I. Infill: Comply with requirements for adjacent fence.
- J. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - 1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence.
- K. Hardware: Latches permitting operation from both sides of gate, roller assemblies and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
- L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- M. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- N. Metallic-Coated-Steel Finish: High-performance coating.
- O. Steel Finish: High-performance coating.
- P. Aluminum Finish: Baked enamel or powder coating.

2.4 GATE OPERATORS

- A. Gate Operators:
1. Basis-of-Design Product: Subject to compliance with requirements, see below for product information:
 - a. DoorKing, Inc., 9235 Vehicular Slide Gate Operator
 - b. HySecurity., HydraSwing, swing gate linear actuator.
- B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 2. Provide operator with UL-approved components.
 3. Provide electronic components with built-in troubleshooting diagnostic feature.
 4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
- C. Comply with NFPA 70.
- D. UL Standard: Manufacturer and label gate operators to comply with UL 325.
- E. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.
- F. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
1. Voltage: 208-220 V.
 2. Horsepower: Not less than 13 hp.
 3. Enclosure: Manufacturer's standard.
 4. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
 5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 6. Phase: One.
- G. Gate Operators: Post mounted and as follows:
1. Hydraulic Swing Gate Operators:
 - a. Duty: Heavy duty, commercial/industrial.
 - b. Gate Speed: Minimum 60 feet per minute.
 - c. Maximum Gate Weight: 4000 lb.
 - d. Frequency of Use: 25 cycles per hour.
 - e. Hydraulic Fluid: Of viscosity required for gate operation at ambient temperature range for Project.
 - f. Locking: Hydraulic in both directions.
 2. Mechanical Slide Gate Operators:
 - a. Duty: Heavy duty, commercial/industrial.
 - b. Gate Speed: Minimum 4 Ft/Sec.
 - c. Maximum Gate Weight: 3000 lb.
 - d. Frequency of Use: 60 cycles per hour.
 - e. Operating Type: Roller chain, with manual release.
 - f. Drive Type: Enclosed worm gear and chain-and-sprocket reducers, roller-chain drive.
 - g. Drive Type: V-belt and chain-and-sprocket reducers, roller-chain drive.
 - h. Thermostatically controlled heater kit.
- H. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 4 enclosure for pedestal mounting, and with space for additional optional equipment. Provide the following remote-control device(s):
1. Card Reader: Functions only when authorized card is presented. Programmable, multiple -code system, permitting four different access time periods.
 - a. Reader Type: Touch plate.
 - b. Features: Capable of monitoring and auditing gate activity.

2. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide two programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 1000 codes per channel configured for the following functions:
 - a. Transmitters: Three button operated, with open and close function.
 - b. Channel Settings: Two independent channel settings controlling separate receivers for operating more than one gate from each transmitter.
- I. Vehicle Loop Detector: System includes automatic closing timer with adjustable time delay, timer cutoff switch, and loop detector designed to hold gate open until traffic clears. System includes electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. System includes number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement, as recommended in writing by detection system manufacturer for function indicated, at location shown on Drawings.
- J. Vehicle Presence Detector: System includes automatic closing timer with adjustable time delay, timer cutoff switch, and presence detector designed to hold gate open until traffic clears. System includes retroreflective detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.
- K. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
 1. Action: Reverse gate in both opening and closing cycles, and hold until clear of obstruction.
 2. Action: Stop gate in opening cycle and reverse gate in closing cycle, and hold until clear of obstruction.
 3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 4. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.
 - a. Along entire gate leaf leading edge.
 - b. Along entire gate leaf trailing edge.
 - c. Across entire gate leaf bottom edge.
 - d. Along entire length of gate posts.
 - e. Along entire length of gate guide posts.
 - f. Where indicated on Drawings.
 5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
- L. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
- M. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.
 1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.
- N. Operating Features:
 1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
 2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
 3. Master/Slave Capability: Control stations designed and wired for gate pair operation.
 4. Automatic Closing Timer: With adjustable time delay before closing[and timer cutoff switch].
 5. Open Override Circuit: Designed to override closing commands.
 6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
 7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
 8. Clock Timer: 24-hour programmable for regular events.

O. Accessories:

1. Warning Module: Visual, strobe-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system:
 - a. Fail-Safe: Gate opens and remains open until power is restored.
 - b. Fail-Secure: Gate cycles on battery power, then fail-safe when battery is discharged.
3. External electric-powered magnetic lock with delay timer allowing time for lock to release before gate operates.
4. Fire box.
5. Fire strobe sensor.
6. Instructional, Safety, and Warning Labels and Signs: Manufacturer's standard for components and features specified.
7. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

2.5 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Uncoated Steel Sheet: Hot-rolled steel sheet, ASTM A 1011/A 1011M, Structural Steel, Grade 45.
- E. Metallic Coated Steel Sheet:
 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G90 coating.
 2. Aluminum-Zinc, Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, with AZ60 coating.
- F. Castings: Either gray or malleable iron unless otherwise indicated.
 1. Gray Iron: ASTM A 48/A 48M, Class 30.
 2. Malleable Iron: ASTM A 47/A 47M.

2.6 COATING MATERIALS

- A. Shop Primers for Steel: Provide primers that comply with Section 09 91 13 "Exterior Painting."
- B. Shop Primer for Steel: Manufacturer's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer for Uncoated Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.
- D. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.
- E. Epoxy Intermediate Coat for Uncoated Steel: Complying with MPI #77 and compatible with primer and topcoat.
- F. Intermediate Coat for Uncoated Steel: Epoxy or polyurethane intermediate recommended in writing by primer and topcoat manufacturer.
- G. Polyurethane Intermediate Coat and Topcoat: Complying with MPI #72 and compatible with undercoat.

2.7 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 03 30 00 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.

- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.8 METALLIC-COATED-STEEL FINISHES

- A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Surface Preparation: Clean surfaces with nonh petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.
- C. Powder Coating: Immediately after cleaning and pretreating, apply TGIC polyester powder-coat finish, with a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
- D. Powder Coating: Immediately after cleaning and pretreating, apply two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat, with a minimum dry film thickness of 2 mils for topcoat. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
 - 2. Comply with surface finish testing requirements in ASTM F 2408 except change corrosion-resistance requirement to 3000 hours without failure.
- E. High-Performance Coating: Apply epoxy primer, polyurethane intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
 - 1. Construction layout and field engineering are specified in Section 01 73 00 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Post Setting:
 - 1. Space posts uniformly at spacing indicated on Drawings.
 - 2. Posts Set in Concrete Footings: Set posts in concrete fill into firm, undisturbed soil.
 - a. Excavation: Drill or hand-excavate holes for posts. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
 - b. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete.
 - c. Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

- d. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - 1) Concealed Concrete: Top 2 inches below grade as indicated on Drawings to allow covering with surface material. Slope top surface of concrete to drain water away from post.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
- C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
- D. Vehicle Loop Detector System: Cut grooves in pavement and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
- E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: a qualified testing agency to perform tests and inspections.
 - 1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - 2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - 3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.7 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.
 - 1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lubricate hardware, gate operators, and other moving parts.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 32 31 19

SECTION 32 32 00

MODULAR RETAINING WALL

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Interlocking modular concrete retaining wall units and accessories.

1.2 REFERENCES

- A. ASTM C1372—Standard Specification for Dry-Cast Segmental Retaining Wall Units.
- B. ASTM D2339—Standard Test Method for Strength Properties of Adhesives in Two-Ply Wood Construction in Shear by Tension Loading.
- C. ASTM D4475—Standard Test Method for Apparent Horizontal Shear Strength of Pultruded Reinforced Plastic Rods By the Short-Beam Method.
- D. ASTM D4595—Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- E. ASTM D5262—Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics.
- F. GRI-GG1—Standard Test Method for Geogrid Rib Tensile Strength.
- G. GRI-GG2—Standard Test Method for Geogrid Junction Strength.
- H. GRI-GG4—Determination of Long Term Design Strength of Geogrids.
- I. GRI-GG5—Determination of Geogrid (Soil) Pullout.
- J. NCMA SRWU-1—Test Method for Determining Connection Strength of SRW.
- K. NCMA SRWU-2—Test Method for Determining Shear Strength of SRW.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Masonry units, when delivered to the site, shall be thoroughly cured and shall be dry. When stored on the site, they shall not be in contact with the ground and shall be kept clean.

1.4 SUBMITTALS

- A. CONTRACTOR shall submit construction drawings and design calculations for the retaining wall system prepared and stamped by a Professional Engineer registered in the State of Wisconsin. The engineering designs, techniques, and material evaluations shall be in accordance with the manufacturer's requirements. The geotechnical parameters used for wall design shall be as provided on the drawings or as required by the Project Soils Engineer. Construction drawings shall include all details necessary for construction of the retaining wall, including elevations and steps in top and bottom of wall, locations, sizes, types, and lengths of geogrid, and any other required information.
- B. Submit gradation of base leveling pad material and unit fill material.
- C. Submit color samples for OWNER's selection.

PART 2 - PRODUCTS

2.1 MODULAR CONCRETE MASONRY UNITS

- A. Masonry units shall be Keystone, Rockwood, Allan Block, Mesa Block, or equal. Specification is written based on the Keystone System.
- B. Masonry units shall conform to ASTM C1372 and have a minimum 28-day compressive strength of 3,000 psi. The concrete shall have a maximum moisture absorption of 8%.
- C. Units shall have angled sides capable of concave and convex alignment curves with a minimum radius of 3.5 feet. For straight walls, cap units shall have nonangled straight sides.
- D. Standard units shall be 8 inches high by 18 inches wide with sculptured rock face texture.

2.2 STRUCTURAL GEOGRID

- A. Geogrid shall be a product with a regular grid structure of a select high density polyethylene or polypropylene resin, UX 1500HP, as manufactured by Tensar Corporation, or equal.
- B. Minimum allowable junction strength of the geogrid, per G.R.I. GG2, shall be equal to or greater than 90% of the ultimate strength of the geogrid, as per G.R.I. GG1.

2.3 CONNECTING PINS

- A. Units shall be interlocked with noncorrosive fiberglass pins.
- B. Connecting pins shall be 1/2-inch diameter thermoset isophthalic polyester resin-pultruded fiberglass reinforcement rods.
- C. Pins shall have a minimum flexural strength of 128,000 psi and short beam shear of 6,400 pounds per ASTM D4475.
- D. Connecting pins are not required for masonry units with integral keys or lips that provide mechanical interlock between adjacent units.

2.4 ADHESIVE

- A. Construction adhesive shall be Keystone Kapseal, or equal, and shall meet requirements of ASTM D2339.

2.5 BASE LEVELING PAD

- A. Base leveling pad material shall be 6 inches of compacted crushed stone, 3/8 inch to 3/4 inch. Pea gravel shall not be allowed.

2.6 UNIT FILL

- A. Unit fill shall be free-draining, well-graded crushed stone, 3/8 inch to 3/4 inch, with no more than 5% passing the No. 200 sieve.

2.7 BACKFILL

- A. Backfill for use beyond drainage zone behind units shall be as specified in Section 31 23 00—Excavation, Fill, Backfill and Grading.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Foundation soil shall be excavated as required for leveling pad dimensions shown on the drawings.
- B. Subgrade shall be observed by the Project Soils Engineer to review that the actual foundation soil conditions meet or exceed assumed design strength. Soils not meeting required strength shall be removed and replaced with acceptable material.

3.2 BASE LEVELING PAD

- A. Leveling pad materials shall be placed as shown on the drawings to a minimum thickness of 6 inches.
- B. Materials shall be compacted so as to provide a level surface on which to place the first course of units. Compaction shall be to 95% of standard proctor for sand or gravel-type materials. For crushed rock, material shall be densely compacted.
- C. Leveling pad shall be prepared to provide complete contact of retaining wall unit with base.

3.3 INSTALLATION

- A. Units shall be installed to conform to elevations shown on the drawings.
- B. Place first course of concrete wall units on the base leveling pad. The units shall be checked for level and alignment. Units shall be in full contact with base. Bottom of wall shall be minimum 8 inches below finished grade and shall be lower if required by design.
- C. Units are placed side by side for full length of wall alignment. Alignment may be done by a string line or offset from base line.

- D. Units shall be interlocked with fiberglass pins or lips cast integrally with each masonry unit. Pins shall protrude into adjoining courses above a minimum of 1 inch. Two pins required per unit.
- E. Fill all voids inside and between units and drainage zone behind units with unit fill material. Tamp fill. Do not use automated compaction equipment directly over the units. Walk behind mechanical compaction equipment may be used to compact soils that are placed beyond the drainage zone behind the unit. Mobile mechanical compaction equipment shall not be used within 5 feet of the wall face.
- F. While placing material behind first course of units, replace the passive soil wedge at the front of these units.
- G. Sweep all excess material from top of units and install next course. Each course shall be completely unit filled, backfilled, and compacted prior to proceeding to next course.
- H. Geogrid reinforcement shall be placed at the elevation(s) and to the extent required by design. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignments.
- I. The geogrid soil reinforcement shall be laid horizontally on compacted backfill. Place the next course of modular concrete facing units over geogrid. The geogrid shall be pulled taut and anchored prior to backfill placement on the geogrid.
- J. Geogrid reinforcements shall be continuous throughout their embedment length(s). Spliced connections between shorter pieces of geogrid will not be allowed.
- K. Place next course, pull each unit forward away from the embankment against pins in the previous course, and backfill as the course is completed. Repeat procedure to the extent of wall height.
- L. Provide permanent mechanical connection of cap units to wall units with construction adhesive. Apply adhesive to top surface of unit below, and place cap unit into position. Place cap units over projecting pin from units below. Pull forward to setback position. Backfill and compact to finished grade.
- M. As appropriate where the wall changes elevation, units shall be stepped with grade or turned into the embankment with a convex return end. Minimum of three units shall be installed into the grade on compacted leveling pad in area of convex return end. Units shall be laid to create the minimum radius possible.

END OF SECTION 32 32 00

SECTION 32 92 00

SEEDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Preparation of subsoil.
 - 2. Placing topsoil.
 - 3. Seeding, fertilizing, and erosion control revegetative mat (ECRM).
 - 4. Maintenance.
- B. Except for paved, riprapped, or built-up areas, all areas of the site which are disturbed and areas noted on the drawings shall be seeded.

1.2 REFERENCES

- A. FS O-F-241--Fertilizers, Mixed, Commercial.
- B. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.3 SUBMITTALS

- A. Submit the following shop drawing information:
 - 1. Provide native seed samples and data showing native seed mix composition and a guarantee of germination.
 - 2. Provide native seed mixture.
 - 3. Provide anticipated planting dates.
 - 4. Provide information on method of sowing see.

1.4 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years of experience. Plant materials shall be free of disease and hazardous insects.
- C. Installer Qualifications: A landscape or restoration company specializing in installing and planting with five years experience.
- D. Restoration Qualifications: Company specializing in native restoration. Staff with proof of arborist certification, erosion control certification, or ecological expertise.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.6 EQUIPMENT

- A. All equipment brought into project site shall be clean and free of weed seed or seed from previous applications.

1.7 GUARANTEE

- A. CONTRACTOR shall guarantee the germination of all seed installed.

PART 2 - PRODUCTS

2.1 SEED MIXTURE-LOW-MAINTENANCE NATIVE MEADOW GARDEN SEED MIX

- A. CONTRACTOR shall provide the Low-Maintenance Native Meadow Garden Seed Mix at the locations shown on the drawings. The Low-Maintenance Native Meadow Garden Seed Mix consists of a low maintenance grass seeds and native meadow perennial seeds. The seed mix shall be the Color Explosion Meadow seed mix available at Taylor Creek Restoration Nurseries in Brodhead, WI, or equal.
- B. Provide the following seed mix in accordance with Section 207 of the City of Madison Standard Specifications for Public Works Construction.

Botanical Name	Common Name	% (by weight)
Low Maintenance Lawn Blend	35% Chewings Fescue 30% Creeping Red Fescue 25% Hard Fescue 10% Blue Fescue	98.92%
Monarda punctata	Horse mint	0.22%
Oligoneuron album	Stiff aster (goldenrod)	0.15%
Coreopsis lanceolate	Sand coreopsis	0.17%
Dalea purpurea	Purple prairie clover	0.19%
Allium cernuum	Nodding wild onion	0.08%
Lupinus perennis	Wild lupine	0.01%
Asclepias verticellata	Whorled milkweed	0.04%
Symphotrichum sericeum	Silky aster	0.15%
Liatris cylindracea	Cylindrical blazing star	0.07%

- C. The Low-Maintenance Native Meadow Garden Seed Mix shall be installed as required in Section 207.3 of the City of Madison Standard Specifications for Public Works Construction. The Seed Mix shall be seeded at a rate of 300 pounds per acre. The area to receive the Low-Maintenance Native Meadow Garden Seed Mix shall be herbicided with nonselected herbicide (glyphosate or Round-up) twice prior to seeding to eliminate weeds and existing grasses. For areas receiving salvaged or hauled-in topsoil, herbicide 2 weeks after placement of topsoil and again 2 weeks after the first herbiciding. For previously undisturbed areas, herbicide 1 month prior to seeding and again 2 weeks prior to seeding. Preparation of seed bed shall occur after the second herbicide application.

2.2 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds, roots and rocks; pH value of minimum 5.4 and maximum 7.0.
- B. Topsoil from the site may be used if it meets the above requirements. Additional topsoil shall be provided as required by drawings and specifications.

2.3 ACCESSORIES

- A. Fertilizer shall be FS O-F-241, Type I, Grade A; recommended for grass, with 50% of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions: Nitrogen 10%, phosphoric acid 10%, soluble potash 10%. Submit composition deviations to suit site conditions for ENGINEER’S review.
- B. Water shall be clean, fresh, and free of substances or matter which could inhibit vigorous growth of grass.

2.4 EROSION MATS

- A. Erosion mat products shall be selected from the PAL in conformance with criteria specified in Conservation Practice Standard 1052 (Nonchannel Erosion Mat) and 1053 (Channel Erosion Mat).
- B. Provide erosion mat urban Class I, Type B for all areas of disturbance that require seeding. All channel areas on site shall be provided with erosion mat Class II, Type B.

- C. A 300 mm by 300 mm sample of a product proposed for erosion mat may be required to verify that it is prequalified. When a sample is required, it shall be accompanied by the manufacturer's literature for the proposed product.
- D. All erosion mat staples shall be of biodegradable materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil in accordance with local, state, and federal regulations.
- C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat deep (> 12 inches) subsoiling or cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL

- A. Spread topsoil to a minimum depth of 6 inches over area to be seeded. Rake until smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign nonorganic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to provide positive drainage.
- E. Manually spread topsoil around trees, plants, and buildings to prevent damage.
- F. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.4 FERTILIZING

- A. Apply fertilizer at a rate of 17 pounds per 1,000 square feet.
- B. Apply after smooth raking of topsoil and prior to installation of seed, no more than 18 hours before seeding.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.5 SEEDING

- A. Do not seed areas in excess of that which can have erosion mat placed on same day.
- B. Planting season shall be between April 15 and June 15, or between August 15 and September 15, unless otherwise agreed upon with OWNER.
- C. Do not sow immediately following rain, when ground is too dry or during windy periods.
- D. Immediately following seeding, apply erosion mat.
- E. Apply water with a fine spray immediately after each area has been mulched and on a daily basis to keep straw in place.
- F. Seeding shall be maintained by CONTRACTOR until seeded areas are well established.
- G. Apply soil stabilizer per Section 31 25 00-Slope Protection and Erosion Control after seeding and prior to placement of erosion control mat.
- H. Place erosion control mats per Section 31 25 00-Slope Protection and Erosion Control.

3.6 INITIAL ACCEPTANCE

- A. Upon providing the specified native seed mix and erosion control mat(s) over native seed restoration areas, the seeded areas shall be evaluated for Initial Acceptance. Initial Acceptance shall be based on receipt and approval of submittals and visual observation by OWNER that the specified native seed mix has been applied at the specified seeding rate.

3.7 GENERAL MAINTENANCE

- A. Immediately reseed areas which do not show a developing stand of cover. Reseeding shall be the same as that originally specified for that particular area.
- B. Correct damage resulting from erosion, gullies, rills, or other causes by filling with topsoil, tamping, and reseeding if damage occurs prior to end of warranty period.
- C. Do not seed areas in excess of that which can be provided with erosion mat on same day.
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. Apply water with a fine spray immediately after each area has been seeded and erosion matted.

3.8 MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable Native Seeding is established.
- B. Maintain by mowing the planting when the weed vegetation reaches a height of 10 to 12 inches. Mow to a height of 6 inches except for first mowing which shall be to a 4-inch height. Mowing can be expected approximately every 3 to 4 weeks the first season depending on the weed species present. Raking and removal of clippings shall occur when greater than 50% of the plant height is removed.
- C. Water just enough to keep the soil moist, every other day for 15 minutes to half an hour to maintain adequate surface soil moisture for proper seed germination. Watering shall continue for not less than 60 days following seeding. After the first 60 days, water as needed to meet warranty provisions.
- D. Selectively treat with a broad spectrum, non-persistent glyphosate-based herbicide aggressive weeds such as Canada Thistle, Horse Nettle, Crown Vetch, Wild Parsnip, and Reed Canary Grass. Treat only on cool windless days preferably by gloved hand wiping method.
- E. Prior to Initial Acceptance and during the Warranty period beginning with the Initial Acceptance:
 - 1. Weeding Field Review: Review the seeded areas at a sufficient frequency so that weeds do not re-seed themselves. Minimum inspection frequency shall include a spring, summer, and fall review.
 - 2. Notify OWNER of the review no less than 48 hours prior to a review. The review shall be performed with OWNER in attendance. A report of the findings will be sent to CONTRACTOR from OWNER including agreed upon maintenance required.
 - 3. CONTRACTOR shall implement the appropriate weed control approach(es) within 7 calendar days of the review, as conditions allow. If weather and/or site conditions would cause unnecessary damage to the site, notify OWNER.
 - 4. Maintain the weed coverage as defined in 3.09 Warranty below. Weed control methods shall be approved by OWNER.
 - 5. Track maintenance activities performed (including herbiciding, weeding, seeding, and watering) and provide a written report to OWNER at the end of the first full growing season documenting the completed activities.
 - 6. Other maintenance activities may be completed at CONTRACTOR's discretion to meet the Warranty performance criteria. Notify OWNER of planned additional maintenance activities prior to implementation.

3.9 WARRANTY

- A. CONTRACTOR shall warranty all seeding for a period of one year from the date of Substantial Completion.
- B. After one full growing season, all areas receiving native seed shall meet the following:
 - 1. The seeded species shall provide at least 85% coverage with no area devoid of the seeded species greater than 9 square feet.
 - 2. The weed coverage shall be less than 15% of this coverage, of which less than 10% shall be invasive species.
 - 3. CONTRACTOR shall set up with OWNER an end of first full growing season warranty review.

- C. If CONTRACTOR fails to meet the Warranty performance criteria at the end of the first full growing season, OWNER and CONTRACTOR shall agree to an approach for increasing the density of the seeded species and/or decreasing the density of weeds, which may include but not be limited to:
 - 1. Herbiciding portions of or the entire seeded area.
 - 2. Re-seeding portions of or the entire seeded area.
 - 3. Selective use of live plants.
- D. If over 25 percent of the seeded area requires non-selective herbiciding and re-seeding at the end of each of the one full growing season, CONTRACTOR shall provide additional maintenance for one full growing season following the Warranty period for the re-seeded areas.

3.10 WARRANTY REVIEW

- A. OWNER will perform a warranty review at the end of the first full growing season.
- B. The review will consist of visual review of the native seeded areas.
- C. The visual review will be used to determine conformance with warranty provisions.
- D. After the warranty review, a written report will be provided to CONTRACTOR from OWNER documenting the findings and listing the suggested maintenance for meeting warranty provisions.
- E. CONTRACTOR shall provide to OWNER a schedule for implementing maintenance activities within 2 weeks of receipt of the written report.
- F. Protect seeded areas with warning signs during warranty period.

END OF SECTION 32 92 00

SECTION 32 93 00

NATIVE PLUGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Perennial plants of type specified.
 - 2. Plant preparation and mulching.
 - 3. Maintenance.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.2 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years experience. Plant materials shall be free of disease and hazardous insects.
- B. Installer Qualifications: A landscape or restoration company specializing in installing and planting the plants with five years experience.
- C. Restoration Qualifications: Company specializing in restoration with on-site staff with proof of Arborist Certification, Erosion Control Certification, or Ecological Expertise.

1.3 REFERENCES

- A. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.4 WARRANTY

- A. All plant material is to be fully guaranteed for a period of one year from the date of substantial completion. Only those plants that are alive and normally healthy within this time frame will be accepted. Unaccepted material shall be removed and replaced by CONTRACTOR at no cost to OWNER during the next suitable growing season.
- B. Replacement plants shall be the same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.5 PERFORMANCE STANDARD

- A. At the end of the first full growing season and one full year after planting, at least 100% of the native plugs will be present and thriving.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS-RHIZOMES, PLUGS, PLANTS

- A. All plant materials shall conform to American Standard for Nursery Stock (current edition), and be delivered standard to the restoration industry. Plants shall be true to species and variety specified and nursery grown in accordance with good horticultural practices.
- B. Plant Materials: Species and size identifiable in this specification, referenced specification, or plant schedule, grown in climatic conditions similar to those in locality of the project.
- C. Native plugs shall be potted plants and shall be labeled according to species and type, source, date of collection, and/or growth history and nursery grown status. Planting stock shall have a minimum of 3 inches of regenerative mass. Native plugs shall be 3-inch by 3-inch potted plant specimens (equivalent to a #SP3 Container Class Specification). They shall be in active growth, healthy, well-watered, with no signs of decay, mold, or other disease. Visible roots shall be pliable and in good condition.

- D. Native Plugs: Install two rows of the following species of plugs around each wet pond. One row shall be installed at the normal water surface and one row shall be installed 0.5 feet vertically above the normal water surface. Provide an equivalent amount of each species. Plant species randomly around the pond edges.

Scientific Name	Common Name
Carex stricta	Tussock Sedge
Acorus calamus	Sweet Flag
Carex stipata	Common Fox Sedge
Scirpus validus	Soft Stem Bulrush
Scirpus acutus	Hard Stem Bulrush
Iris virginica shrevei	Blue Flag Iris

- E. The substitution of plant materials is not permitted unless authorized in writing by OWNER. If written proof is submitted by CONTRACTOR that a plant of specified species, variety, or size is unavailable, consideration will be given towards the nearest available size or variety, or towards an alternate species selection, with a corresponding adjustment of the contract price.
- F. Larger plants than those specified can be used upon approval of OWNER. The use of larger plants shall not increase the contract price. The root ball, root spread, and container size of the larger specimen shall be proportionally increased, relative to the specified size.
- G. Rootstock Source: Plant material shall be from Illinois, Iowa, or Wisconsin nurseries specializing in growing native species from Wisconsin genotypes within Zones 4b or 5a of the 2012 USDA Plant Hardiness Zone Map. Provide documentation of plant material source.

PART 3 - EXECUTION

3.1 TRANSPORTING AND STORING PLANTS

- A. After one-week notice of delivery, OWNER or designee will observe the plants and bulbs at the work site at the beginning of each planting day and reject any material that is not properly packaged (including clear labeling by species) or that is not in a firm, moist, or viable condition. Any plants remaining at the end of the day shall be removed from the work site and properly stored by CONTRACTOR.
- B. Before planting, sufficient water shall be added to stock and potted plants so that the soil around the roots is not dry and crumbly when the plants are removed from the pots.

3.2 LAYOUT OF PLANTING

- A. The planting bed shall be approved by OWNER or designee prior to planting.
- B. Prepare the planting areas by saturating planting soil with water prior to planting.
- C. Space plants on 12-inch centers.

3.3 PLANTING TIME

- A. Planting times for the various types of perennial plants shall be as follows: Native plugs shall be planted between April 1 and June 1. If approved by OWNER, native plugs may be planted between August 15 and September 15.

3.4 PLANTING

- A. Place plant plugs in prepared holes that are no deeper than the depth of the plant, container, or root system when the plant is at its proper grade. Set plants vertical, firmly pressing surrounding soils with hand or foot to provide full soil-to-root contact.

B. Planting Procedures:

1. The spacing of the plants shall be 12 inches on center. Plants shall be planted by a hand method standard of the restoration industry and approved by OWNER.
2. Install plant plugs in accordance with the supplier's instructions, planting details, and Standard Specifications.

3.5 PLANT PRUNING

- A. Each plant, rhizome, tuber, or plug shall be root on top-pruned in accordance with good horticulture practice to enhance establishment to facilitate growth, and provide plant with best chance for survival and appearance.

3.6 MAINTENANCE

- A. Neatly trim plants where necessary. Mow or string trim plants once per year to a height of 6 inches.
- B. Immediately remove clippings after trimming.
- C. Watering: All native plugs shall be watered within the first 24 hours of initial planting and not less than twice weekly (weekly or one time rainfall amount exceeding 1-inch shall fulfill such weekly requirements) for 60 days after initial planting. Water used shall be of sufficient quality for irrigation and free of materials harmful to plant growth.
- D. Control growth of weeds by hand or application of herbicides in accordance with manufacturer's instructions.
- E. Apply pesticides in accordance with manufacturer's instructions.
- F. CONTRACTOR shall be responsible for, and shall repair damage resulting from, erosion until final completion, unless agreed upon otherwise in writing.

3.7 LAYOUT

- A. See project drawings for additional information.

END OF SECTION 32 93 00

SECTION 32 94 00

TREES, PLANTS, STONE MULCH, AND EDGING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Trees and plants.
 - 2. Hardwood mulch.
 - 3. Plastic and aluminum edging.
 - 4. Maintenance.
 - 5. Tree pruning.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.2 REFERENCES

- A. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

1.3 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with 3 years' experience. Plant materials shall be free of disease and hazardous insects.
- B. Installer Qualifications: Company specializing in installing and planting the plants with 3 years' experience.
- C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.

1.4 WARRANTY

- A. All plant material is to be fully guaranteed for a period of one year from the date of substantial completion. Only those plants that are alive and normally healthy within this time frame will be accepted. Unaccepted material shall be removed and replaced by CONTRACTOR at no cost to OWNER during the next suitable growing season.
- B. Replacement plants shall be the same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

- A. All plant materials shall conform to American Standard for Nursery Stock (current edition). Plants shall be true to species and variety specified and nursery grown in accordance with good horticultural practices.
- B. Plant Materials: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the project for at least 2 years.
- C. Trees with multiple leaders, unless specified, will be rejected. Trees with a damaged, cut, or crooked leader, included bark, abrasion of bark, sunscald, disfiguring knots, insect damage, mold, or prematurely opened buds are cause for rejection.

2.2 MULCH MATERIALS

- A. Hardwood Mulch: Organic hardwood mulch, free from deleterious materials, weeds, stones, sticks and growth or germination-inhibiting ingredients.

2.3 ACCESSORIES

- A. Edging: Black Diamond by Valley View Industries; commercial edging by COL-MET, or equal. Metal edging shall be commercial grade 1/8 inch by 4 inches. Plastic edging shall have a minimum 4-inch side wall and 1-inch-diameter head and shall have a V-lip configuration for added stiffness and anchor-holding power.
- B. Membrane: Weed barrier 3.4oz/yd², water-permeable polyolefin fabric.

PART 3 - EXECUTION

3.1 PLANTING

- A. Plant pits shall be excavated with vertical sides. These holes shall be no deeper than the depth of the ball, container, or root system when the plant is at its proper grade. Set plants vertical.
- B. Place topsoil in holes around roots or balls, mixed with fertilizer and peat moss or compost. Topsoil around roots shall be compacted and watered. After plant pit is backfilled, shallow basin shall be formed with ridge of soil to facilitate watering.
- C. Place plants where indicated on the drawings. Position plants for best appearance.
- D. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.
- E. Remove nonbiodegradable root containers and twine.

3.2 TREE REMOVAL AND REPLACEMENT

- A. It is intended that as many trees as possible be saved during construction. No trees, except those so designated, shall be removed without prior approval of OWNER. CONTRACTOR shall conduct the work to protect all trees to remain. CONTRACTOR shall provide suitable fencing installed at the tree drip line for all trees within the construction area to protect trees from damage and soil compaction by its equipment.
- B. Trees that are damaged during construction shall be repaired. CONTRACTOR shall retain the services of a professional nurseryman who is a member of the National Arborist Association to direct CONTRACTOR on the proper repair of damaged trees. Damaged limbs and roots shall be pruned or dressed according to recommendations of the nurseryman. Backfill shall be replaced as soon as possible to reduce exposure of roots to air. Scarfed areas on trees shall be suitably dressed. Compaction of root areas under the drip line of the tree is to be avoided whenever possible.
- C. When removing trees, special care shall be taken to not damage surrounding private property. Costs for tree removal or replacement and construction around trees shall be included in the price bid for the work.

3.3 INSTALLATION OF ACCESSORIES

- A. Place membrane (weed barrier) in all areas to receive hardwood mulch.

3.4 TREE PRUNING

- A. Each tree and shrub shall be pruned in accordance with good horticulture practice to preserve natural character of plant and to facilitate growth.

3.5 MULCH

- A. Place organic hardwood mulch to a depth of 3 inches over membrane for all trees and plants unless mulched with other materials as indicated on the drawings.

3.6 MAINTENANCE

- A. Maintain plant life for one year after date of substantial completion.
- B. Neatly trim plants where necessary.
- C. Immediately remove clippings after trimming.
- D. Water to prevent soil from drying out.
- E. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
- F. Apply pesticides in accordance with manufacturer's instructions.

3.7 SCHEDULE-PLANT LIST

- A. See drawings for schedule.

END OF SECTION 32 94 00

SECTION 33 00 00

BURIED PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. All underground piping and valves of every description.
 - 2. Excavation, dewatering, and backfilling for all work under this section unless otherwise noted.

1.2 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications within this section shall refer to the *Standard Specifications for Sewer and Water Construction in Wisconsin*.
- B. Plumbing Code: Unless otherwise indicated, plumbing code within this section shall refer to the Wisconsin Plumbing Code.
- C. Ten State Standards.
- D. Reference the City of Madison Standard Specifications for Public Works Construction, latest edition. The City of Madison Standard Specifications for Public Works Construction, latest edition, takes precedence over this specification section.

PART 2 - PRODUCTS

2.1 MATERIALS OF CONSTRUCTION

- A. All materials used in the manufacture, assembly, and painting of piping and valves in contact with water shall be compatible with potable water supplies and in contact with chemical feed systems shall be compatible with the chemicals being used. All glues, solvents, solders, etc., shall likewise be compatible. For instance, no lead-base solders shall be used. All materials in contact with water to be used for potable water supplies shall be National Sanitation Foundation (NSF)-approved.
- B. Size and Type:
 - 1. All materials shall conform to the size and type shown on the drawings or called for in the specifications.
 - 2. In joining two dissimilar types of pipe, standard fittings shall be used when available. In the event standard fittings are not available, the method of joining shall be standard selected by CONTRACTOR and submitted for review by ENGINEER.
- C. Piping appurtenances shall be made of the materials specified. All appurtenances not designated as to type shall be selected by CONTRACTOR and submitted for review by ENGINEER.

2.2 MANHOLES

- A. All manholes and accessories shall be as specified in the City of Madison Standard Specifications for Public Works Construction, Latest Edition.
- B. Frames and Covers:
 - 1. Frames and covers shall be provided for the openings indicated on the drawings.
 - 2. For standard manholes, frames shall be Neenah R-1550, heavy-duty R-1050 frame, with logo lid 1550-0054, (see S.D.D. 5.7.16 of the City of Madison Standard Specifications for Public Works Construction, latest edition) non-rocking, with Type B lid, with two concealed pickholes equipped with self-sealing gaskets. Storm manhole frames shall be Neenah R-1550, heavy-duty R-1050 frame with machined frame, self-sealing gaskets, and Type D open grate.
- C. Manhole Chimney Seals:
 - 1. External manhole chimney seals shall be provided for all new manholes. Chimney seal shall be Cretex, or equal.

2. Existing manholes exposed during the construction period shall have the adjustment rings replaced and a new external manhole chimney seal installed. Existing castings shall be reused.
- D. External Manhole Joint Seal:
1. Sanitary sewer manhole barrel joints shall be sealed on sanitary sewer structures around the outside circumference of the structure. Manhole joint seal shall be minimum of 9 inches wide. The seal shall consist of flexible rubberized seal conforming to ASTM C923 held in place with stainless steel compression bands or butyl adhesive tape conforming to ASTM C877 or heat shrink sleeve over visco-elastic adhesive sealant.
 2. Acceptable products and manufacturers are the following:
 - a. Mac Wrap, Mar Mac Manufacturing Company.
 - b. NPC External Joint Seal, NPC, Inc.
 - c. EZ-Wrap, Press-Seal Gasket Corporation.
 - d. Rizer-Wrap, Pipeline Seal and Insulator.
 3. Alternate manufacturers and products not listed above are subject to preapproval by OWNER.
- E. Valve boxes shall be provided for all buried valves.
- F. Curb inlets in standard curb and gutter sections shall be Neenah R-3067, or equal, with Type R reversible grate at low points and Type L grate on slope. Manhole connections for storm sewer mains shall be made with poured-in-place concrete during completion of the manhole.

2.3 BURIED PIPING

- A. Ductile Iron Piping and Ductile Iron Fittings:
1. Unless otherwise shown or specified, all underground piping 3 inches in diameter or larger shall be ductile iron conforming to AWWA C151/A21.51 with mechanical joints or push-on joints. Unless otherwise shown or specified, all piping shall be minimum Special Thickness Class 53 with a minimum rated working pressure of 250 psi. Pipe wall thickness shall be furnished as required by AWWA C150 for buried piping with the depth of cover of 7 feet for laying condition 4 Special Thickness Class 53 minimum.
 2. The words "Ductile Iron" and the weight and class of pipe shall be plainly marked on each piece of pipe.
 3. Except as otherwise specified, underground pipe shall have mechanical joints or push-on joints conforming to AWWA C110 and C111 with vulcanized styrene butadiene rubber gaskets conforming to AWWA C111. Gaskets that include metal locking segments vulcanized into the gasket to grip the pipe and provide joint restraint are not acceptable. Bolts on exterior joints shall be high-strength low-alloy steel (Corten, or equal), conforming to AWWA C111. Certificate to that effect shall be provided.
 4. All mechanical and push-on joints on water main and force main shall be bonded with cable bond conductors or electrobond conductivity strips.
 5. Restrained joints shall be provided in accordance with Part 3-Execution. Mechanical joints shall be restrained with MEGALUG® Series 1100, by EBAA Iron Sales, Inc., UNIFLANGE Series 1400 by Ford Meter Box Co., Inc., or equal, restraint. Push-on joints for ductile iron piping shall be restrained with MEGALUG® Series 1700, by EBAA Iron Sales, Inc., UNIFLANGE Series 1450 by Ford Meter Box Co., Inc., Flex-Ring or Lok-Ring by American Cast Iron Pipe Company, TR Flex by U.S. Pipe Company, or equal.
 6. Joint restraint is not required for gravity sewers, drains, and those pipes designated in Paragraph 1. of 3.02.G. Infiltration/Exfiltration Tests.
 7. Underground pipe shall have mechanical joint or push-on joint ductile iron fittings conforming to AWWA C110 and C111 or AWWA C153 compact fittings with a minimum rated working pressure of 150 psi. Gaskets for fittings shall be as specified for underground piping.
 8. All ductile iron fittings shall be American, Clow, Griffin, Tyler, U.S. Pipe, or equal.
 9. Unless otherwise specified, all ductile iron piping and fittings shall be cement-mortar lined and asphaltic-coated inside. Unless otherwise specified, underground piping and fittings shall be asphaltic-coated outside. Cement-mortar lining shall be in accordance with AWWA C104. Asphaltic coating shall conform to applicable standards herein for the pipe and fittings.
 10. All buried ductile iron piping and appurtenances shall be polyethylene encased in accordance with AWWA C105. Polyethylene encasement shall be Class C (black) and shall be minimum 8 mil thickness.

- B. Reinforced Concrete Sewer Pipe:
1. Reinforced concrete pipe for storm sewer shall meet the requirements of ASTM C76, for circular pipe and ASTM C507 for elliptical pipe. Strength and class of the pipe shall conform to the drawings and as specified herein. All reinforced concrete pipe used in the work shall be of adequate strength to support the trench loads applied. Unless otherwise shown or specified, all reinforced concrete pipe shall be Class IV minimum.
 2. Standard and special fittings shall be of approved manufacturer and shall conform to requirements of the trade and these specifications. All fittings shall be of a strength at least equal to that of the sewer main and shall be jointed with the same type of joint as used in the sewer main.
 3. Not more than one lift hole per length of pipe shall be used in storm sewer.
 4. Reinforced concrete pipe and fittings shall be joined with joints and gaskets that meet the requirements of ASTM C443. Gaskets for storm sewer shall be Tylox, or equal. All pipe shall be specifically built to fit the gasket used. Provide precast concrete endwalls on all storm sewers.
 5. Provide storm sewer joint ties at the new apron endwalls and the next joint, conforming to Section 504.2 of the City of Madison Standard Specifications for Public Works Construction.
- C. Perforated Pipe: Modular block retaining wall drain piping shall be perforated corrugated polyethylene tubing with integral filter fabric. Size shall be minimum 6-inch diameter. Piping shall meet requirements of ASTM F405. Provide all required bends, adapters, couplings, risers, cleanout covers, etc. Piping shall be as furnished by Wisconsin Tubing, Inc. of Omro, Wisconsin, or equal.
- D. Sanitary Sewer Piping:
1. Polyvinyl chloride (PVC) pipe shall meet the requirements of ASTM D3034 for pipe sizes 4 inches through 15 inches.
 2. PVC material for ASTM D3034 pipe shall have cell classification 12454-B or 12454-C as defined in ASTM D1784 with minimum modulus of elasticity of 400,000 psi. Pipe stiffness shall be minimum 46 psi when tested in accordance with ASTM D2412. Pipe shall have a maximum standard dimension ratio (SDR) of 35.
 3. Pipe and fittings shall be the product of one manufacturer, and the manufacturer shall have experience records substantiating acceptable performance of the pipe and fittings to be furnished. The minimum wall thickness of fittings shall be the same as the pipe to which it connects.
 4. Acceptance of piping and fittings shall be subject to tests conducted by an approved testing agency in accordance with ASTM D3034.
 5. Fittings such as saddles, elbows, tees, wyes, and others shall be of material and construction corresponding to and have a joint design compatible with the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe.
 6. Joints shall be of the elastomeric type for pipes 4 inches or larger and elastomeric or solvent cement for pipes less than 4 inches.
 7. Elastomeric joints shall be a bell and spigot joint conforming to ASTM D3212 sealed by a rubber gasket conforming to ASTM F477 so that the assembly will remain watertight under all conditions of service, including the movements resulting from the expansion, contraction, settlement, and deformation of the pipe. Bells shall be formed integrally with the pipe and shall contain a factory-installed positively restrained gasket.
 8. Solvent cement joints shall be assembled using solvent cement obtained from the pipe manufacturer, which conforms to the requirements of ASTM D2564.
 9. The assembled joint shall pass the performance tests as required in ASTM D3212.
- E. Sewer Lateral and Water Main Electronic Markers:
1. All non-metallic sanitary laterals, storm sewer laterals, and all water main installed shall be accompanied by a means of locating the newly installed underground pipe. Sewer mains that have manhole or inlet structures on both ends with the City right-of-way are considered exempt.
 2. CONTRACTOR shall provide a marker system that includes the installation of extended range ball markers over the sanitary sewer laterals and storm sewer laterals, which after construction provide a signal that can be located by OWNER's utility locator after construction is complete.

3. The 3M ScotchMark Electric Ball Marker System Extended Range Marker (Model No. 1404-XR) shall be considered an acceptable marker device for this specification. If an alternate equivalent marker is selected, CONTRACTOR shall provide specifications and data sheets of the selected device to OWNER prior to construction in order for OWNER to confirm that the proposed marker device is compatible with OWNER's marking equipment.
4. Markers shall be installed in accordance with manufacturer's written instruction. Electronic marker balls shall be installed in the trench directly above the sewer pipe. The key constraint is the maximum depth of the marker. The signal range of the 3M Electronic Marker System (EMS) 4-Inch Extended Range 5-Foot Ball Marker-Wastewater (Model No. 1404-XR) is 5 feet. However, electronic marker balls shall be installed at 4 feet from finished grade.
5. Each lateral or main shall have a minimum of 2 electronic markers: one shall be located above the wye on the sewer main (or at the beginning of the main line in the case of storm sewer) and one shall be located above the lateral at the building. Additional markers shall be placed at each change in horizon direction.
6. Upon completion, CONTRACTOR shall test each electronic marker to confirm it is installed and functioning properly. If it is determined that the marker has not been installed correctly and/or is not functioning properly, CONTRACTOR shall be responsible for all work associated with the installation of a properly functioning marker. This work shall be completed with no additional reimbursement to CONTRACTOR.

2.4 HYDRANTS AND VALVES

- A. All fire hydrants, valves, and accessories shall be as specified in the City of Madison Specifications for Public Works Construction, Latest Edition.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Underground Piping:
 1. Except where noted or specified, all ductile iron underground piping shall be laid in accordance with AWWA C600 with the conditions that (a) blocking shall not be used to support pipe and (b) all bends and fittings shall be restrained as specified below, and pipe joints shall be restrained in all directions from all bends and fittings to the length as specified in the following table.
 2. For restrained pipe joints, all underground ductile iron pipe joints (except for the branch of tees and dead ends) shall be restrained to the length listed below in all directions from all bends and fittings. The branch of tees and all dead ends shall be restrained to two times the length listed below. All joints on fire hydrant leads shall be restrained.

MINIMUM LENGTH (IN FEET) RESTRAINED PIPE
 FROM BENDS OR FROM BENDS OR FITTINGS
 (POLYWRAPPED AND MINIMUM 6 FEET BURY DEPTH)

	Test Pressure, psi				
	10	25	50	100	150
Pipe Size, Inches					
3 to 12	5	18	18	36	36
14 to 18	5	18	18	36	54

3. PVC sewer piping shall be installed in accordance with ASTM D2321. Except where noted or specified, PVC or other thermoplastic pressure piping shall be installed in accordance with ASTM D2774.
4. Except where noted or specified, reinforced concrete pipe shall be installed in accordance with ASTM C12.
5. Plumbing system shall be installed and tested in accordance with local and state plumbing code requirements and applicable portions of Wisconsin Plumbing Code. Where requirements conflict, the stricter standard shall apply.

6. CONTRACTOR shall excavate and lay all pipe to the line and grade with bell ends uphill wherever possible. If not possible, CONTRACTOR shall excavate and lay pipe to the line and grade with bell ends in the direction of laying. Grade stakes will be required for all lines. Water piping shall have a minimum 7 feet of cover.
7. Except as otherwise specified, all underground pipe shall be bedded in crushed stone or crushed gravel aggregate. Ductile iron piping, except as otherwise specified, shall be placed using Class "C" Bedding Details as shown on Drawing 01-975-43A. All other piping shall be placed using Class "B" Bedding Details as shown on Drawing 01-975-43A. CONTRACTOR shall perform all necessary excavation and shall provide all required materials to provide this bedding. Bedding material shall conform to the requirements of ASTM C33. The material shall be hard, tough, and durable and shall meet the following gradation requirements:

PERCENTAGE BY WEIGHT PASSING

	Crushed Stone Aggregate	Crushed Stone Chips	Crushed Gravel Aggregate
1 inch	100	---	100
3/4 inch	90 to 100	---	90 to 100
1/2 inch	---	100	---
3/8 inch	20 to 55	90 to 100	20 to 55
No. 4	0 to 10	---	0 to 10
No. 8	0 to 5	0 to 15	0 to 5
No. 30	---	0 to 5	---
No. 100	---	---	---
Passing No. 200	---	---	---

8. No materials native to the trench shall be used as bedding material unless they meet the above specifications.
9. Immediately before placing the pipe, bedding shall be shaped by hand to fit the entire bottom quadrant of the pipe between bell holes. Bell holes shall be large enough to permit proper making of the joint but not larger than necessary to make the joint. All adjustments to line and grade must be done by scraping away or filling in bedding under the body of the pipe. Bedding must be tamped into place. If necessary to obtain uniform contact of the pipe with the bedding, a template shall be used.
10. Trenches shall be kept water-free and dry during bedding, laying, and jointing. CONTRACTOR shall provide, operate, and maintain all pumps or other equipment necessary to drain and keep all excavation pits and trenches and the entire subgrade area free from water under any and all circumstances that may arise.
11. Material that is to be placed from the bedding material around and to 1 foot above the top of all pipes shall be termed cover material. Except as otherwise specified, (a) cover material shall consist of durable granular particles ranging in size from fine to coarse in a substantially uniform combination, (b) crushed bank-run gravel will be considered generally acceptable for cover material, (c) no stones larger than 3/4 inch in their greatest dimension shall be allowed in the cover material, and (d) native materials may be used if they conform to the above specifications. Cover material for copper piping shall be sand.
12. Cover material for polyethylene-encased piping shall be sand, unwashed bank-run sand, or river gravel. Crushed stone or crushed gravel or other bedding or cover material that will damage polyethylene encasement will not be acceptable and shall not be used unless polyethylene-encased pipe and fittings are wrapped with a nonwoven geotextile fabric. Geotextile fabric shall be minimum of 4.0 ounce/square yards.
13. Cover material shall be deposited in the trench for its full width on each side of the pipe, fittings, and appurtenances simultaneously. Cover material shall be placed over the top of the pipe to the height as shown on Drawing 01-975-43A for Class "B" (minimum 12 inches) or Class "C" (minimum 6 inches) Bedding. This backfill shall be placed by hand in 6-inch layers and shall be compacted using hand tamping bars and/or mechanical tampers. If bedding material conforming to any of the above three crushed stone or crushed gravel gradations is used as cover material, it need not be tamped. The remaining 6 inches to make up the required 1 foot of select cover material for Class "C" Bedding shall be granular material specified previously with no stones larger than 3/4 inch.

14. All cover material shall be placed in maximum 6-inch layers and compacted by hand tamping. Compaction shall be equivalent to that described under "Compacted Fill and Backfill" as specified in Section 31 23 00–Excavation, Fill, Backfill and Grading.
15. Except as otherwise specified, all backfill above 1 foot above the pipe shall be "Compacted Fill and Backfill" as specified in Section 31 23 00–Excavation, Fill, Backfill and Grading.
16. The locations and elevations of existing piping and manholes are approximate. Where necessary, existing piping shall be exposed by CONTRACTOR to confirm location and elevation before installing new piping. Any changes in pipe location or elevation shall be approved by OWNER.
17. Polyethylene encasement of ductile iron pipe and appurtenances shall be in accordance with AWWA C105. Use Method A for pipe and Method C for valves.
18. Valve Boxes: The valve box shall be centered and plumb over the wrench nut of the valve with the box cover flush with the finished ground elevation. Solid 4-inch concrete blocks shall be placed under the base of valve boxes so that the bottom of the base is about 2 inches away from contact with the valve bonnet. The valve box shall not transmit shock or stress to the valve.

3.2 FIELD QUALITY CONTROL

- A. CONTRACTOR shall include the cost of all testing, cleaning, and disinfection in the price bid.
- B. All work shall be inspected, tested, and approved in accordance with federal, state, and local rules and regulations. All work shall also be tested as specified in this section. Unless indicated in writing before testing begins, all tests shall be witnessed by ENGINEER and others as necessary. Test results shall be recorded and reports or appropriate certificates shall be submitted to ENGINEER in triplicate.
- C. All new piping and concrete manholes shall be tested. All underground piping shall be backfilled or properly secured to avoid damage during testing. Should underground piping fail test, CONTRACTOR shall be responsible for removal and replacement of backfill. All piping, interior or exposed, shall be subject to test before being covered with insulation or paint. All piping and appurtenances shall be watertight or airtight and free from visible leaks. Manholes and appurtenances shall be free of leaks. Any leakage shall be sealed by acceptable methods from the exterior of the manhole or structure. Precast reinforced concrete manhole risers and tops shall be tested in accordance with ASTM C497.
- D. All piping shall be flushed or blown out after installation prior to testing. CONTRACTOR shall provide all necessary piping connections, water, air, test pumping equipment, water meter, bulkheads, valves, pressure gauge and other equipment, materials, and facilities necessary to complete the specified tests. CONTRACTOR shall provide all temporary sectionalizing devices and vents for testing.
- E. Use of City Water:
 1. When CONTRACTOR chooses to use City of Madison water for any part of the project, CONTRACTOR shall proceed as follows:
 - a. Request Water Utility to install valve on convenient hydrant.
 - b. Agree to pay Water Utility charges for installation, use, and removal of the valve.
 - c. Notify Water Utility immediately when use of valve is no longer necessary.
 2. CONTRACTOR shall not make connections to Water Utility facilities without permission from the Water Utility.
- F. Pressure Tests:
 1. Pressure tests shall be performed as required by AWWA C600, unless otherwise noted herein.
 2. When test medium for piping is water, all air shall be removed from piping by flushing, opening vents, loosening flanges, utilizing equipment vents and/or installation of corporations at high points in system. Presence or absence of air will be determined during pressurization of the piping system.
 3. The test pressure in all lines shall be held for one hour during which time the leakage allowance shall not exceed that specified. In case repairs are required, the pressure test shall be repeated until the pipeline installation conforms to the specified requirements. Pumps, air compressors, instrumentation, and similar equipment shall not be subjected to the pressure tests.

G. Infiltration/Exfiltration Tests:

1. Infiltration/exfiltration tests for all gravity sewers will be as follows. If groundwater is above the pipe, measurements shall be taken to determine the rate of infiltration into the pipe. If groundwater is below the pipe, the stretch of pipe shall be plugged at its downstream end and water shall be placed inside the pipe to fill the pipe. Measurements shall then be taken to determine the rate of leakage out of the pipe by filling the pipe. Concrete pipe shall be filled with water at least 8 hours before measurements are taken. CONTRACTOR shall furnish all labor, water, and materials necessary for making the tests. The rate of infiltration or leakage shall not exceed 100 gallons per inch diameter per mile per day for any stretch of pipe measured. CONTRACTOR shall immediately make all necessary repairs to bring infiltration or leakage within the above acceptable limits.
2. Air test procedure may be used, when allowed by ENGINEER, for the above-listed pipe designations and shall be conducted as follows:
 - a. Clean pipe to be tested.
 - b. Plug all pipe outlets with suitable test plugs. Brace each plug securely. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
 - c. After an internal pressure of 4.0 psig is obtained, allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
 - d. When pressure decreases to 3.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding times for runs of single pipe diameter and for systems of 4-inch, 6-inch, or 8-inch laterals in combination with trunk lines shall be as recommended by National Clay Pipe Institute.
 - e. If the pipe to be tested is submerged in groundwater, determine the height of groundwater above the crown of the sewer. This is the pressure head of water above the pipe because of groundwater submergence over the sewer. All gauge pressures in the test should be increased by the pressure head of water above the pipe.
 - f. ENGINEER may elect to test sewers in groundwater by measuring the infiltration through the use of a weir provided in the manhole at the downstream end of the sewer being tested.
 - g. The air test may be dangerous if a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.
 - h. As a safety precaution, pressurizing equipment should include a regulator set at 10 psi to avoid overpressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.
 - i. Deflection Testing:
 - 1) All PVC pipe used for sanitary sewer shall be tested for vertical deflection. Maximum deflection after completion of backfilling shall be 5% of the inside pipe diameter. Testing shall not be started until trench backfill has been in place for 30 days. CONTRACTOR shall keep a record of all tests performed. These records shall show the individual lengths of main tested and test results. Deflection shall be measured by pull a mandrel with a vertical diameter equal to 95% of the pipe inside diameter through the line, after thoroughly flushing the lines to be tested. The testing device shall be controlled using cables at both the upstream and downstream manholes. The testing device must pass freely through the sewer without the use of unreasonable force on the control cables. Any line that will not pass the test cylinder will not be accepted until the faulty sections have been removed and replaced and the line retested.
 - 2) Deflection testing of thermoplastic storm sewer shall be provided in accordance with the above requirements.

3.3 CLEANING AND DISINFECTION

- A. All equipment and materials shall be clean before installation. CONTRACTOR shall disinfect and flush the potable water system before it is put online. Water main shall be disinfected according to AWWA C651.

END OF SECTION 33 00 00

DRAWINGS

NOTES
 1. DETAILS RELATIVE TO ITEMS SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

2. VARIATIONS IN DIMENSIONS AND DESIGN MAY BE PERMISSIBLE, PROVIDING EQUIVALENT CAPACITY AND STRENGTH ARE ATTAINED.

3. ALL CONCRETE FILLETS SHALL BE HAND TROWELED WITH A 1/4" FT. SLOPE.

4. INSIDE DIMENSIONS FOR MANHOLES: USE MINIMUM 4' DIAMETER FOR SEWER LESS THAN 18" IN DIAMETER; USE MINIMUM 5' DIAMETER FOR SEWER 18" THRU 24" IN DIAMETER; USE MINIMUM 6' DIAMETER OR MINIMUM 6' SQUARE FOR SEWER OVER 24" IN DIAMETER.

5. BEDDING CLASSES "B" AND "C" SHALL MEET OR EXCEED ASTM C12 REQUIREMENTS.

6. DROP TYPE ENTRANCE TO STANDARD MANHOLE WILL BE PAID FOR SEPARATELY IF SO LISTED IN THE BID.

7. SEE DRAWINGS FOR DROP TYPE ENTRANCES FOR SANITARY SEWERS LARGER THAN 15".

8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF REGULATORY BODIES OF THE STATE AND APPLICABLE MUNICIPAL ORDINANCES.

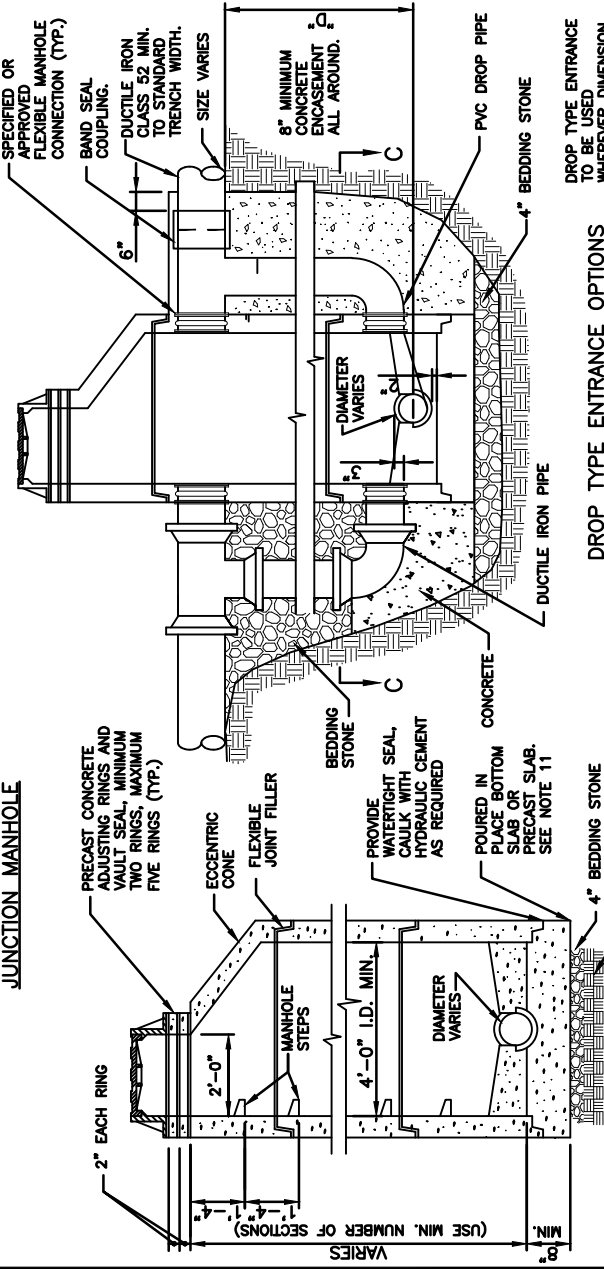
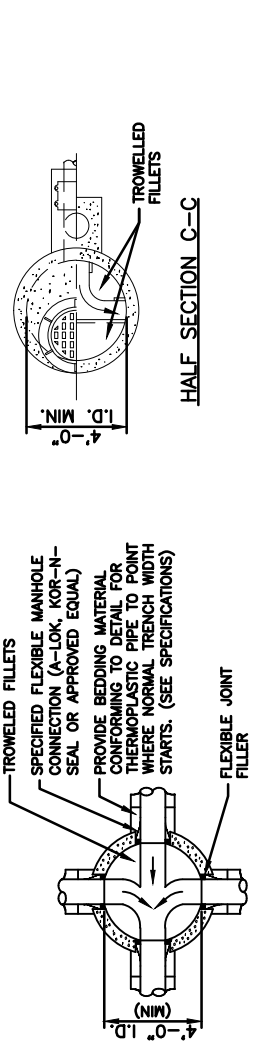
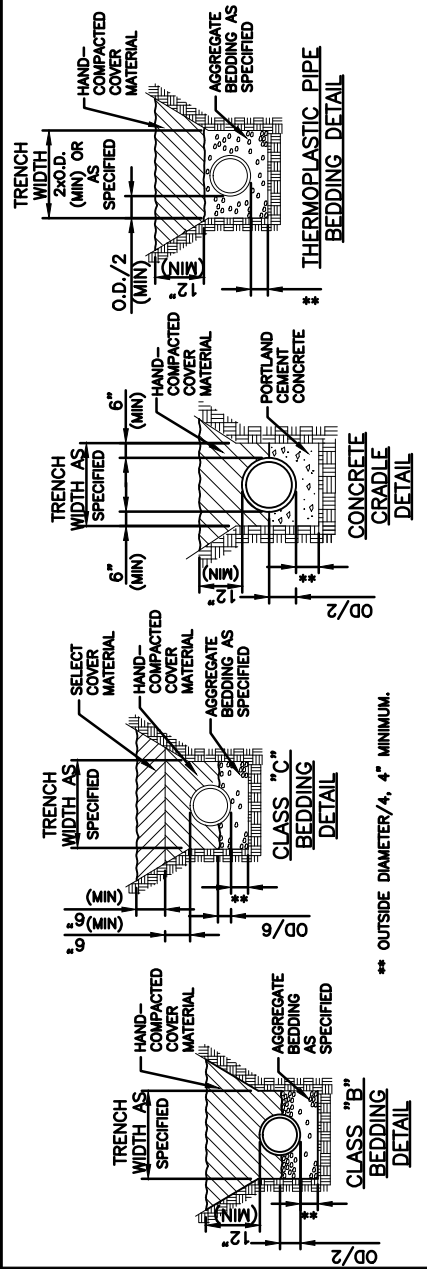
9. ALL NEW CONSTRUCTION SHALL BE PLACED ON UNDISTURBED EARTH OR STONE BEDDING.

10. FLAT SLAB TOPS SHALL BE DESIGNED FOR H-20 TRUCK LOADING AND SHALL MEET REQUIREMENTS OF ASTM C-478.

11. BASE SLABS SHALL BE REINFORCED AS FOLLOWS: REINFORCING SHALL BE PLACED IN EACH DIRECTION AT 2" CLEAR FROM TOP SURFACE OF SLAB. REINFORCING SHALL BE GRADE 60. USE OF CAST-IN-PLACE SLAB SHALL NOT RELIEVE CONTRACTOR OF REQUIREMENTS TO PROVIDE WATERTIGHT JOINTS.

INSIDE DIA.	DEPTH	REINF.
4'	≤ 30"	#3@8"
5'	≤ 20"	#3@8"
5'	20'-30"	#4@10"
6'	≤ 20"	#4@10"
6'	20'-25"	#4@8"
6'	25'-30"	#4@6"

12. FLAT SLABS SHALL BE PROVIDED IN SHALLOW DEPTH SITUATIONS IN LIEU OF ECCENTRIC CONES.

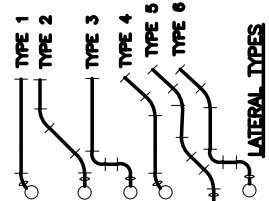
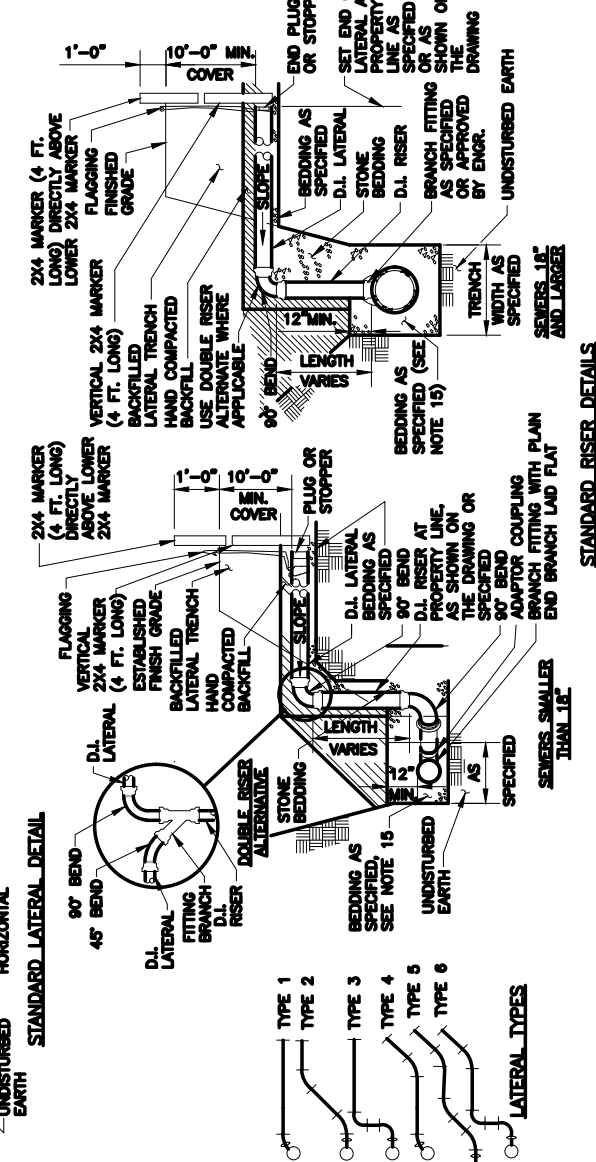
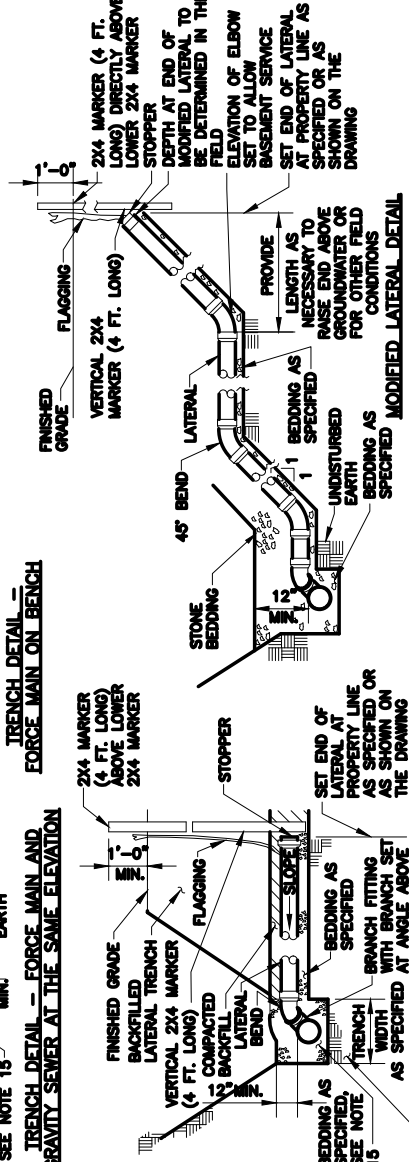
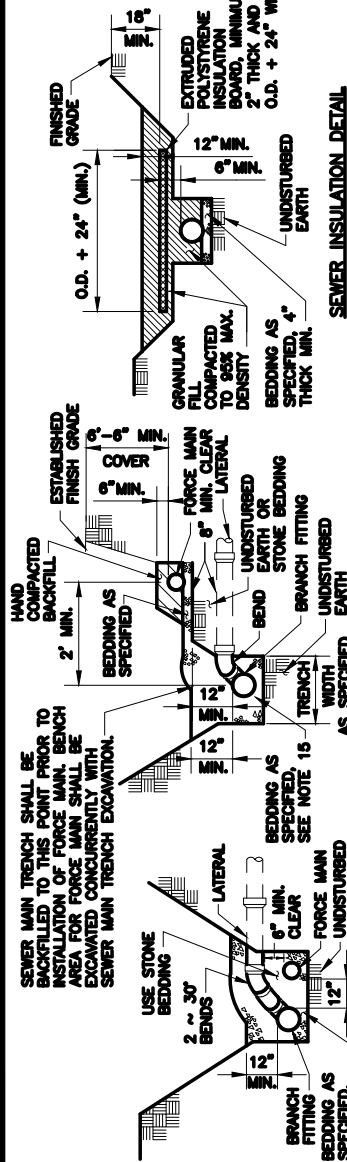


SANITARY SEWER APPURTENANCES

STANDARD DETAIL

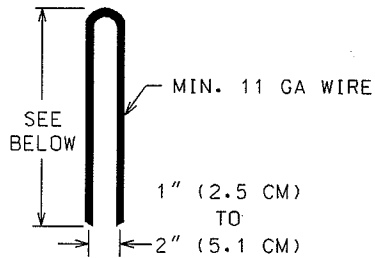
STRAND ASSOCIATES
 01-975-43A
 OCTOBER 2011

NOTES:
 1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF REGULATORY BODIES OF THE STATE AND APPLICABLE MUNICIPAL ORDINANCES.
 2. DETAILS RELATIVE TO ITEMS SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.
 3. VARIATIONS IN DIMENSIONS AND DESIGN MAY BE PERMISSIBLE, PROVIDING EQUIVALENT CAPACITY AND STRENGTH ARE ATTAINED.
 4. ALL NEW CONSTRUCTION SHALL BE PLACED ON UNDISTURBED EARTH OR STONE BEDDING.
 5. BEDDING CLASSES "B" AND "C" SHALL MEET OR EXCEED ASTM C12 REQUIREMENTS.
 6. ALL LATERALS SHALL BE LAID AT A STANDARD SLOPE OF 1/4-INCH PER FOOT UNLESS OTHERWISE NOTED ON THE DRAWINGS, OR SPECIFIED IN NO CASE SHALL LATERAL SLOPE BE LESS THAN 1/8-INCH PER FOOT. MAXIMUM LATERAL SLOPE SHALL BE 1 TO 1.
 7. END PLUGS OR STOPPERS FOR THE ENDS OF LATERALS AND BRANCH FITTINGS SHALL BE PROVIDED.
 8. 2x4'S SHALL BE PLACED AT ALL LATERALS ENDS SO THAT ONE PROTRUDES 12 INCHES ABOVE FINISHED GRADE AND ONE IS LOCATED IN THE GROUND AT THE END OF THE LATERAL. 2x4'S SHALL BE PAINTED FLOURESCENT ORANGE. 2x4'S SHALL EACH BE AT LEAST 4 FT. LONG.
 9. BAR STEEL REINFORCEMENT SHALL BE IMBEDDED 1 1/2-INCH CLEAR MINIMUM.
 10. THE TOP OF ANY MANHOLE STRUCTURE SHALL BE LEFT SUFFICIENTLY LOW TO PERMIT PROPER ADJUSTMENT OF COVER TO GRADE.
 11. INSTALL DOUBLE RISERS WHERE SHOWN ON THE DRAWINGS OR SPECIFIED.
 12. STANDARD LATERALS AND MODIFIED LATERALS SHALL BE CONSTRUCTED OF MATERIAL AS SPECIFIED.
 13. RISERS AND LATERALS FROM RISERS SHALL BE CONSTRUCTED OF DUCTILE IRON. FITTINGS FOR RISERS AND LATERALS FROM RISERS SHALL BE GRAY IRON OR DUCTILE IRON.
 14. FLAGGING SHALL BE 4-INCH WIDE STANDARD ORANGE VINYL TAPE. THE FLAGGING AROUND END OF ALL LATERALS AND EXTEND UNBROKEN TO FINISHED GRADE DIRECTLY ABOVE ENDS OF LATERALS.
 15. STONE BEDDING SHALL BE USED AROUND AND TO ONE FT. ABOVE TOP OF ALL SEWER MAINS AT LATERAL CONNECTIONS. PROVIDE BEDDING AS SPECIFIED ELSEWHERE.



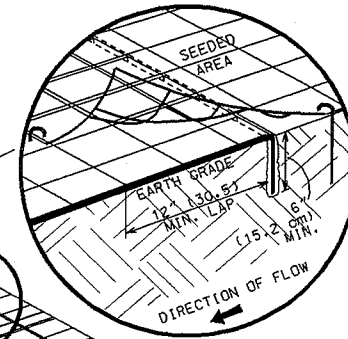
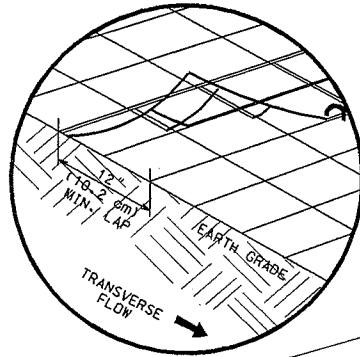
**SANITARY SEWER
 LATERALS
 STANDARD DETAIL**

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 01-975-754
 OCTOBER 2011

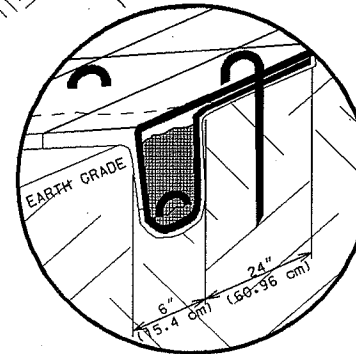
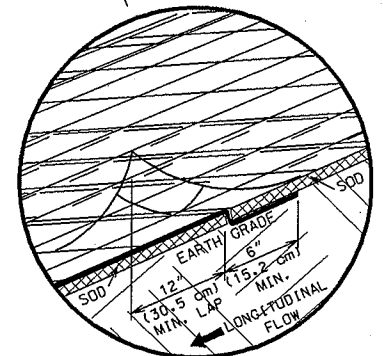
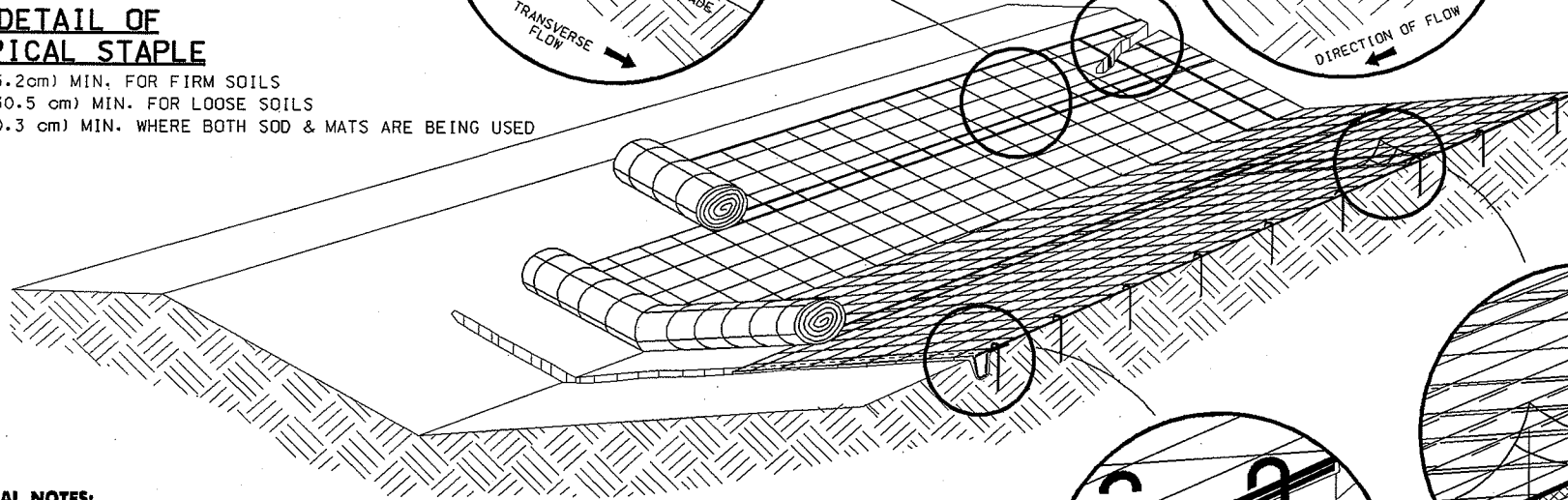


**DETAIL OF
TYPICAL STAPLE**

6" (15.2cm) MIN. FOR FIRM SOILS
 12" (30.5 cm) MIN. FOR LOOSE SOILS
 8" (20.3 cm) MIN. WHERE BOTH SOD & MATS ARE BEING USED



**JUNCTION SLOT
(SEED ONLY)**



**ANCHOR SLOT
AT BEGINNING OF EROSION MAT
EXTRA STAPLE AT END ONLY
(SEED AND SOD)**

GENERAL NOTES:

DETAILS OF CONSTRUCTION MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

VARIATIONS IN THE DIMENSIONS OR MATERIALS SHOWN HEREON SHALL BE PERMITTED IF THEY PROVIDE EQUIVALENT PROTECTION AND MATERIAL STRENGTH AND IF PRIOR APPROVAL OF THE ENGINEER IS OBTAINED.

LAP JOINTS SHALL NOT BE PLACED IN THE BOTTOM OF V-SHAPED DITCHES.

JUNCTION SLOTS ON ADJACENT STRIPS OF MATTING SHALL BE STAGGERED A MINIMUM OF 4 FEET (1.219 m) APART.

EROSION MAT SHALL BE MEASURED AND PAID FOR IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

EROSION MAT OVER SOD:

- a. ONLY JUTE FABRIC WILL BE PERMITTED OVER SOD.
- b. WOOD STAKES FOR SOD MAY BE OMITTED BY THE ENGINEER IF EXISTING SLOPE AND SOIL CONDITIONS SO WARRANT.
- c. THE WIDTH OF EROSION MAT SHALL ALWAYS EXCEED THE SOD WIDTH.

EROSION MAT OVER SEEDING:

JUNCTION OR ANCHOR SLOTS SHALL BE AT MINIMUM INTERVALS OF 100 FEET (30.48 m) ON GRADES UP TO AND INCLUDING 3 PERCENT, AND 50 FEET (15.24 m) ON GRADES EXCEEDING 3 PERCENT.

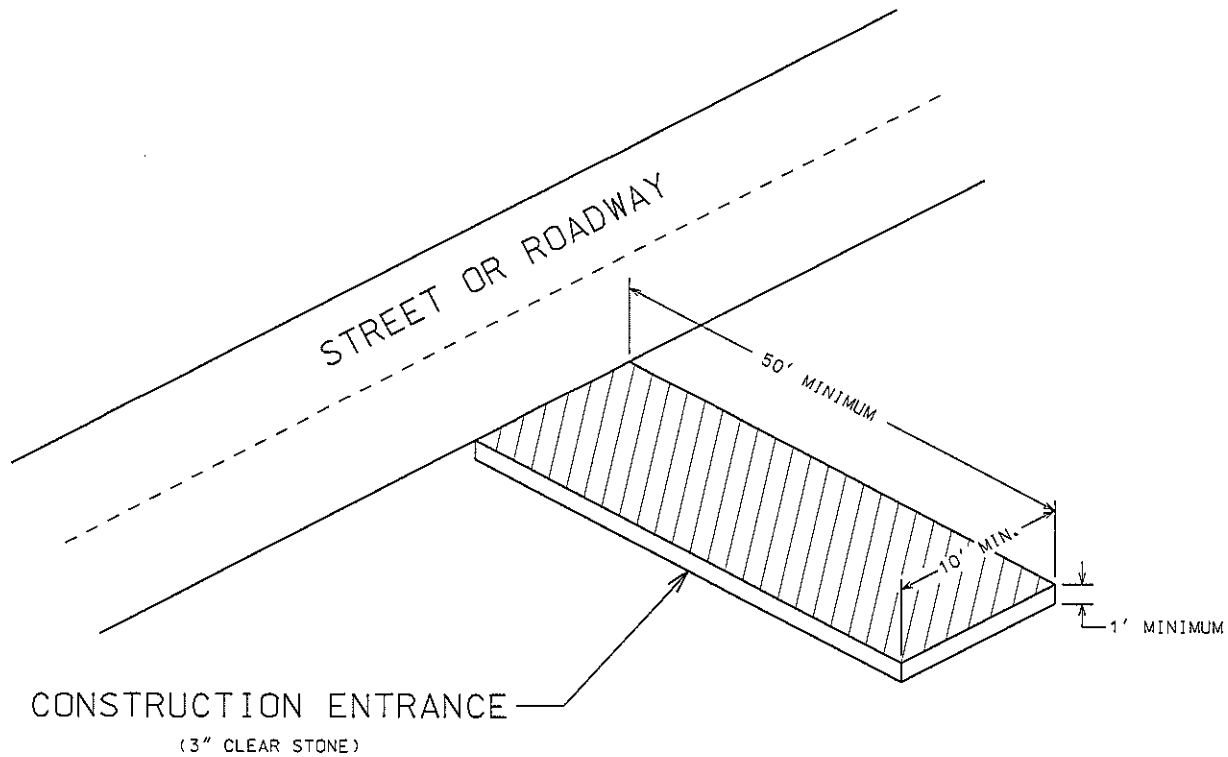
2004

CITY OF MADISON
ENGINEERING DIVISION

EROSION MAT

DRAWING NOT TO SCALE

STANDARD DETAIL DRAWING 1.02



1.07

GENERAL NOTES:

1. CONSTRUCTION ENTRANCE TO BE INSTALLED PRIOR TO ANY TRAFFIC LEAVING THE SITE.
2. THE AGGREGATE FOR THE CONSTRUCTION ENTRANCE SHALL BE 3 INCH CLEAR OR WASHED STONE.
3. AGGREGATE SHALL BE PLACED IN A LAYER AT LEAST 12 INCHES THICK.
4. THE CONSTRUCTION ENTRANCE SHALL BE UNDERLAIN WITH A WDOT TYPE HR OR FF GEOTEXTILE FABRIC TO PREVENT MIGRATION OF UNDERLYING SOIL INTO THE STONE.
5. SURFACE WATERS MUST BE PREVENTED FROM PASSING THROUGH THE CONSTRUCTION ENTRANCE. FLOWS SHALL BE DIVERTED AWAY FROM THE CONSTRUCTION ENTRANCE OR CONVEYED UNDER AND AROUND THEM BY USE OF A CULVERT, DIVERSION BERM OR OTHER PRACTICES AS APPROVED BY THE CONSTRUCTION ENGINEER.
6. CLEANING BY SCRAPING OR ADDING NEW STONE SHALL BE REQUIRED IF ENTRANCE BECOMES MORE THAN 50% COVERED BY TRACKED MUD.

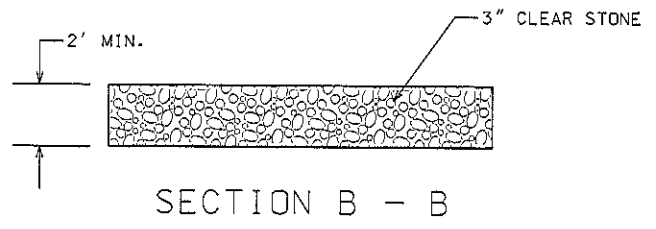
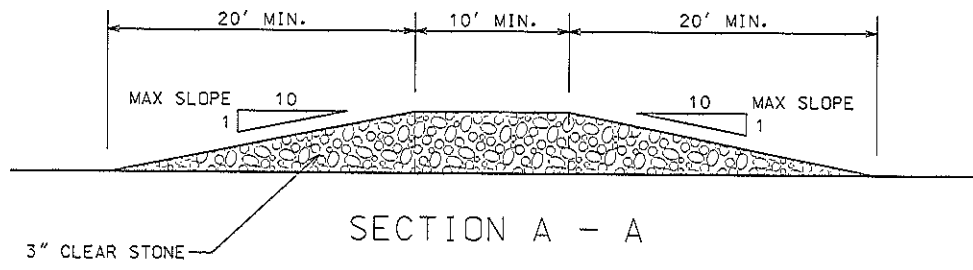
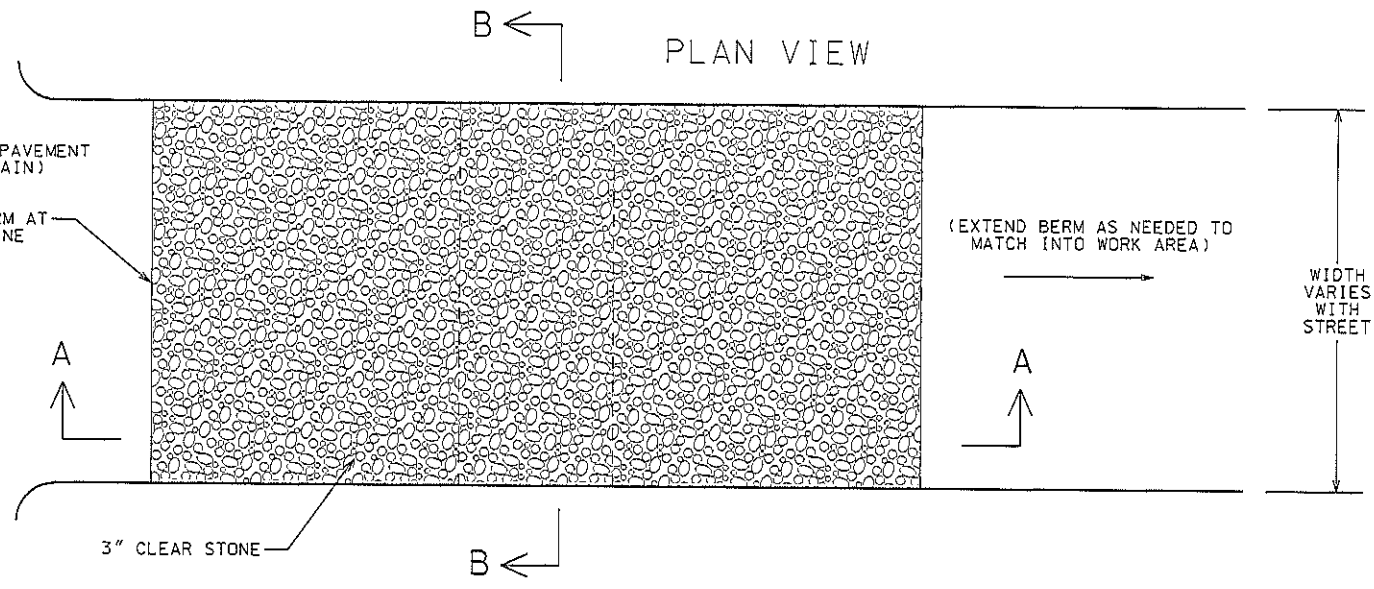
2012

CITY OF MADISON
ENGINEERING DIVISION

CONSTRUCTION
ENTRANCE

STANDARD DETAIL DRAWING 1.07

1.08

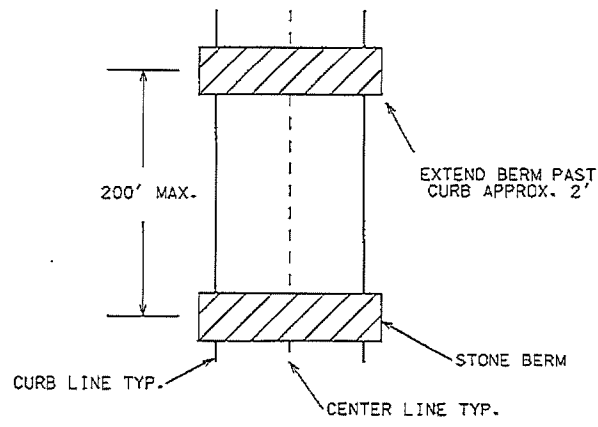


GENERAL NOTES:

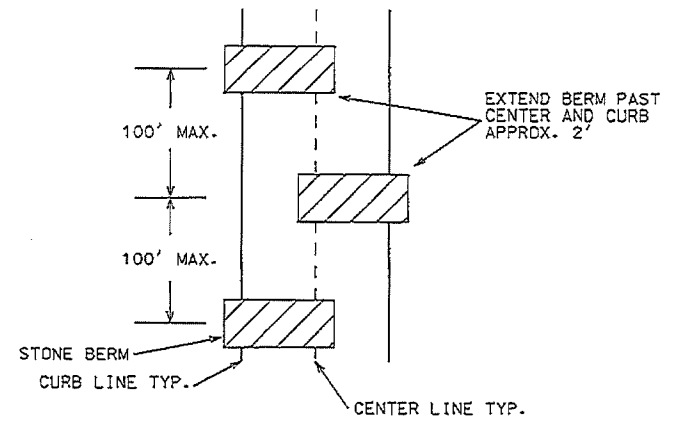
1. THE STREET CONSTRUCTION ENTRANCE BERM IS TO BE INSTALLED PRIOR TO ANY TRAFFIC LEAVING THE SITE.
2. THE AGGREGATE FOR THE STREET CONSTRUCTION ENTRANCE BERM SHALL BE 3 INCH CLEAR OR WASHED STONE.
3. MINIMUM OVERALL LENGTH OF THE STREET CONSTRUCTION ENTRANCE BERM SHALL BE 50 FEET. THE BERM SHALL START AT THE SAWCUT LINE AND EXTEND INTO THE WORK AREA UNTIL IT MATCHES INTO THE WORK AREA GRADES.
4. THE MAXIMUM ALLOWABLE SLOPE OF 10:1 SHALL NOT BE EXCEEDED. THIS IS TO ALLOW EMERGENCY VEHICLE ACCESS TO THE CONSTRUCTION AREA WITHOUT NEEDING TO REMOVE THE BERM.
5. THE STREET CONSTRUCTION ENTRANCE BERM SHALL BE UNDERLAIN WITH A WDOT TYPE HR OR FF GEOTEXTILE FABRIC TO PREVENT MIGRATION OF UNERLYING SOIL INTO THE STONE.
6. CLEANING BY SCRAPING OR ADDING NEW STONE SHALL BE REQUIRED IF ENTRANCE BECOMES MORE THAN 50% COVERED BY TRACKED MUD.

2012
CITY OF MADISON ENGINEERING DIVISION
STREET CONSTRUCTION ENTRANCE BERM
STANDARD DETAIL DRAWING 1.08

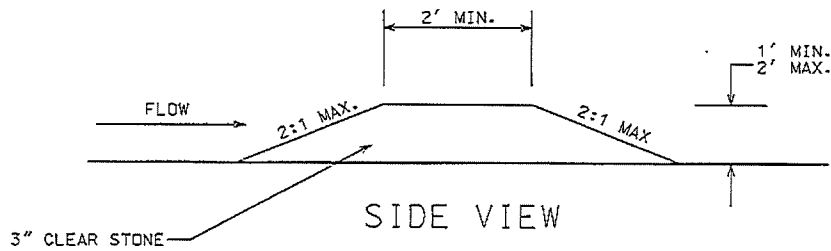
1.10



FULL WIDTH SPACING



STAGGERED SPACING



SIDE VIEW

GENERAL NOTES:

1. THE STREET CONSTRUCTION STONE BERM IS NOT INTENDED FOR USE ON STREETS WITH GREATER THAN 6 PERCENT SLOPES.
2. THE AGGREGATE FOR THE STREET CONSTRUCTION STONE BERM SHALL BE 3 INCH CLEAR OR WASHED STONE.
3. MINIMUM OVERALL LENGTH OF THE STREET CONSTRUCTION STONE BERM WILL BE DICTATED BY THE WIDTH OF THE EXISTING OR PROPOSED STREET.
4. SPACING OF STREET CONSTRUCTION STONE BERMS SHALL BE PER THE APPROVED EROSION CONTROL IMPLEMENTATION PLAN. FOR PROJECTS WITHOUT AN EROSION CONTROL IMPLEMENTATION PLAN SPACING SHALL BE AS NOTED ABOVE.

2011

CITY OF MADISON
ENGINEERING DIVISION

STREET CONSTRUCTION
STONE BERM

STANDARD DETAIL DRAWING 1.10

Single, straight, main trunk.
Lower branches may require
removal for height clearance

Remove transit guard

Root flare to be level
with the finished grade

3"-4" of woody mulch:
Shredded or Ground
hardwood bark mulch

Remove wire baskets; or cut top and
fold down in pit after positioned for
backfill planting. Cut and remove or
fold down burlap from upper 1/2
of ball.

Cut and remove all poly ties and burlap !!

Water thoroughly to eliminate air pockets,
and to settle the surrounding soil

Finish Grade

Soil under ball undisturbed
to support root ball
and reduce settling

Break down sides of
hole when backfilling

3 times ball diameter

Backfill: Excavated soil or amended
as specified. Do Not Tamp !!!

2004

CITY OF MADISON
PARKS DIVISION

STANDARD PLANTING
TECHNIQUE FOR TREES
IN TURF AREAS

STANDARD DETAIL DRAWING 2.01

Branching to be full throughout entire tree/shrub as is typical from the species.
Any broken branches to be removed

Single, straight, main trunk.
Lower branches may require removal for height clearance
(when / where applicable / specified)

Root flare to be level with the finished grade

3"-4" of woody mulch:
Shredded or Ground hardwood bark mulch
(over landscape fabric when/where specified)

Remove wire baskets; or cut top and fold down in pit after positioned for backfill planting. Cut and remove or fold down burlap from upper 1/2 of ball.
Cut and remove all poly ties and burlap !!
- or -
Remove Poly Pot and dispose

Water thoroughly to eliminate air pockets, and to settle the surrounding soil

Finish Grade

Soil under ball undisturbed to support root ball and reduce settling

Break down sides of hole when backfilling

3 times ball diameter

Backfill: Excavated soil or amended as specified. Do Not Tamp !!!

2004

CITY OF MADISON
PARKS DIVISION

STANDARD PLANTING
TECHNIQUE FOR
EVERGREENS

STANDARD DETAIL DRAWING 2.03

Branching to be full throughout entire tree/shrub as is typical from the species.
Any broken branches to be removed

Single, straight, main trunk.
Lower branches may require removal for height clearance
(when / where applicable / specified)

3"-4" of woody mulch:
Shredded or Ground
hardwood bark mulch
(over landscape fabric
when/where specified)

Root flare to be level
with the finished grade

Remove wire baskets; or cut top and
fold down in pit after positioned for
backfill planting. Cut and remove or
fold down burlap from upper 1/2
of ball.

Cut and remove all poly ties and burlap !!

- or -

Remove Poly Pot and dispose

Water thoroughly to eliminate air pockets,
and to settle the surrounding soil

Finish Grade

Soil under ball undisturbed
to support root ball
and reduce settling

Break down sides of
hole when backfilling

3 times ball diameter

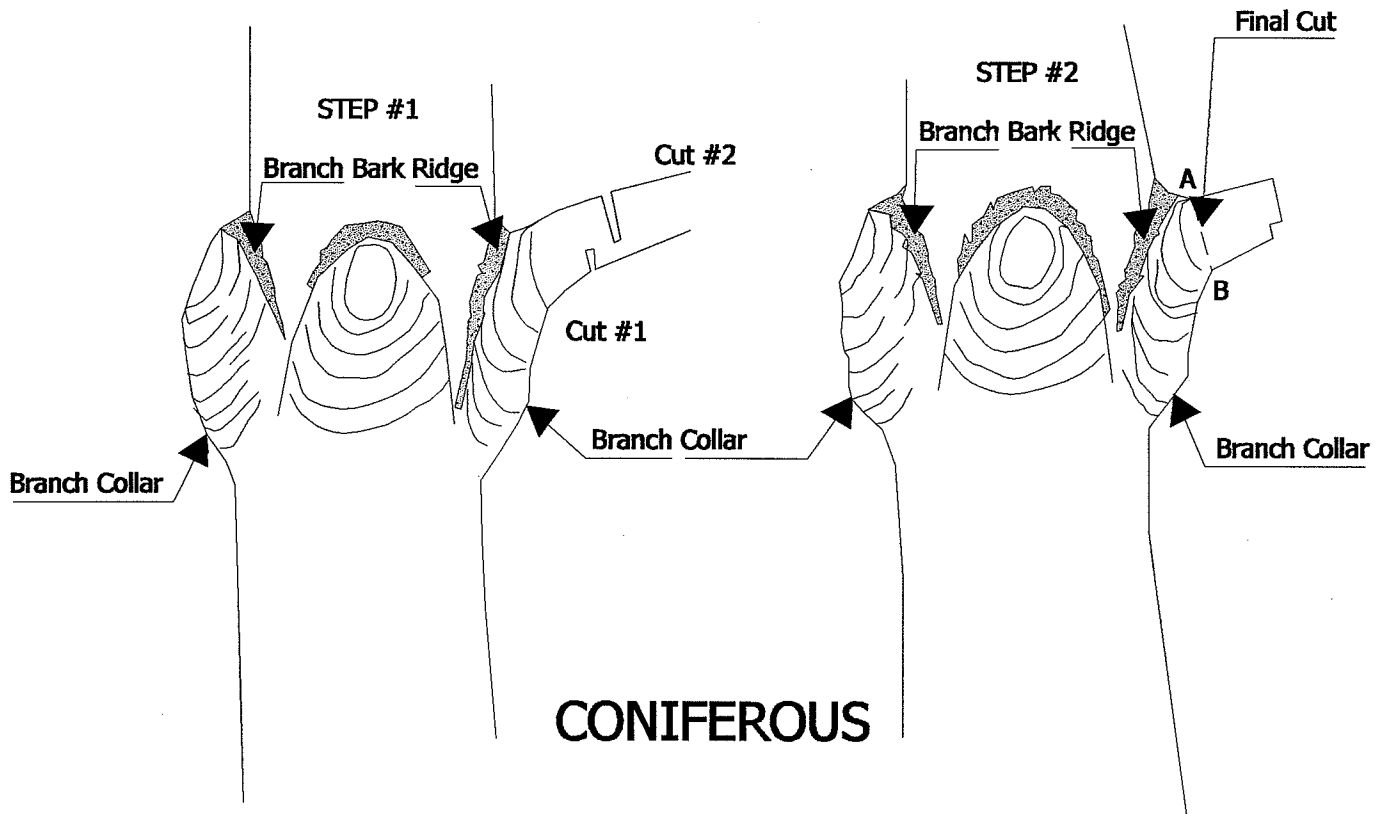
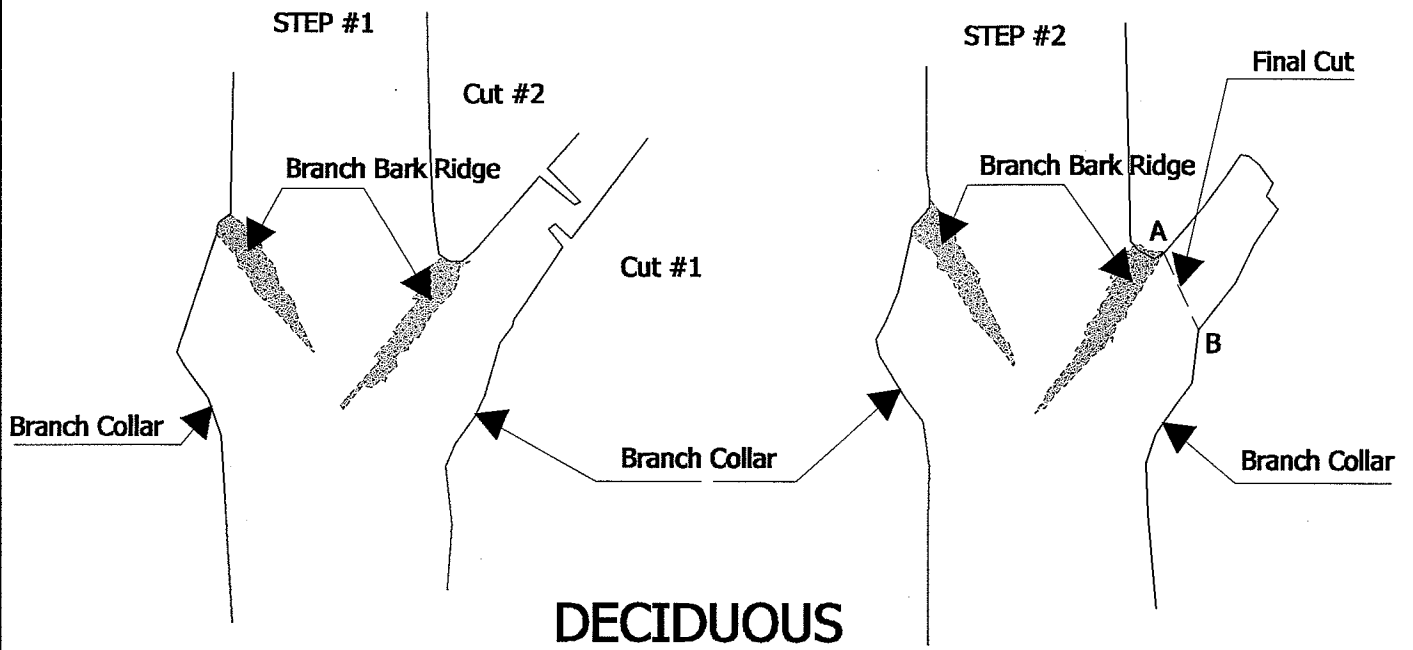
Backfill: Excavated soil or amended
as specified. Do Not Tamp !!!

2004

CITY OF MADISON
PARKS DIVISION

STANDARD PLANTING
TECHNIQUE FOR SHRUBS

STANDARD DETAIL DRAWING 2.04



1)-Step #1 - This 2 cut process reduces the likelihood that the limb will peel and cause additional unwanted tissue damage

2)-Step #2 - Your finish or final cut should be made from Point A to Point B:

DO NOT LEAVE STUBS & DO NOT FLUSH CUT

NOTE: DO NOT CUT INTO THE BRANCH BARK RIDGE

DO NOT REMOVE THE BRANCH COLLAR

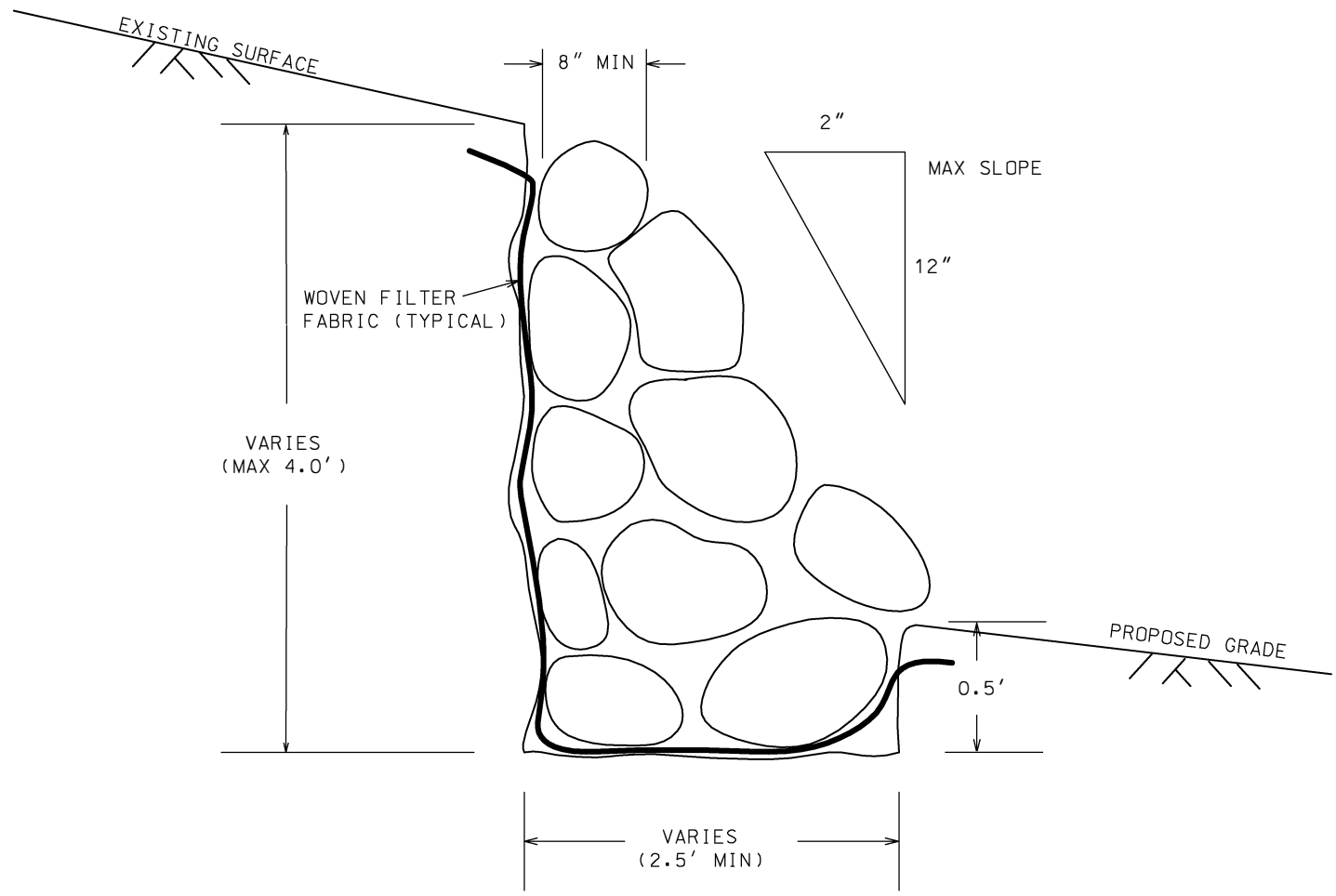
2004

CITY OF MADISON
PARKS DIVISION

STANDARD PRUNING TECHNIQUES
FOR DECIDUOUS AND CONIFEROUS
TREES AND SHRUBS

STANDARD DETAIL DRAWING 2.05

2.06



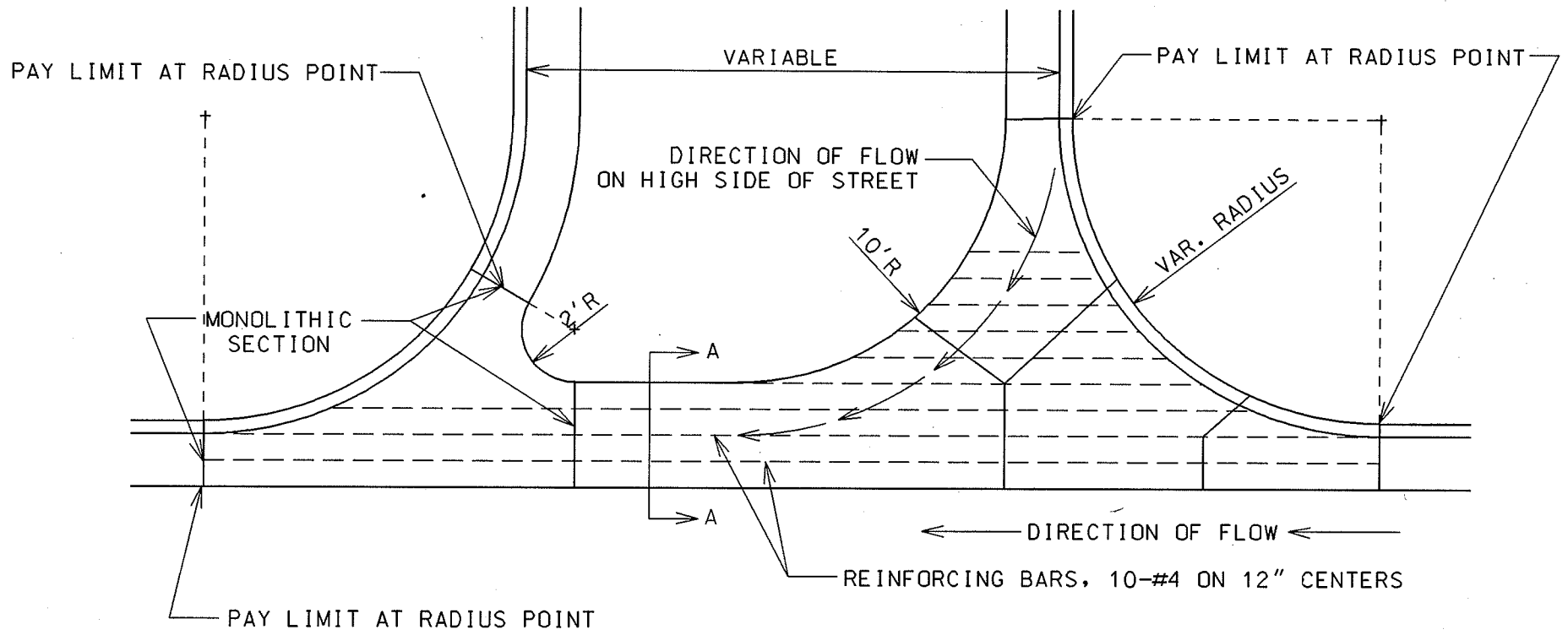
NOTE: FILTER FABRIC TO BE
 PLACED BEHIND WALL
 UNLESS OTHERWISE SPECIFIED

2004

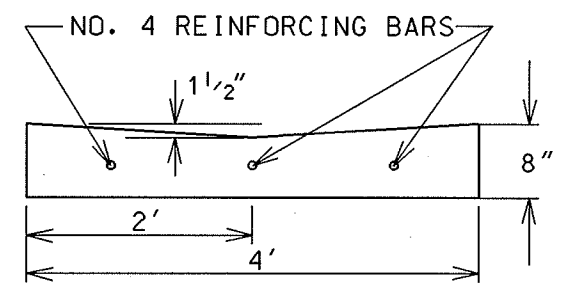
CITY OF MADISON ENGINEERING DIVISION
TYPICAL FIELD STONE RETAINING WALL
STANDARD DETAIL DRAWING 2.06

DRAWING NOT TO SCALE

3.01



REINFORCING BARS, 10-#4 ON 12" CENTERS



SECTION A-A

GENERAL NOTES:

SPECIAL WATERWAY DETAIL SHALL BE USED WHEN SPECIFIED ON THE PLAN IN LIEU OF A SLOPE GUTTER AT STREET INTERSECTIONS

SPECIAL WATERWAY SHALL BE MEASURED AND PAID FOR BY THE SQUARE FOOT

REINFORCING BARS SHALL BE EPOXY COATED AND INSTALLED IN THE SPECIAL WATERWAY AS SHOWN AND SHALL BE INCIDENTAL TO THE SPECIAL WATERWAY

2004

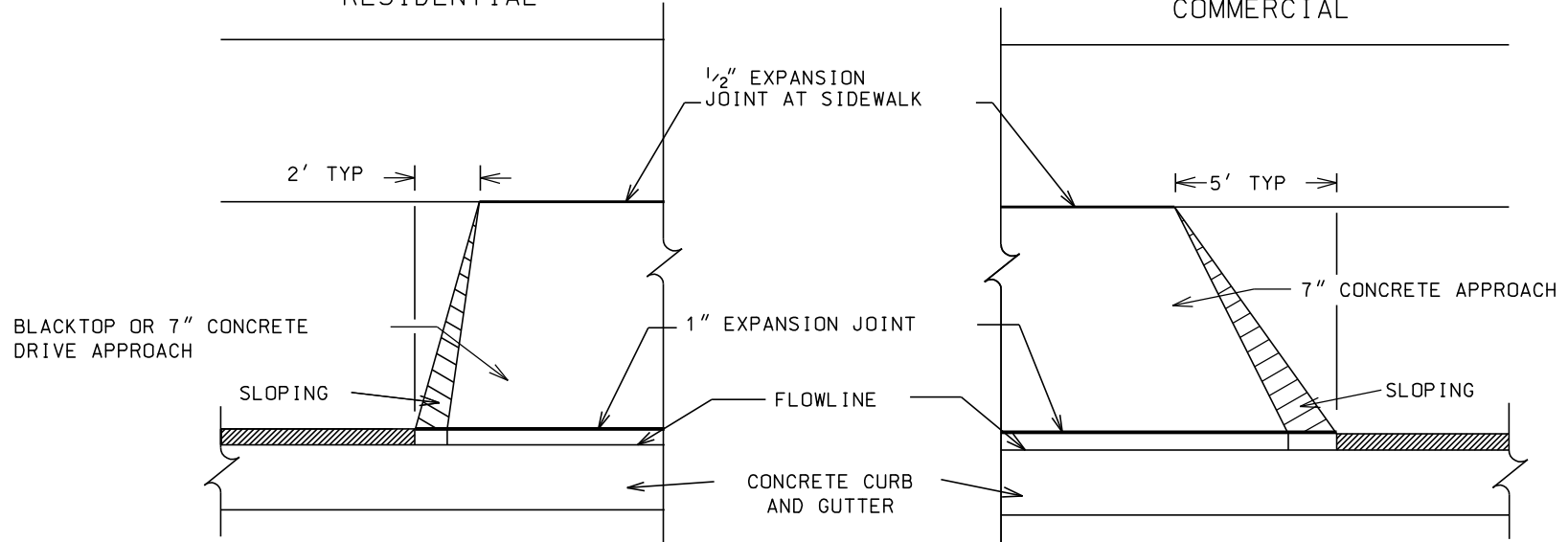
CITY OF MADISON
ENGINEERING DIVISION

STANDARD
SPECIAL WATERWAY

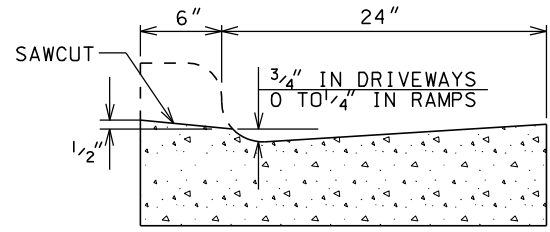
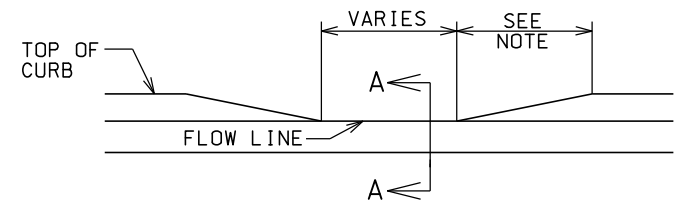
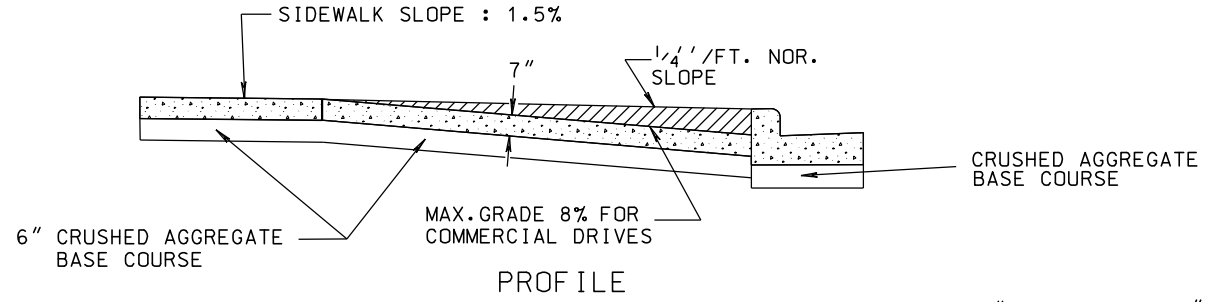
STANDARD DETAIL DRAWING 3.01

RESIDENTIAL

COMMERCIAL



EXPANSION JOINTS IN ACCORDANCE WITH REQUIREMENTS OF 302.2d and 303.2d



NOTE:
12" TO 18" TAPER FOR STANDARD DRIVEWAY APPROACH
18" TO 24" TAPER FOR STANDARD RAMP

TYPICAL CURB CUT TAPER

GENERAL NOTE:
IF THE CURB CUT IS NOT CONSTRUCTED WITH THE INITIAL CURB AND GUTTER CONSTRUCTION, THE CURB CUT CAN BE MADE BY REMOVING AND REPLACING THE ENTIRE CURB AND GUTTER SECTION OR BY SAWCUTTING THE EXISTING CURB HEAD BY MEANS OF A SPECIAL SAW DESIGNED TO MEET THE DETAILS ABOVE FOR MADISON STANDARD CURB CUTS.

ALL EXPANSION JOINTS SHALL EXTEND THROUGH THE ENTIRE THICKNESS OF THE APPROACH OR SIDEWALK, WHICHEVER IS THICKER.

DRIVEWAY SECTION TYPE 'A'
CONCRETE CURB & GUTTER

SECTION A-A

2016

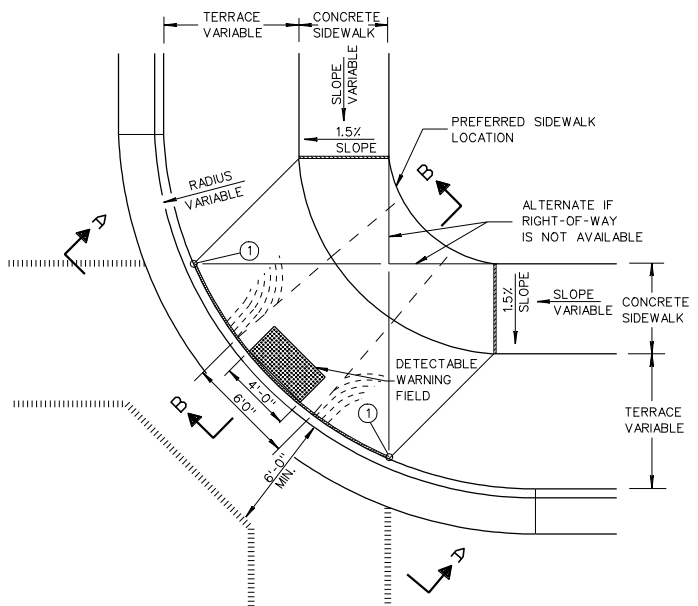
CITY OF MADISON
ENGINEERING DIVISION

MADISON STANDARD
CURB CUT DETAILS

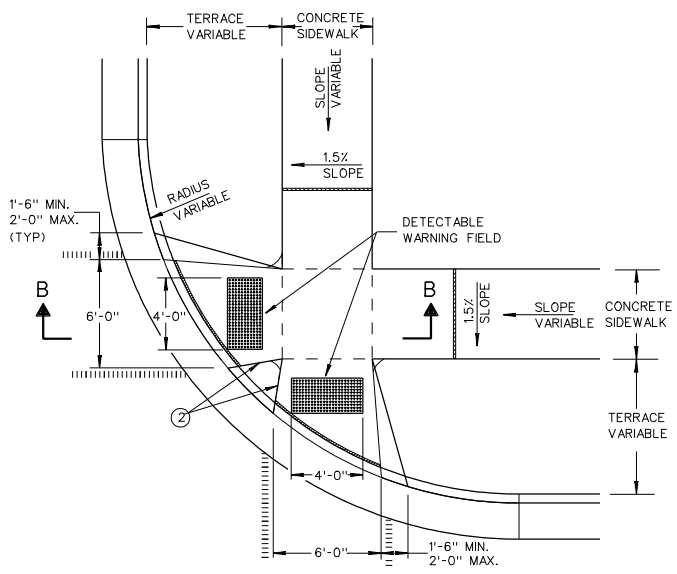
STANDARD DETAIL DRAWING 3.02

3.02

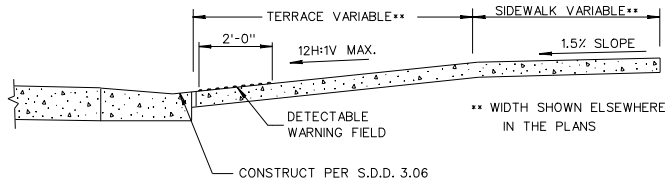
3.03



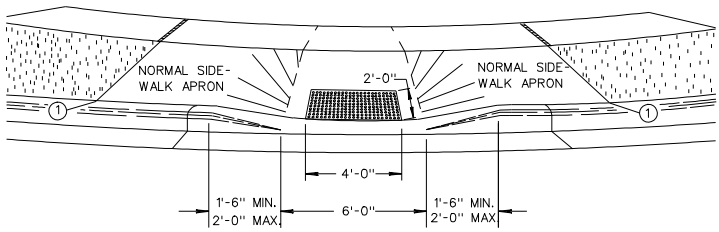
PLAN VIEW
TYPE 1 RAMP
(CENTER OF CORNER RADIUS)



PLAN VIEW
TYPE 2 RAMP
(ON LINE WITH SIDEWALK)



SECTION B-B



SECTION A-A

GENERAL NOTES

TYPE 2-A RAMPS SHALL BE USED IN NEW DEVELOPMENTS UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.

DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

RAMPS SHALL BE BUILT AT 12H:1V OR FLATTER. WHEN NECESSARY, THE SIDEWALK ELEVATION MAY BE LOWERED TO MEET THE HIGH POINT ON THE RAMP.

DETECTABLE WARNING FIELD SHALL BE MEASURED AND PAID BY THE SQUARE FOOT AS "CURB RAMP DETECTABLE WARNING FIELD".

SURFACE TEXTURE OF THE RAMP SHALL BE OBTAINED BY COARSE BROOMING TRANSVERSE TO THE SLOPE OF THE RAMP.

THE DETECTABLE WARNING SURFACE SHALL BE LOCATED SO THAT THE EDGE NEAREST THE CURB LINE IS 6 INCHES MINIMUM AND 8 INCHES MAXIMUM FROM THE CURB LINE.

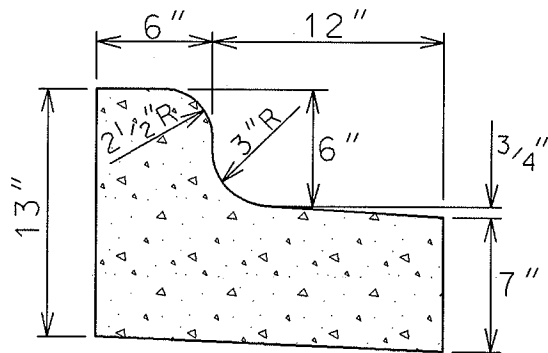
- ① THIS POINT IS AN EXTENSION OF OUTSIDE EDGE OF APPROACHING SIDEWALK WHERE IT MEETS THE BACK OF CONCRETE CURB.
- ② WHEN THIS DISTANCE IS LESS THAN 6'-0" IT MAY BE DIFFICULT TO ACHIEVE A 12H:1V SLOPE, OR FLATTER, ON THE RAMP. REDUCE CURB HEIGHT IN TRIANGLE AREA TO ACHIEVE 12H:1V SLOPE, OR FLATTER, ON RAMP. 2" MINIMUM CURB HEIGHT.

LEGEND

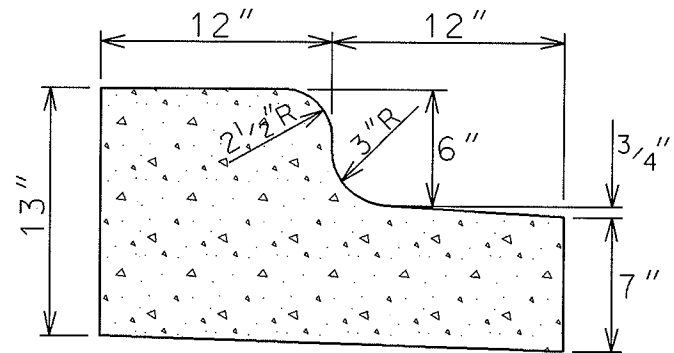
- 1" EXPANSION JOINT-SIDEWALK
- - - - - CONTRACTION JOINT FIELD LOCATED
- ||||| PAVEMENT MARKING, WHITE, 6-INCH
- ALTERNATIVE LAYOUT

2015

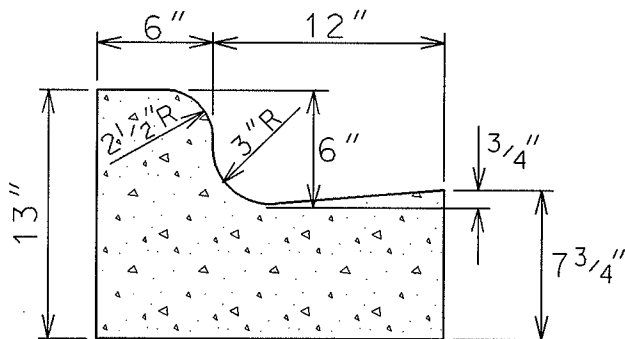
CITY OF MADISON ENGINEERING DIVISION
STANDARD CURB RAMPS TYPES 1 AND 2
STANDARD DETAIL DRAWING 3.03



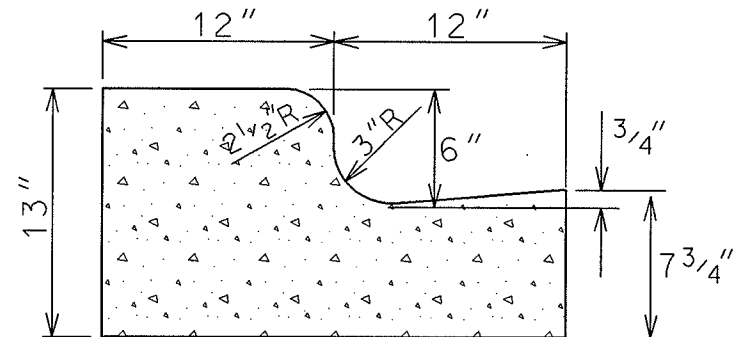
TYPE 'D' CONCRETE CURB & GUTTER



TYPE 'E' CONCRETE CURB & GUTTER



TYPE 'G' CONCRETE CURB & GUTTER



TYPE 'H' CONCRETE CURB & GUTTER

GENERAL NOTES:

LATERAL CONTRACTION JOINTS SHALL BE PLACED AT INTERVALS OF NOT MORE THAN 15' NOR LESS THAN 6' IN LENGTH. THE JOINTS SHALL BE A MINIMUM OF 3" IN DEPTH

EXPANSION JOINTS SHALL BE PLACED TRANSVERSLY AT RADIUS POINTS ON CURVES OF RADIUS 200' OR LESS, AND AT ANGLE POINTS, OR AS DIRECTED BY THE ENGINEER. THE EXPANSION JOINT SHALL BE A ONE PIECE ASPHALTIC MATERIAL HAVING THE SAME DIMENSIONS AS CURB & GUTTER AT THAT STATION AND BE 1/2" THICK.

IN ALL CASES, CONCRETE CURB & GUTTER SHALL BE PLACED ON THOROUGHLY COMPACTED CRUSHED STONE

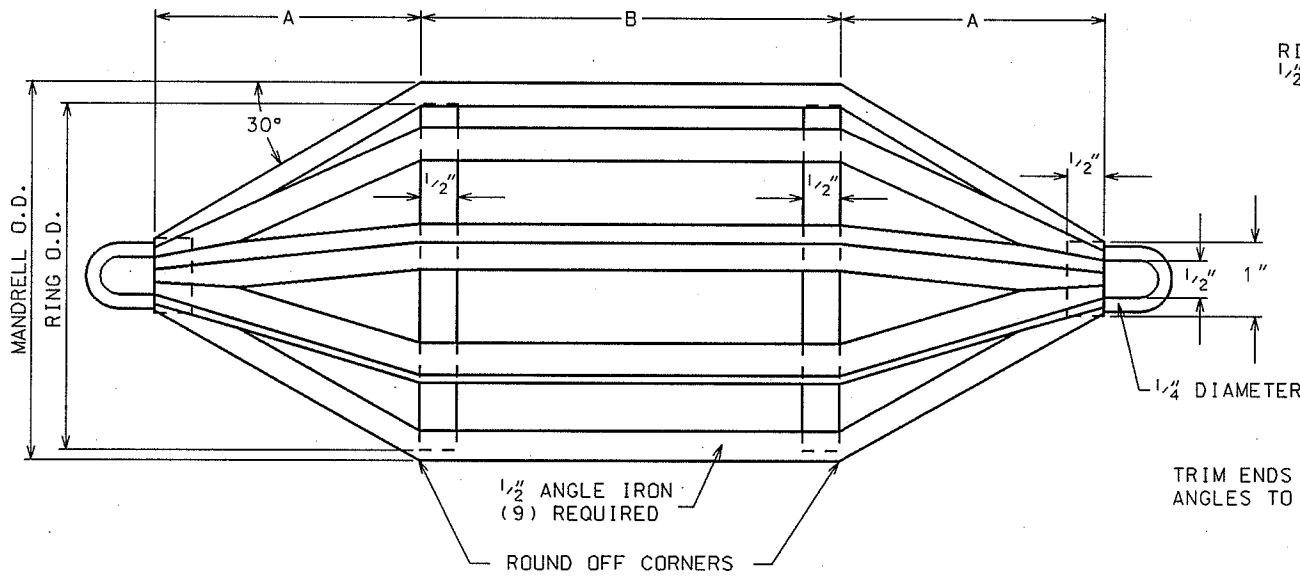
80.5

2004

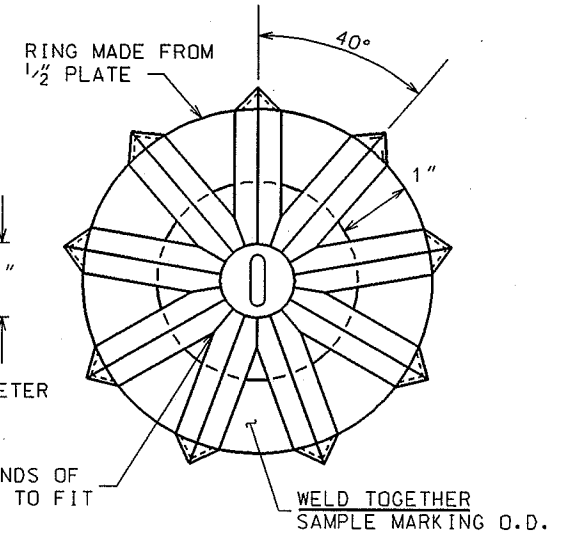
CITY OF MADISON
ENGINEERING DIVISION

MADISON STANDARD
CONCRETE CURB & GUTTER

STANDARD DETAIL DRAWING 3.08



SIDE VIEW



END VIEW

NOMINAL PIPE SIZE ID, in	DIMENSIONS		MANDRELL O.D., in	RING O.D., in
	A, in	B, in		
6	4.0	4	5.61	4.90
8	5.3	6	7.36	6.65
10	6.7	6	9.21	8.50
12	8.0	8	11.06	10.35
15	10.0	9	13.82	13.11

MANDREL FOR USE IN ALL P.V.C. SEWER PIPE

NOTE:

AFTER CONSTRUCTION IS COMPLETE, TRUE THE O.D. DIMENSION FOR THE FULL LENGTH OF "B" TO +/-0.010" BY TOOL AND LATHE OR GRINDING.

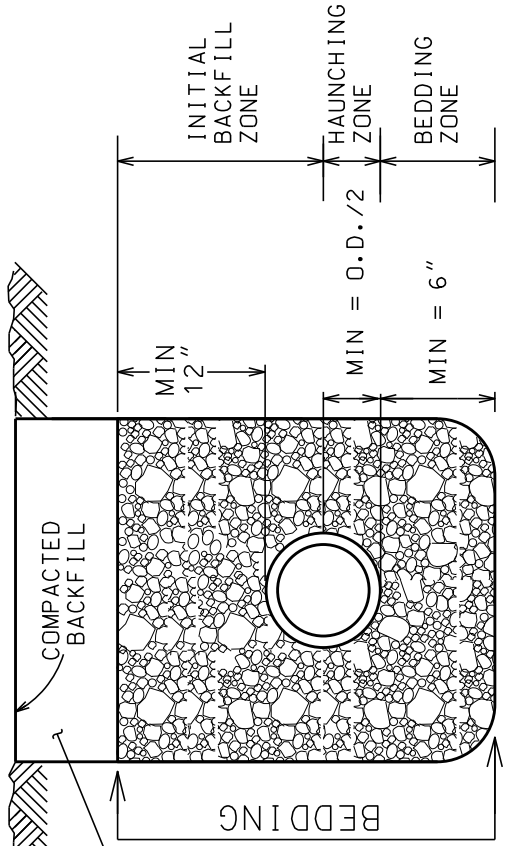
2004

CITY OF MADISON
ENGINEERING DIVISION

MANDREL DETAIL

STANDARD DETAIL DRAWING 5.1.1

MIN = O.D. + 24" OR 1.25 * O.D. + 12",
WHICHEVER IS GREATER

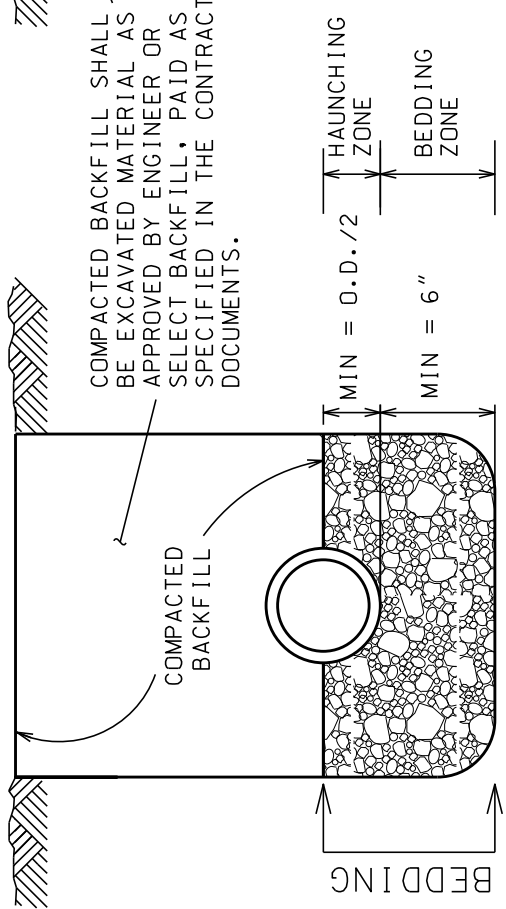


WASHED GRAVEL, CRUSHED STONE, SAND OR LIMESTONE SCREENINGS FOR PIPE SIZES 10" IN DIAMETER OR LESS. WASHED GRAVEL OR CRUSHED STONE FOR PIPE SIZES OVER 10" IN DIAMETER, AS SPECIFIED IN SECTION 502.1 (d), BEDDING OF SEWER PIPES



BEDDING FOR REINFORCED CONCRETE SEWER PIPES

MIN = O.D. + 24"



WASHED GRAVEL OR CRUSHED STONE AS SPECIFIED IN SECTION 502.1 (d), BEDDING OF SEWER PIPES



BEDDING FOR SANITARY PIPE

NOTES:

UNLESS OTHERWISE SPECIFIED, ALL SANITARY PIPES, INCLUDING LATERALS AND LEADS, SHALL BE INSTALLED WITH THE TYPE OF BEDDING SHOWN FOR THE TYPE AND SIZE OF PIPE INSTALLED.

THE COSTS OF BEDDING SHALL BE INCLUDED IN THE UNIT PRICES BID FOR THE PIPE. FOR RCP, BEDDING INCLUDES THE HAUNCHING & BEDDING ZONES. FOR PLASTIC PIPES, THE BEDDING INCLUDES THE HAUNCHING, BEDDING & INITIAL BACKFILL ZONES. THE BEDDING SHALL BE INSTALLED & COMPACTED IN 6" MAXIMUM LIFTS.

ALL TRENCHES SHALL BE HAND BACKFILLED TO A POINT 12" ABOVE THE TOP OF THE PIPE. ALL BEDDING SHALL BE MECHANICALLY COMPACTED.

PAYMENT SHALL NOT BE MADE FOR BACKFILL WITH EXCAVATED MATERIAL, IF APPROVED. SELECT FILL, IF REQUIRED, SHALL BE PAID PER CONTRACT.

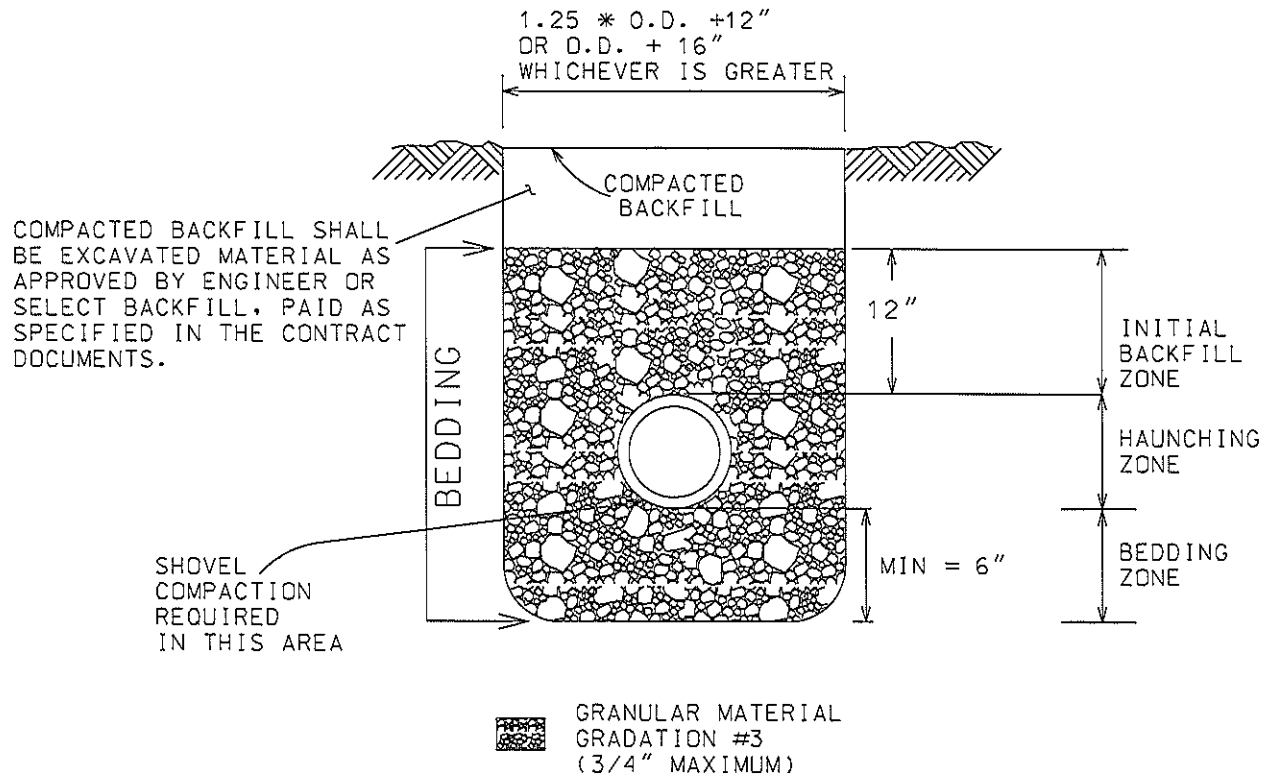
THE MAXIMUM ALLOWABLE TRENCH WIDTH SHALL BE 3 * O.D.; THE MINIMUM TRENCH WIDTH AS SPECIFIED, AND SHALL APPLY FROM THE BOTTOM OF THE TRENCH TO A POINT 12" ABOVE THE TOP OF THE PIPE. WHERE THIS WIDTH IS EXCEEDED, THE CONTRACTOR SHALL FURNISH AND INSTALL A HIGHER TYPE OF BEDDING AT **NO EXTRA COST**. THE TYPE OF BEDDING SHALL BE DETERMINED BY THE ENGINEER.

O.D. EQUALS THE OUTSIDE DIAMETER OF THE PIPE.

2016

CITY OF MADISON ENGINEERING DIVISION
PIPE BEDDING AND BACKFILL
STANDARD DETAIL DRAWING 5.2.1

DRAWING NOT TO SCALE



BEDDING FOR
TYPE II, TYPE III,
AND TYPE IV STORM PIPE,
SECTION 1 OF S.D.D 5.2.2

NOTES:

BEDDING SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321-14

THE COSTS OF BEDDING SHALL BE INCLUDED IN THE UNIT PRICES BID FOR THE PIPE. THE BEDDING INCLUDES THE HAUNCHING, BEDDING & INITIAL BACKFILL ZONES. THE BEDDING SHALL BE INSTALLED & COMPACTED IN 6" MAXIMUM LIFTS, AND SHOVEL COMPACTION UNDER THE HAUNCH OF PIPE IS REQUIRED.

ALL TRENCHES SHALL BE HAND BACKFILLED TO A POINT 12" ABOVE THE TOP OF THE PIPE. ALL BEDDING SHALL BE MECHANICALLY COMPACTED.

PAYMENT SHALL NOT BE MADE FOR BACKFILL WITH EXCAVATED MATERIAL, IF APPROVED. SELECT FILL, IF REQUIRED, SHALL BE PAID PER CONTRACT.

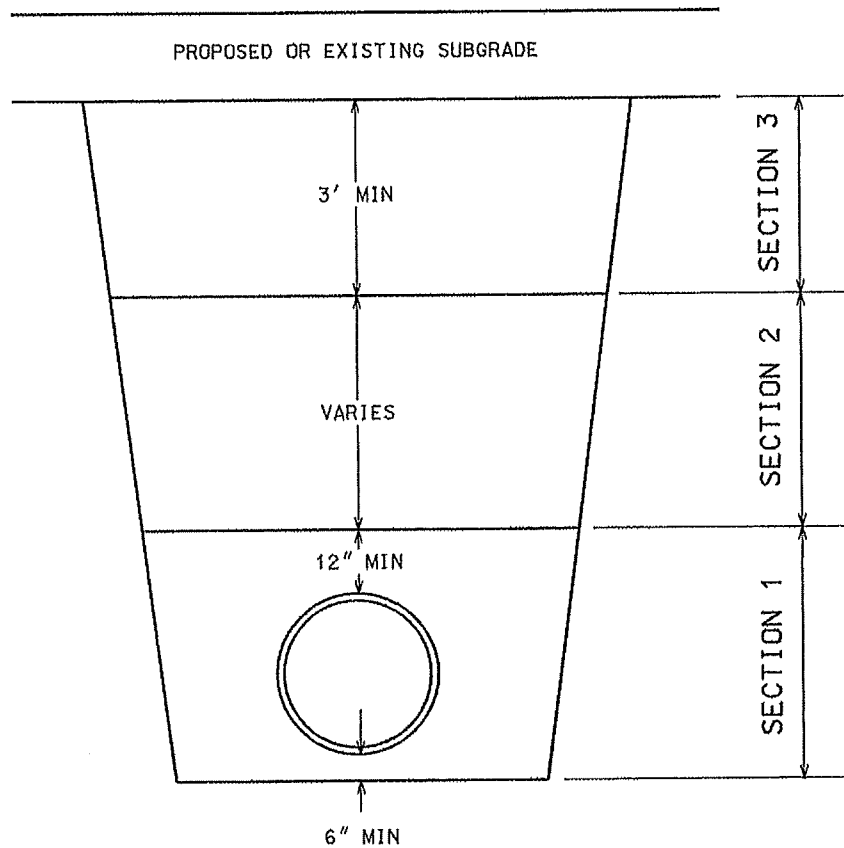
THE MAXIMUM ALLOWABLE TRENCH WIDTH SHALL BE THE MIN SPECIFIED PLUS 12", AND SHALL APPLY FROM THE BOTTOM OF THE TRENCH TO A POINT 12" ABOVE THE TOP OF THE PIPE. WHERE THIS WIDTH IS EXCEEDED, THE CONTRACTOR SHALL FURNISH AND INSTALL A HIGHER TYPE OF BEDDING AT NO EXTRA COST. THE TYPE OF BEDDING SHALL BE DETERMINED BY THE ENGINEER.

O.D. EQUALS THE OUTSIDE DIAMETER OF THE PIPE.

2016

CITY OF MADISON ENGINEERING DIVISION
STORM PIPE BEDDING AND BACKFILL - SECTION 1 OF S.D.D.5.2.2
STANDARD DETAIL DRAWING 5.2.1A

DRAWING NOT TO SCALE



TYPICAL TRENCH COMPACTION

ALL BACKFILL MATERIAL SHALL BE PLACED IN LIFTS NOT TO EXCEED 12" BEFORE COMPACTION UNLESS AUTHORIZED BY THE ENGINEER DUE TO THE CHARACTER OF THE MATERIAL AND THE COMPACTING EQUIPMENT. EACH LIFT SHALL BE MECHANICALLY COMPACTED TO THE REQUIRED DENSITY PRIOR TO PLACING SUCCEEDING LIFTS OF BACKFILL MATERIAL.

IN COLD WEATHER, TRENCHES SHALL BE COMPACTED IN ACCORDANCE WITH THE REQUIREMENTS SPECIFIED IN SECTION 502.1 (e), BACKFILLING EXCAVATIONS AND COMPACTION OF BACKFILL, OF THESE SPECIFICATIONS.

SECTION 1:

MECHANICALLY COMPACTED BEDDING AS REQUIRED BY THE SPECIFICATIONS. COMPACTION ACHIEVED WITH SMALLER PLATE COMPACTOR. FOR ALL PLASTIC PIPE SECTION 1 SHALL BE INSTALLED IN ACCORDANCE WITH S.D.D. 5.2.1A

SECTION 2:

MINIMUM COMPACTION OF 90% MAXIMUM DENSITY. COMPACTION OF BACKFILL WITH BOMAG OR HOE-PAC SHALL NOT BEGIN UNTIL THE DEPTH OF BACKFILL MATERIAL IS TWO FEET ABOVE THE TOP OF PIPE.

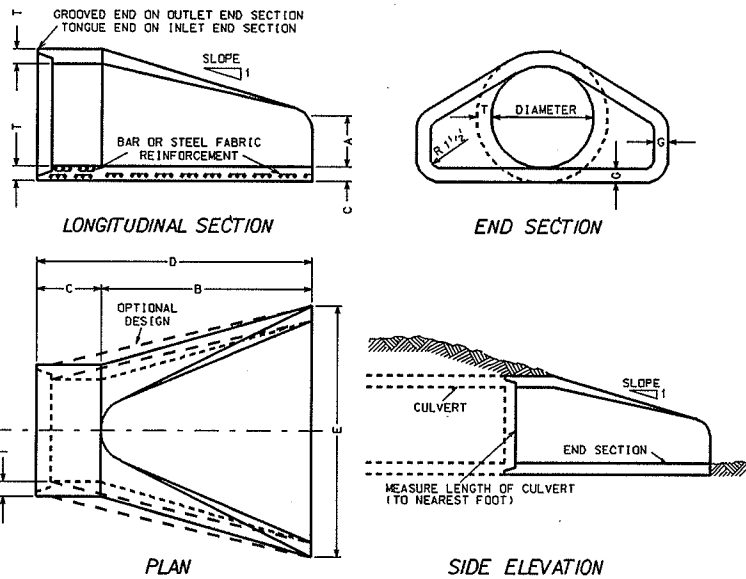
SECTION 3:

MINIMUM COMPACTION OF 95% MAXIMUM DENSITY.

2011

CITY OF MADISON ENGINEERING DIVISION
TYPICAL TRENCH COMPACTION
STANDARD DETAIL DRAWING 5.2.2

REINFORCED CONCRETE APRON ENDWALLS



DIA	APPROX. WEIGHT/SECTION	T	A	B	C	D	E	G	APPROX. SLOPE
12"	530	2"	4"	24"	48 1/4"	72 1/4"	24"	2"	3 TO 1
15"	740	2 1/2"	6"	27"	46"	73"	30"	2 1/4"	3 TO 1
18"	990	2 1/2"	9"	27"	46"	73"	36"	2 1/2"	3 TO 1
21"	1280	2 3/4"	9"	36"	37 1/2"	73 1/2"	42"	2 3/4"	3 TO 1
24"	1520	3"	9 1/2"	43 1/2"	30"	73 1/2"	48"	3"	3 TO 1
27"	1930	3 1/4"	10 1/2"	49 1/2"	24"	73 1/2"	54"	3 1/4"	3 TO 1
30"	2190	3 1/2"	12"	54"	19 3/4"	73 3/4"	60"	3 1/2"	3 TO 1
36"	4100	4"	15"	63"	34 3/4"	97 3/4"	72"	4"	3 TO 1
42"	5380	4 1/2"	21"	63"	35"	98"	78"	4 1/2"	3 TO 1
48"	6550	5"	24"	72"	26"	98"	84"	5"	3 TO 1
54"	8040	5 1/2"	27"	65"	33 1/4"/35"	98 1/4"/100"	90"	5"	2 1/2 TO 1
60"	8730	6"	30"/35"	60"	39"	99"	96"	5"	2 TO 1
66"	10630	6 1/2"	24"/30"	72"/78"	21"/27"	99"	102"	5 1/2"	2 TO 1
72"	12520	7"	24"/36"	78"	21"	99"	108"	6"	2 TO 1
78"	14430	7 1/2"	24"/36"	78"	21"	99"	114"	6 1/2"	2 TO 1
84"	18160	8"	36"	90 1/2"	21"	111 1/2"	120"	6 1/2"	1 1/2 TO 1

NOTE: MINIMUM/MAXIMUM

GENERAL NOTES:

DETAILS OF CONSTRUCTION, MATERIALS, AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

VARIATIONS OF THE DIMENSIONS AND DESIGNS SHOWN BEFORE WILL BE PERMITTED PROVIDING EQUIVALENT CAPACITY AND STRUCTURAL INTEGRITY ARE ATTAINED, AND PRIOR APPROVAL OF THE ENGINEER IS OBTAINED.

CONCRETE CULVERT ENDWALLS MAY NOT BE USED WITH GALVANIZED STEEL OR ALUMINUM CULVERT PIPE OR VICE VERSA.

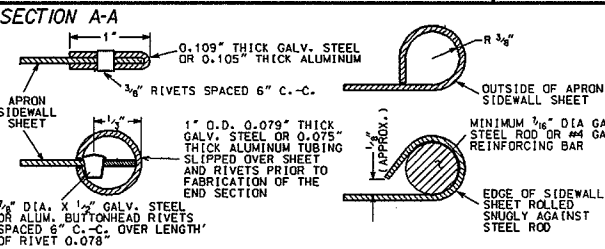
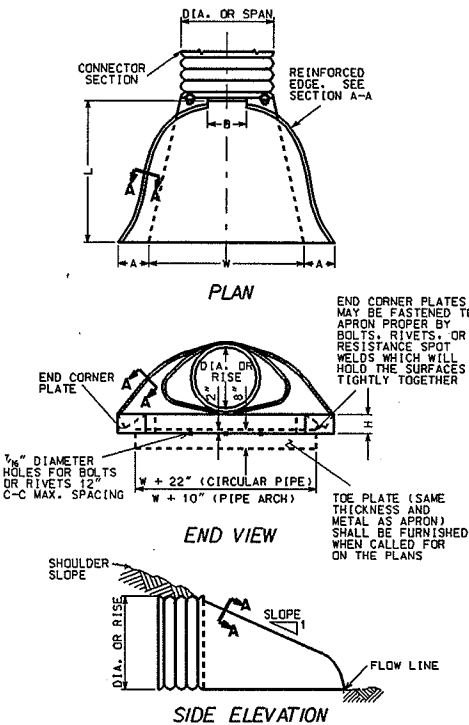
GALVANIZED STEEL OR ALUMINUM ENDWALLS SHALL NORMALLY BE INSTALLED ON CULVERT PIPE OF THE SAME METAL. THE USE OF GALVANIZED STEEL ENDWALLS ON ALUMINUM PIPES IS PERMITTED, PROVIDED THE TWO METALS AT THE JOINT INTERFERENCE ARE KEPT SEPARATED BY A SUITABLE INSULATING MATERIAL APPROXIMATELY 1/8" THICK OR GREATER. SUCH MATERIAL WOULD BE AN ASPHALT IMPREGNATED FABRIC, A SHEET PLASTIC, A RUBBER GASKET OR OTHER NONBIODEGRADABLE MATERIAL OF SUBSTANTIAL STRENGTH.

WHEN TWO OR MORE PIPE ARCHES WITH APRON ENDWALLS ARE TO BE LAID ADJACENT TO EACH OTHER, THEY SHALL BE SEPARATED BY THE FOLLOWING AMOUNT.
 PIPES: TOTAL WIDTH OF APRON ENDWALL LESS THE DIAMETER OF PIPE PLUS 6 INCHES.
 PIPE ARCHES: TOTAL WIDTH OF APRON ENDWALL LESS THE SPAN DIMENSION OF THE PIPE ARCH PLUS 6 INCHES.

METAL APRON ENDWALLS FOR PIPE ARCHES

PIPE-ARCH DIMENSIONS SPAN RISE	MIN. METAL THICK	DIMENSIONS					APPROX. SLOPE	
		A +/-1"	B MAX	H +/-1"	L +/-1 1/2"	W +/-2"		
17"	13"	0.064	7"	9"	6"	19"	31"	2 1/2 TO 1
21"	15"	0.064	7"	10"	6"	23"	26"	2 1/2 TO 1
24"	18"	0.064	8"	12"	6"	28"	42"	2 1/2 TO 1
28"	20"	0.064	9"	14"	6"	32"	48"	2 1/2 TO 1
35"	24"	0.079	10"	16"	6"	39"	60"	2 1/2 TO 1
42"	29"	0.079	12"	18"	8"	46"	75"	2 1/2 TO 1
49"	33"	0.109	13"	21"	9"	53"	85"	2 1/2 TO 1
57"	38"	0.109	18"	26"	12"	63"	90"	2 1/2 TO 1
64"	43"	0.109	18"	30"	12"	70"	102"	2 1/2 TO 1
71"	47"	0.109	18"	33"	12"	77"	114"	2 1/2 TO 1
77"	52"	0.109	18"	36"	12"	77"	126"	2 TO 1
83"	57"	0.109	18"	39"	12"	77"	138"	2 TO 1

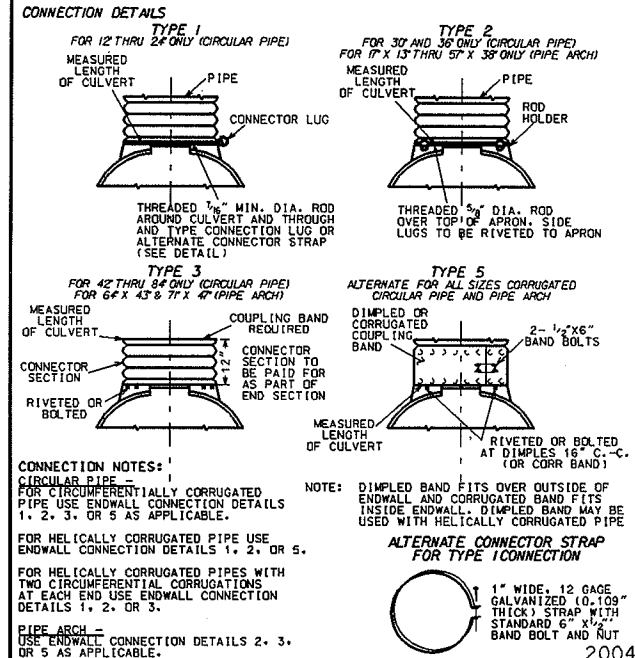
NOTE: ALL SPLICES TO BE LAP RIVETED OR BOLTED



METAL OR ALUMINUM APRON ENDWALLS FOR CIRCULAR PIPES

DIA	MIN. METAL THICKNESS	MIN. ALUM THICKNESS	DIMENSIONS					APPROX. SLOPE
			A +/-1"	B MAX	H +/-1"	L +/-1 1/2"	W +/-2"	
12"	0.064	0.060	6"	6"	6"	21"	24"	2 1/2 TO 1
15"	0.064	0.060	7"	8"	6"	26"	30"	2 1/2 TO 1
18"	0.064	0.060	8"	10"	6"	31"	36"	2 1/2 TO 1
21"	0.064	0.060	9"	12"	6"	36"	42"	2 1/2 TO 1
24"	0.064	0.075	10"	13"	6"	41"	48"	2 1/2 TO 1
30"	0.079	0.105	12"	16"	8"	51"	60"	2 1/2 TO 1
36"	0.079	0.105	14"	19"	9"	60"	72"	2 1/2 TO 1
42"	0.109	0.105	16"	22"	11"	69"	84"	2 1/2 TO 1
48"	0.109	0.105	18"	27"	12"	78"	90"	2 1/2 TO 1
54"	0.109	0.105	18"	30"	12"	84"	102"	2 TO 1
60"	0.109	N/A	18"	33"	12"	87"	114"	1 3/4 TO 1
66"	0.109	N/A	18"	36"	12"	87"	120"	1 1/2 TO 1
72"	0.109	N/A	18"	39"	12"	87"	126"	1 1/2 TO 1
78"	0.109	N/A	18"	42"	12"	87"	132"	1 1/4 TO 1
84"	0.109	N/A	18"	45"	12"	87"	138"	1 1/4 TO 1

NOTE: ALL SPLICES TO BE LAP RIVETED OR BOLTED

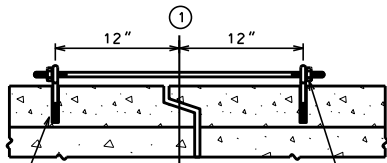
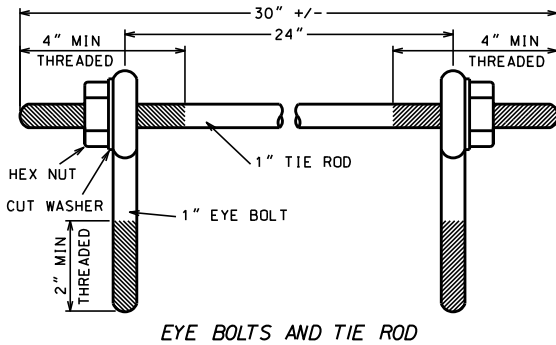


CITY OF MADISON
ENGINEERING DIVISION

APRON ENDWALLS FOR PIPES AND PIPE ARCHES

STANDARD DETAIL DRAWING 5.4.1

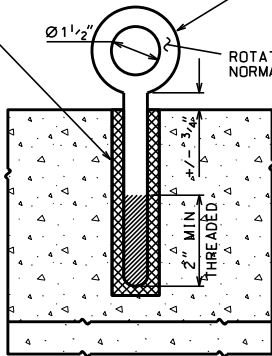
ALTERNATE 1
EYE BOLT AND TIE ROD ASSEMBLY
 (JOINT TIES FOR 72" DIA AND OVER CONCRETE PIPE)



② INSERT. CAST-IN-PLACE DURING FABRICATION FOR 1" DIA. EYE BOLT

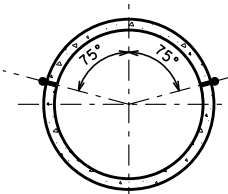
WELDED EYE BOLT OR APPROVED EQUAL

ROTATE 90° FOR NORMAL POSITION



(CAST-IN-PLACE THREADED INSERT)
 LONGITUDINAL SECTIONS

PLACEMENT OF (2) CAST-IN-PLACE INSERTS OR HOLES DURING FABRICATION FOR PIPE SECTIONS REQUIRING TIE RODS



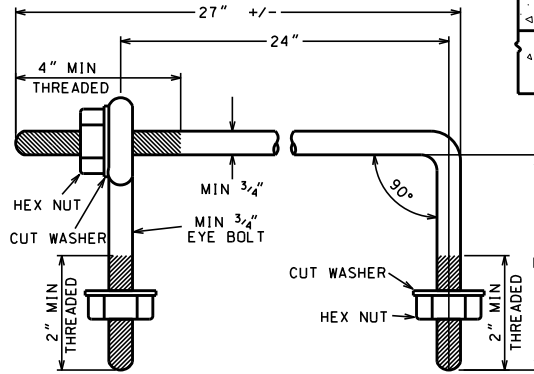
TRANSVERSE SECTION

GENERAL NOTES:

CONCRETE CULVERT PIPE SHALL BE TIED TOGETHER IN THE MANNER ILLUSTRATED BY THIS DETAIL AND PER STANDARD SPEC. 504.3 (C) AT LOCATION DESIGNATED ON THE PLAN. THE CONTRACTOR MAY USE EITHER ALTERNATE 1, 2, OR 3 FOR DRAINAGE STRUCTURES. ONLY ALTERNATE 1 AND 3 MAY BE USED FOR CATTLE PASSES. UNLESS OTHERWISE STATED IN THE CONTRACT, THE MATERIALS, FABRICATION AND WORK NECESSARY TO THE CULVERT PIPE AS INDICATED ON THE PLANS AND BY THIS DETAIL WILL BE CONSIDERED INCIDENTAL TO CULVERT PIPE, REINFORCED CONCRETE CULVERT PIPE, OR REINFORCED CONCRETE PIPE CATTLE PASS.

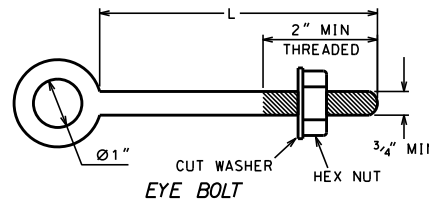
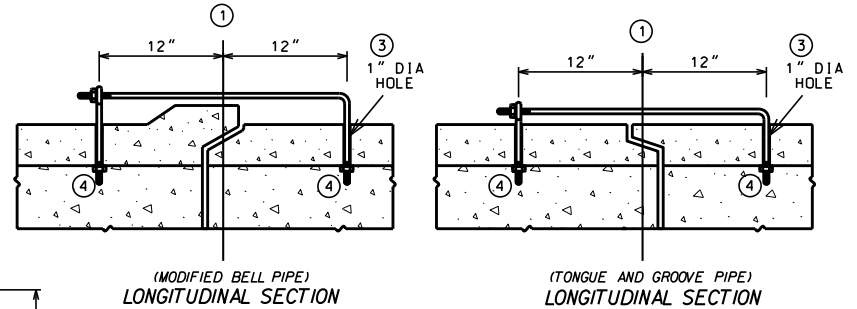
DETAILED DRAWINGS FOR PROPOSED ALTERNATE DESIGNS FOR JOINT TIES SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.

ALTERNATE 2
EYE BOLT AND TIE ROD ASSEMBLY
 (JOINT TIES FOR 18" TO 66" DIA CONCRETE PIPE)



NOTE: TWO EYE BOLTS MAY BE USED WITH A 30" LONG THREADED ROD IN LIEU OF THE 90° BENT TIE ROD

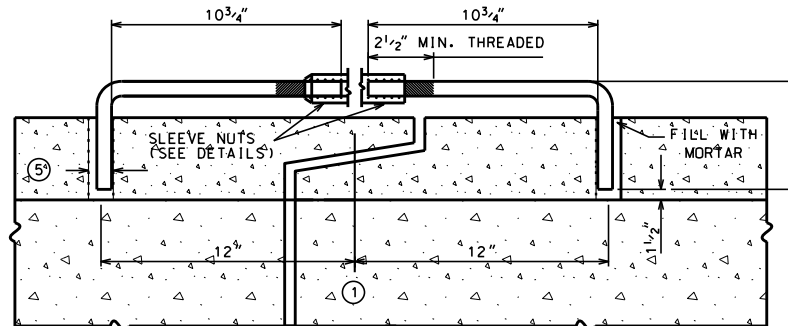
EYE BOLT AND TIE ROD



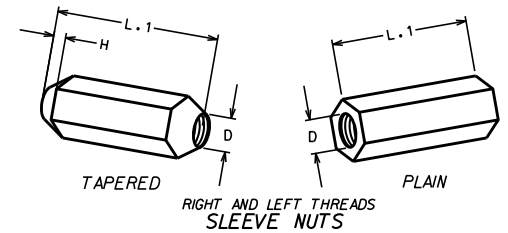
PIPE SIZE	L = LENGTH	
	TONGUE & GROOVE PIPE	MODIFIED BELL PIPE
18" TO 24"	4 1/2"	6 1/4"
30"	5"	7"
36"	5 1/2"	7"
42"	6"	
48"	6 1/2"	
60"	7 1/2"	
66"	8"	

EYE BOLT DIMENSION TABLE

ALTERNATE 3
ADJUSTABLE TIE ROD
 (JOINT TIES FOR 12" TO 108" DIA CONCRETE PIPE)



LONGITUDINAL SECTION



PIPE DIAMETER	TIE ROD DIAMETER	D	L	H	R
12" TO 30"	1/2"	1/2"	5"	1/2"	1 3/4"
66" TO 84"	3/4"	3/4"	5"	1/2"	5"
90" TO 104"	1"	1"	7"	1 1/16"	7 1/2"

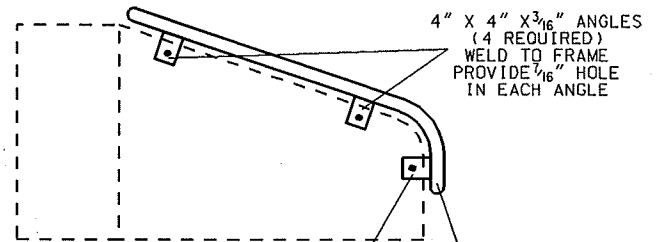
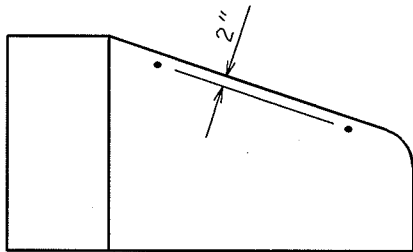
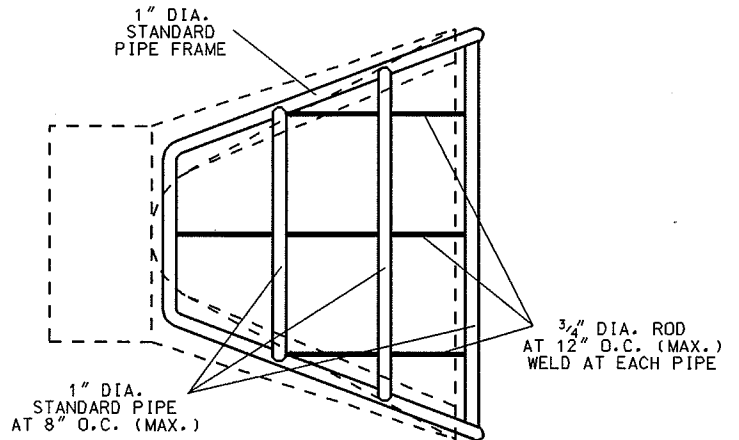
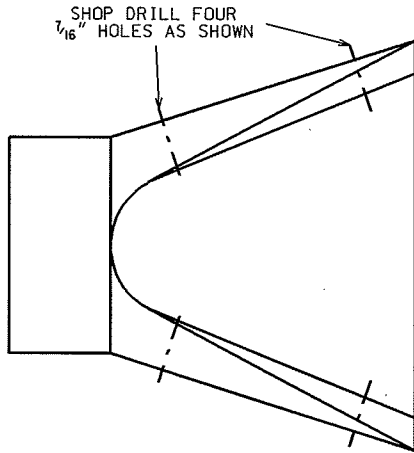
ADJUSTABLE TIE ROD TABLE

- ① C OF TONGUE AND GROOVE OR BELL AND SPIGOT JOINTS
- ② THE INSIDE OF THE THREADED INSERTS SHALL BE CLEAN TO ALLOW THE INSERTION OF THREADED EYE BOLTS
- ③ HOLES SHALL BE CAST-IN-PLACE OR DRILLED, 12" FROM C OF TONGUE AND GROOVE
- ④ RODS SHALL BE CUT FLUSH W/ BOLT HEAD OR THE TIE SYSTEM ROTATED SO THE NUT IS ON THE OUTSIDE OF THE PIPE
- ⑤ ROD DIAMETER = 1 INCH

CITY OF MADISON
 ENGINEERING DIVISION

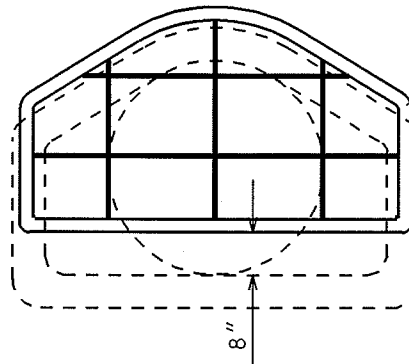
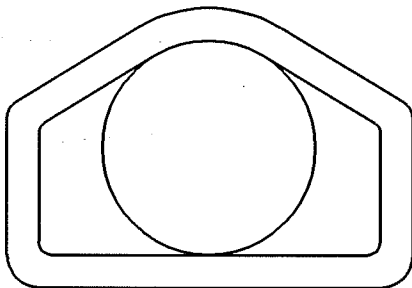
**CONCRETE PIPE
 JOINT TIES**

STANDARD DETAIL DRAWING 5.4.6



PROVIDE 2 ADDITIONAL
CONNECTIONS WHEN
PIPE IS 36" OR LARGER

1" DIA.
STANDARD
STEEL PIPE



THE CONTRACTOR SHALL BOLT THE PIPE GATE
TO THE CONCRETE ENDWALL WITH FOUR $\frac{3}{8}$ " X 6"
MACHINE BOLTS WITH NUTS ON INSIDE WALL.

PAINING SPECIFICATIONS

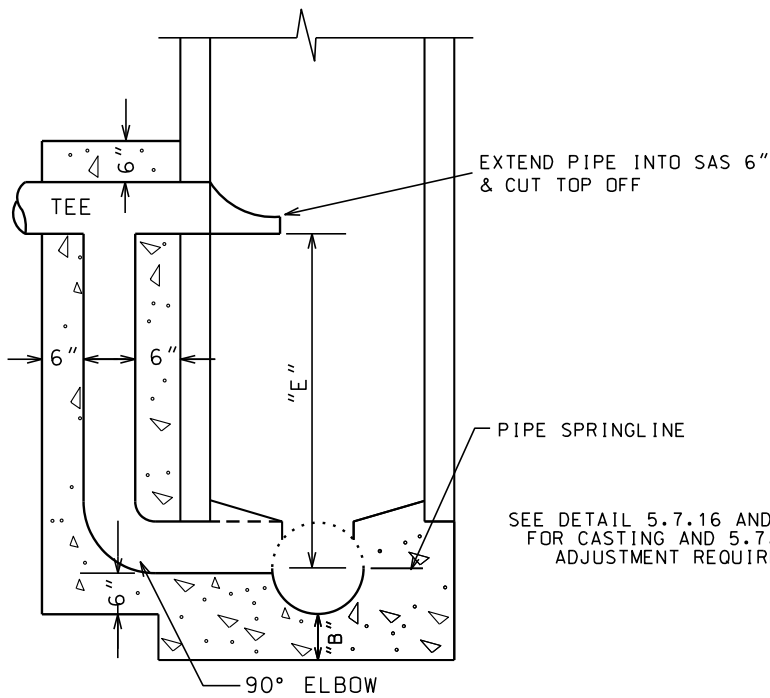
FOR PAINTING REQUIREMENTS, SEE SECTION 506.2 (b)
STRUCTURAL STEEL PAINT-EPOXY
SYSTEM FOR STORM SEWER GRATES/GATES

2004

CITY OF MADISON
ENGINEERING DIVISION

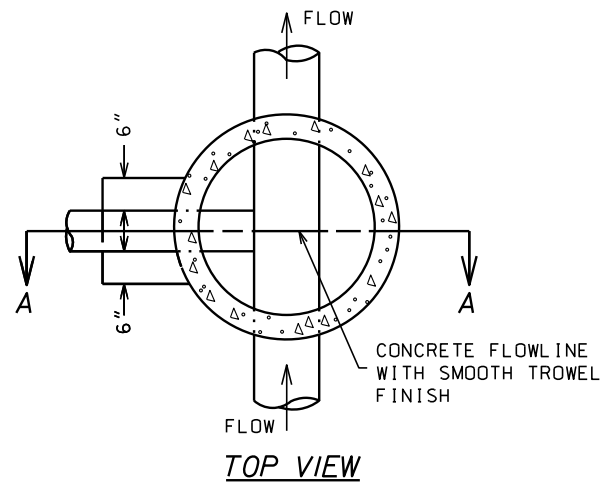
RCP AE
GATE

STANDARD DETAIL DRAWING 5.6.1



DETAIL A

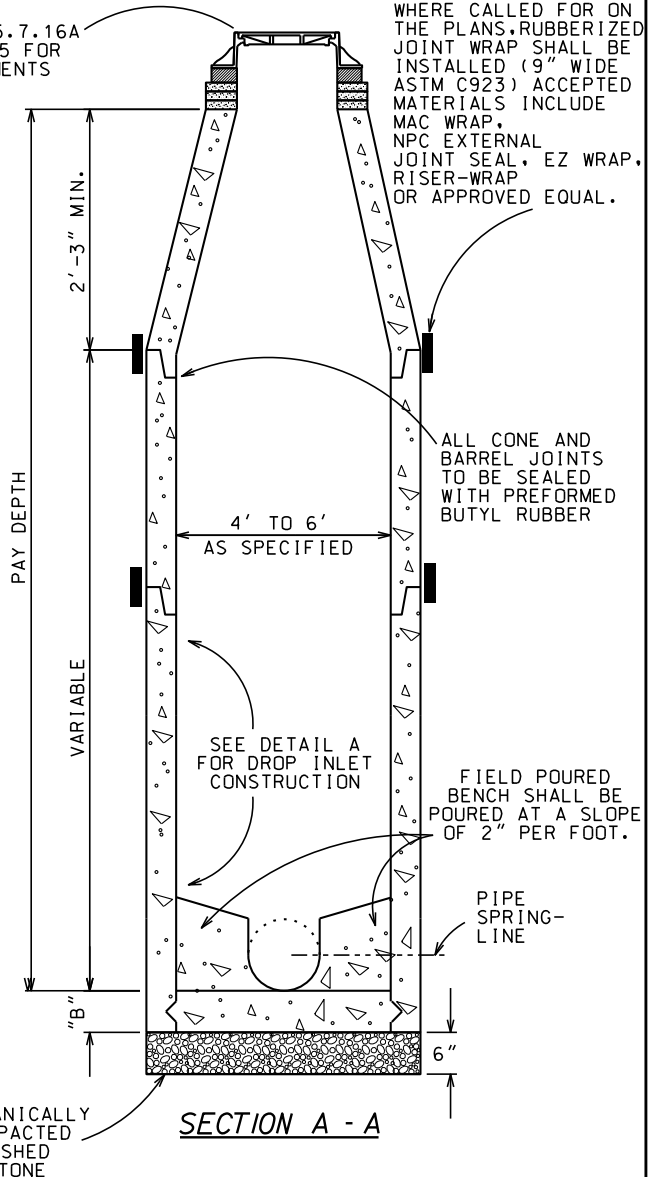
SHOWING DROP INLET CONSTRUCTION FOR SANITARY SEWER MAINS & LATERALS



TOP VIEW

SEE DETAIL 5.7.16 AND 5.7.16A FOR CASTING AND 5.7.15 FOR ADJUSTMENT REQUIREMENTS

WHERE CALLED FOR ON THE PLANS, RUBBERIZED JOINT WRAP SHALL BE INSTALLED (9" WIDE ASTM C923) ACCEPTED MATERIALS INCLUDE MAC WRAP, NPC EXTERNAL JOINT SEAL, EZ WRAP, RISER-WRAP OR APPROVED EQUAL.



SECTION A - A

NOTES:

- 1) PRECAST S.A.S. SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ASTM C-478.
- 2) THICKNESS OF BASE, "B":
6" MIN. FOR 4' DIAMETER SAS
8" MIN. FOR 5' AND 6' DIAMETER SAS
- 3) FOR CASTING DESIGNATION REFER TO STANDARD DETAIL DRAWING 5.7.16 AND 5.7.16A
- 4) CENTERED (CONCENTRIC) CONE SHALL BE INSTALLED UNLESS OTHERWISE DIRECTED.
- 5) DROP INLET SHALL BE BUILT FOR ALL SEWER MAINS AND LATERALS WHEN "E" IS GREATER THAN 24". "E" SHOULD BE MEASURED FROM INVERT OF INCOMING PIPE TO THE SPRINGLINE OF THE OUTGOING SEWER. INSIDE DROP PER STANDARD DETAIL DRAWING 5.7.30 MAY BE INSTALLED FOR 4" AND 6" SERVICE CONNECTIONS WHERE OUTSIDE DROP INLET CONSTRUCTION IS INFEASIBLE. ENGINEER SHALL APPROVE INSIDE DROP INLET PRIOR TO INSTALLATION.
- 6) FLEXIBLE PIPE TO SAS CONNECTOR REQUIRED PER STANDARD DETAIL DRAWING 5.7.31
- 7) ALL BENCHES TO BE FIELD POURED CONCRETE WITH SMOOTH TROWEL FINISH. PRECAST BENCHES ONLY PERMITTED WITH PRIOR APPROVAL OF ENGINEER IN WRITING.
- 8) ALL JOINTS BETWEEN RINGS SHALL BE SEALED WITH $\frac{3}{8}$ " OF AIR-ENTRAINED TYPE M OR S MORTAR. THE OUTSIDE SURFACE OF THE ADJUSTING RINGS SHALL BE SEALED WITH A $\frac{1}{2}$ " THICK AIR-ENTRAINED MORTAR TYPE M OR S SEAL. THE METHOD USED FOR SEALING THE OUTSIDE SURFACE SHALL BE COMPATIBLE WITH THAT USED TO SEAL JOINTS BETWEEN THE RINGS.
- 9) PRECAST SANITARY SEWER ACCESS STRUCTURES FOR STREET RECONSTRUCTION PROJECTS AND FOR STREET EXCAVATION PERMITS REQUIRE PRECAST SHOP DRAWING APPROVAL FROM CITY ENGINEERING. PRIOR TO BEING FABRICATED BY THE MANUFACTURER NO PRECAST SHOP DRAWINGS ARE REQUIRED FOR NEW CONSTRUCTION IN SUBDIVISION DEVELOPMENTS.

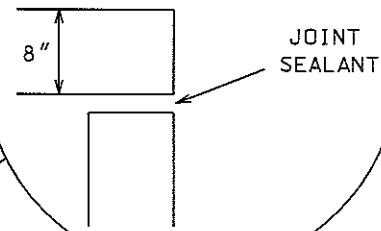
2015

CITY OF MADISON ENGINEERING DIVISION
SANITARY SEWER PRECAST SAS
STANDARD DETAIL DRAWING 5.7.2

5.7.5

SEE DETAIL 5.7.15
FOR CASTING AND
ADJUSTMENT REQUIREMENTS

ALTERNATE ROOF DETAIL



PIPE MAY BE PLACED
AT ANY LOCATION IN
CUT OUT PROVIDED
INVERTS MATCH THOSE
IN THE STORM TABLE

JOINT WILL BE SEALED WITH CONSEAL
(CS - 102 OR CS - 202) DEPENDING ON
FIELD TEMPERATURES

DIMENSION FROM BOTTOM OF GROOVE
TO TOP OF CUT OUT SHALL BE SUCH THAT
THE BOTTOM OF THE GROOVE IS INTACT.

CONCRETE COLLAR REQUIRED AROUND
ALL PIPE/STRUCTURE CONNECTIONS.
CONTRACTOR WILL USE A MECHANICAL
VIBRATOR DURING CONSTRUCTION OF
THE FLOOR AND COLLAR.

CIRCUMFERENTIAL
ROUGH SCORED
NOTCH CENTERED
IN BASE

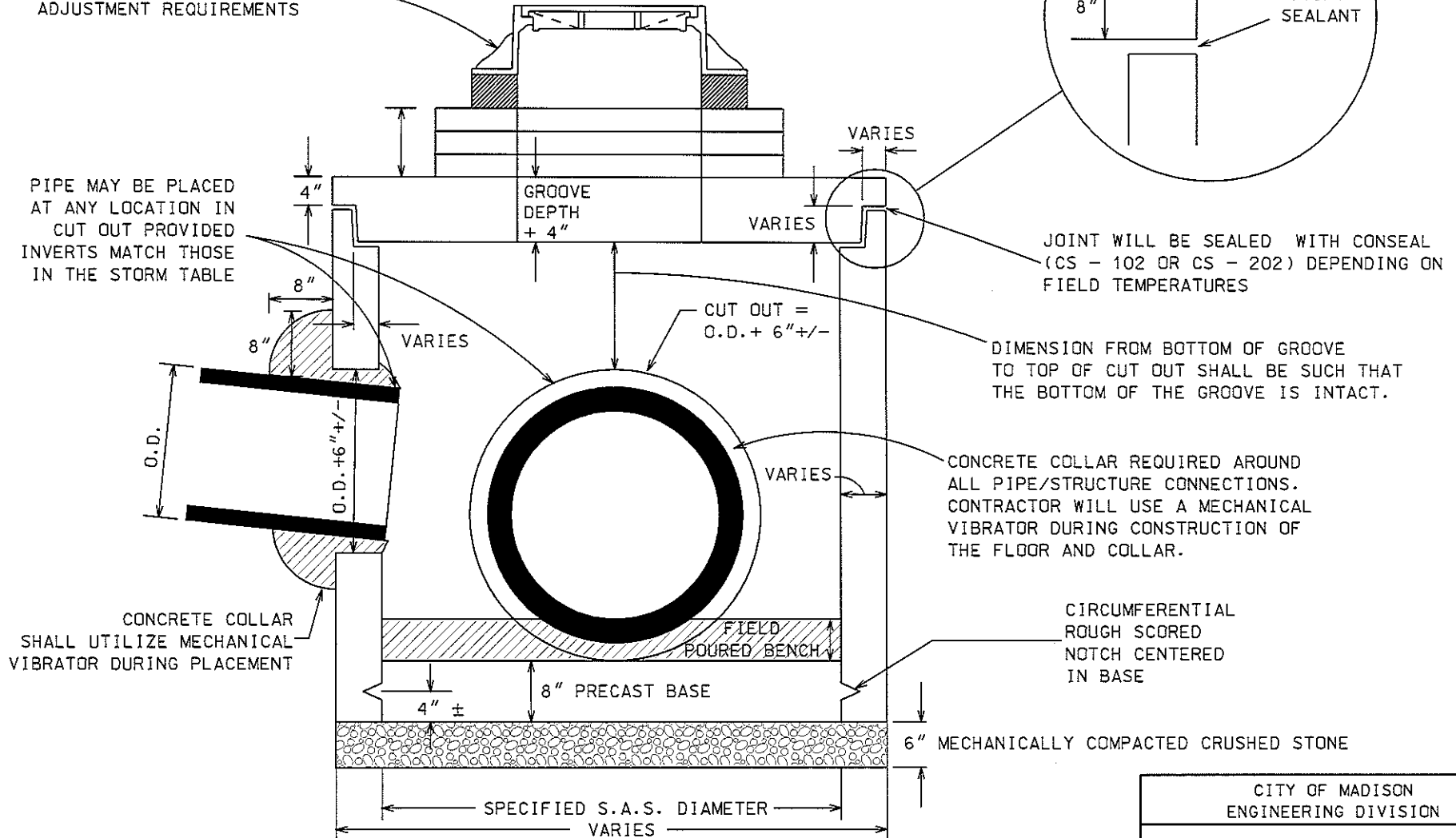
6" MECHANICALLY COMPACTED CRUSHED STONE

2006

CITY OF MADISON
ENGINEERING DIVISION

STORM SEWER
PRECAST SAS
(THROUGH SECTION VIEW)

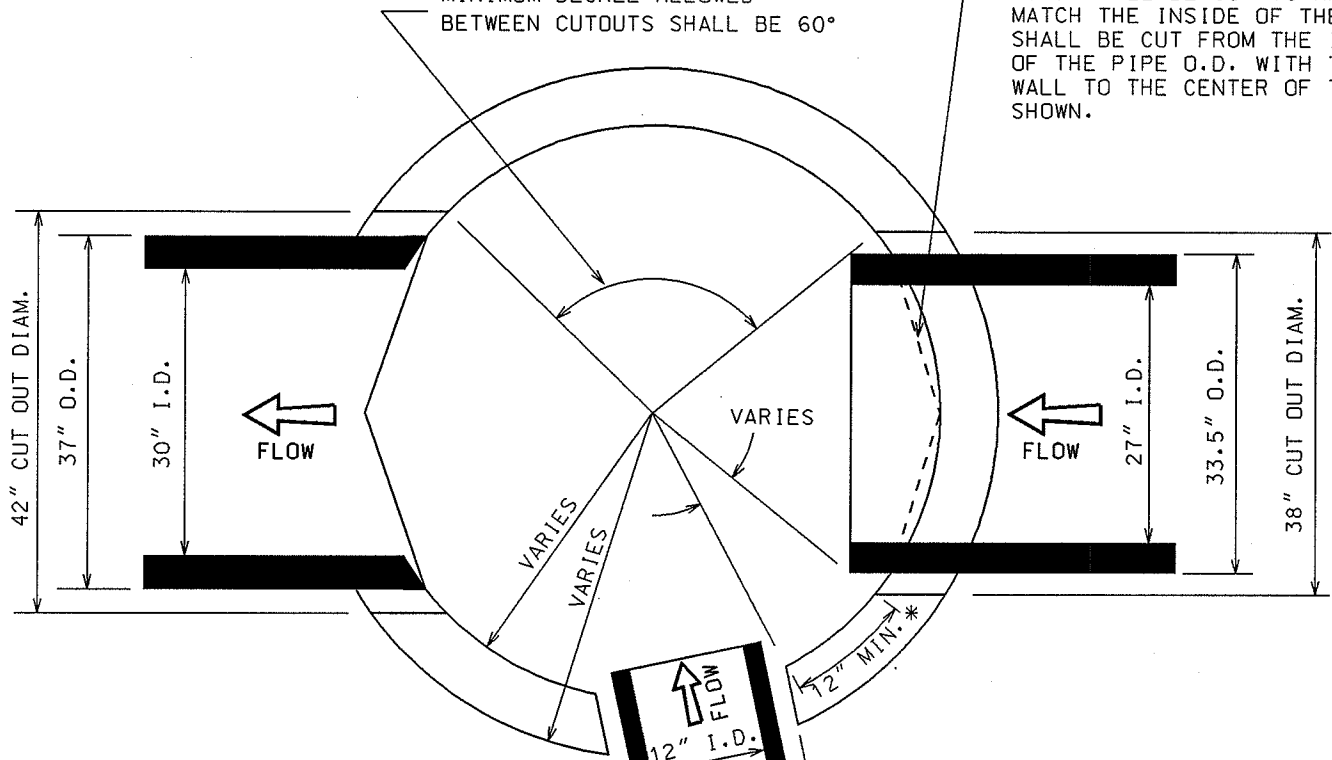
STANDARD DETAIL DRAWING 5.7.5



NOTE: ALL STORM SEWER ACCESS STRUCTURES (S.A.S.) SHALL BE CONSTRUCTED IN COMPLIANCE WITH ASTM C478

NOTE: FOR STRAIGHT THROUGH PIPE ALIGNMENTS IN STORM SEWER ACCESS STRUCTURES THE MINIMUM DEGREE ALLOWED BETWEEN CUTOUTS SHALL BE 60°

PIPE SHALL BE CUT TO APPROXIMATELY MATCH THE INSIDE OF THE S.A.S.. PIPES SHALL BE CUT FROM THE INTERSECTION OF THE PIPE O.D. WITH THE STRUCTURE WALL TO THE CENTER OF THE PIPE AS SHOWN.



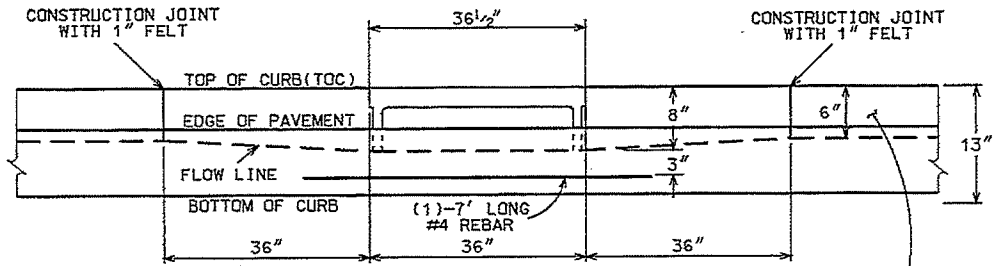
5.7.6

* 12" OF CONCRETE MINIMUM, AS MEASURED ALONG THE INSIDE WALL RADIALLY FROM THE CLOSEST POINT BETWEEN CUTOUTS, SHALL BE PROVIDED IN THE DESIGN OF ALL PRECAST SEWER ACCESS STRUCTURES. WHEN MEASURED IN THE FIELD THIS DIMENSION SHALL BE ALLOWED TO BE 10" DUE TO MANUFACTURING TOLERANCES. STRUCTURES WITH LESS THAN 10" SHALL ONLY BE ALLOWED WITH THE CONSTRUCTION ENGINEER'S APPROVAL.

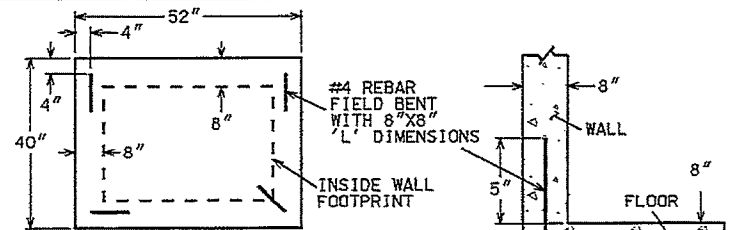
** NOTE: PIPES SHOWN IN VARIOUS CONSTRUCTION STAGES FOR ILLUSTRATIVE PURPOSES.

2004

CITY OF MADISON ENGINEERING DIVISION
STORM SEWER PRECAST SAS (TOP VIEW)
STANDARD DETAIL DRAWING 5.7.6



FRONT ELEVATION

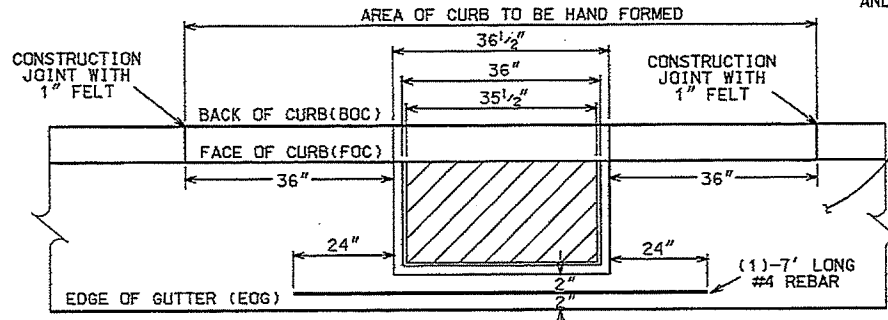


THREE ACCEPTABLE ORIENTATIONS OF LEG INTO BASE SHOWN. CENTER REBAR AT THE CORNER OF THE INLET.

TOP VIEW OF FLOOR WITH INSIDE WALL FOOTPRINTS

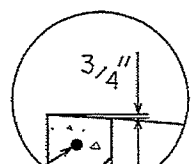
INLET WALL AND FLOOR INTERSECTION

FIELD POURED FLOOR REINFORCEMENT



PLAN VIEW

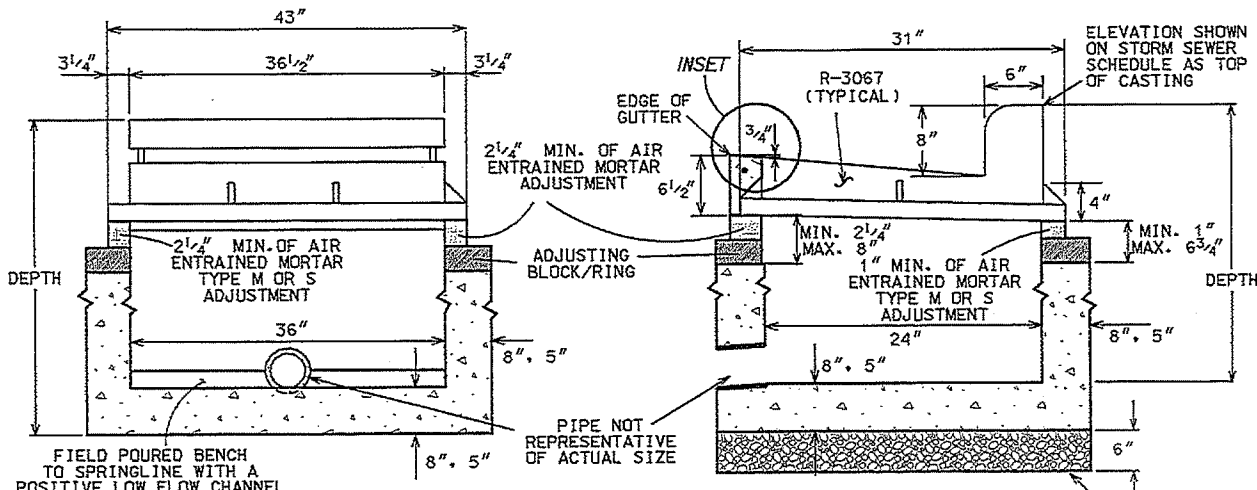
NOTE: TYPE "A" CURB AND GUTTER SHOWN



NOTE: 3/4" TILT CREATES SPECIFIED FLOW LINE DEPRESSION

INSET

- NOTES:
1. PRECAST REINFORCED CONCRETE STRUCTURES MAY BE USED IF APPROVED ACCORDING TO SECTION 106.3, 507.3 (b) OF THE STANDARD SPECIFICATIONS.
 2. INSTALLATION COST OF INLETS SHALL INCLUDE THE COST OF REINFORCING BARS AS FOLLOWS:
 - (1) - #4 BARS 7'-0" LONG IN CONCRETE GUTTER ALONG THE FRONT OF INLET.
 - (4) #4 REBARS FIELD BENT WITH 8"x8" 'L' DIMENSIONS.
 3. WHEN AN "S" INLET IS SPECIFIED, THE INSIDE DIMENSIONS OF THE STANDARD "H" INLET SHALL BE ALTERED TO 2'-4" x 1'-6".
 4. PRECAST INLETS REQUIRE 2" OF CONCRETE FROM THE EDGE OF CUTOFF/KNOCKOUT TO THE INSIDE WALLS AND TO THE TOP OF STRUCTURE. FIELD POURED STRUCTURES SHALL HAVE A BENCH POURED INSIDE TO THE SPRINGLINE OF THE PIPES CREATING A POSITIVE LOW FLOW CHANNEL AS SHOWN IN THE TYPICAL FRONT SECTION VIEW.
 5. ASSUMING 90 DEGREE PIPE CONNECTIONS, THE MAXIMUM PIPE OUT A 3' SIDE IS 24" AND THE MAXIMUM PIPE OUT A 2' SIDE IS 12".
 6. WALL THICKNESS DIMENSIONS OF 8" AND 5" CORRESPOND TO CAST-IN-PLACE AND PRECAST STRUCTURES, RESPECTIVELY.
 7. THERE SHALL BE AN 8" FLOWLINE DEPRESSION FROM TOC ALONG THE INLET TAPERED FROM THE TYPICAL 6" FLOWLINE AS SHOWN IN THE FRONT ELEVATION.
 8. SEE STANDARD DETAIL DRAWING 5.7.29 FOR INLET CASTING OFFSET CRITERIA FOR H INLETS.
 9. FLOOR REINFORCEMENT REQUIRED IN ALL FIELD POURED INLETS



TYPICAL FRONT SECTION

TYPICAL SECTION

DRAWING NOT TO SCALE

INLET DEPTH AS PER PLANS

INLET DEPTH AS PER PLANS

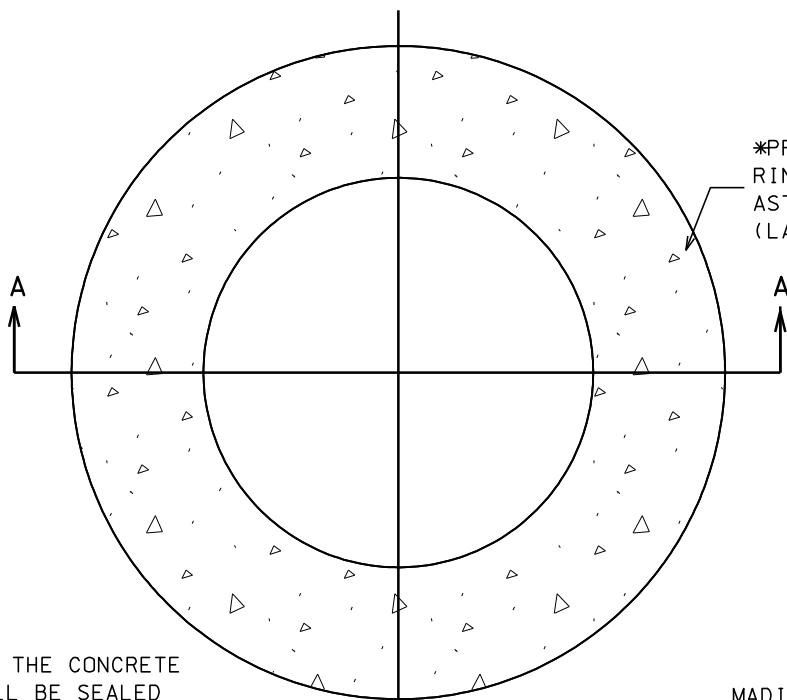
5.7.7

2011

CITY OF MADISON
ENGINEERING DIVISION

TYPE "H"
INLET

STANDARD DETAIL DRAWING 5.7.7



*PRE-CAST CONCRETE GRADE RINGS IN CONFORMANCE WITH ASTM C-478 OR HDPE RINGS (LADTECH OR APPROVED EQUAL)

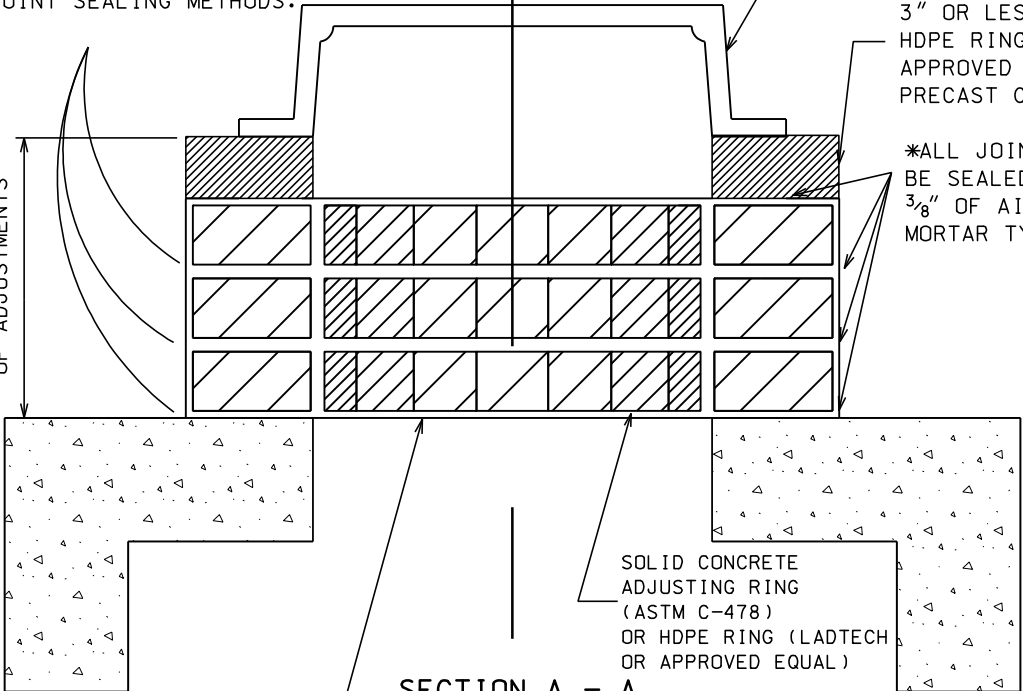
*THE OUTSIDE OF THE CONCRETE ADJUSTING RINGS SHALL BE SEALED WITH A 1/2" THICK, AIR ENTRAINED MORTAR TYPE M OR S SEAL. THE METHOD USED WILL BE COMPATIBLE WITH THE ADJUSTING RING JOINT SEALING METHODS.

MADISON STANDARD MACHINED CAST IRON ACCESS STRUCTURE COVER

TOP ADJUSTMENT RING 3" OR LESS SHALL BE HDPE RING (LADTECH OR APPROVED EQUAL) OR PRECAST CONCRETE RING

*ALL JOINTS SHALL BE SEALED WITH 3/8" OF AIR ENTRAINED MORTAR TYPE M OR S.

MIN. 3" / MAX. 9" OF ADJUSTMENTS



SOLID CONCRETE ADJUSTING RING (ASTM C-478) OR HDPE RING (LADTECH OR APPROVED EQUAL)

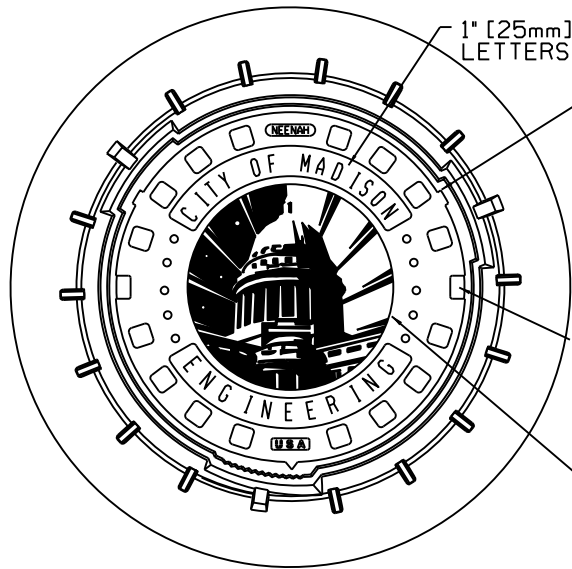
SECTION A - A

** PRE-CAST CONCRETE GRADE RINGS IN CONFORMANCE WITH ASTM C-478

**** NOTE:** HDPE ADJUSTMENT RINGS (LADTECH OR APPROVED EQUAL) MEETING AASHTO HS25 SPECS, ASTM D-1248 INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS WILL BE CONSIDERED AN ACCEPTABLE ALTERNATE TO PRECAST RINGS. CRETEX PRO RING WILL BE CONSIDERED AN ACCEPTED ALTERNATE FOR TOP 3" ADJUSTMENT OVER PRECAST RINGS. RING JOINT SEALANT SHALL BE ASTM C990 AND AASHTO M-198 (TROWABLE EZ-STICK #3 OR EQUAL)

2016

CITY OF MADISON ENGINEERING DIVISION
SAS CHIMNEY AND CASTING
STANDARD DETAIL DRAWING 5.7.15



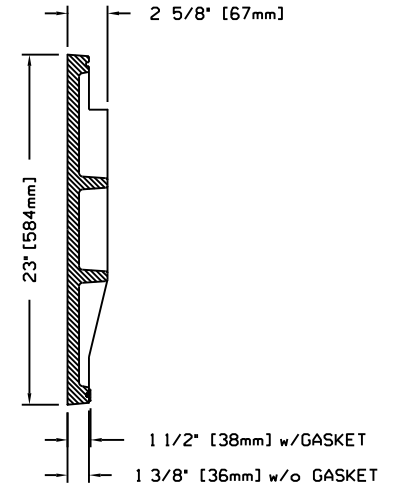
1" [25mm] HIGH LETTERS

NON-ROCKING FEATURE - 3 PLACES, 120° APART

(2) CONCEALED TYPE PICKHOLES PER NF-22642

CITY OF MADISON ENGINEERING LOGO, SHADED AREA REPRESENTS RECESSED AREA

LOGO DETAIL



NOTES:

APPROXIMATE TOTAL WEIGHTS:
 R-1550 R-1050 FRAME w/ LOGO LID 1550-0054, 9" FRAME AND LID = 240 LBS.
 R-1689 FRAME w/ LOGO LID 1550-0054, 4" FRAME AND LID = 279 LBS.

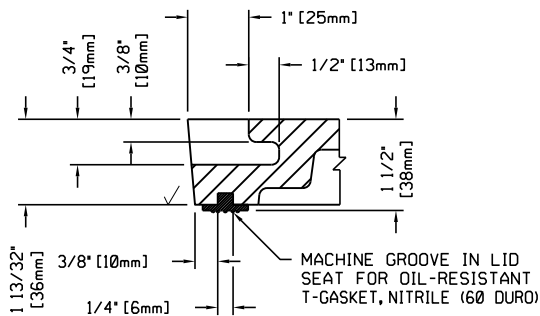
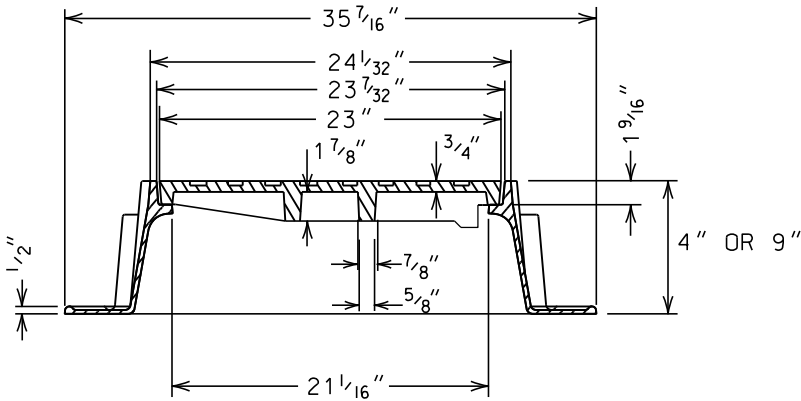
IF LOCKABLE LID IS NECESSARY, R-1916 C, 8 3/4" FRAME AND LID = 300 LBS
 THERE IS NO CITY OF MADISON LOGO LID AVAILABLE FOR THIS FRAME AND CASTING.

THE FOLLOWING NEENAH FOUNDRY CASTINGS (OR EQUAL CASTINGS) SHALL BE ACCEPTABLE:

1. R-1050, 9" NON-ROCKING ACCESS STRUCTURE FRAME.
2. R-1689, 4" NON-ROCKING ACCESS STRUCTURE FRAME (WHEN REQUESTED BY THE CITY CONSTRUCTION ENGINEER).
3. R-1916 C LOGO WITH A LOCKING CASTING AS WELL AS A LOCKING FRAME. THIS CASTING SHALL BE USED IN GREENWAYS AND EASEMENTS (SEE SDD 5.7.16a)

1. FRAME AND COVER SHALL BE MACHINED AND FITTED SO THAT ROCKING AND CHATTERING WILL BE ELIMINATED.
2. ALL LIDS SHALL BE SELF-SEALING EXCEPT FOR STORM SEWER.
3. ALL LIDS SHALL HAVE CITY OF MADISON LOGO AS SHOWN IN DETAIL (R-1050-0054 OR EQUIV.)

LID NOTES: ALL DIMENSIONS SHOWN ARE IN ENGLISH AND [METRIC]
 MATERIAL: CAST GRAY IRON ASTM A-48, CLASS 40A



T-SEAL GASKET / CONCEALED PICK DETAIL

2015

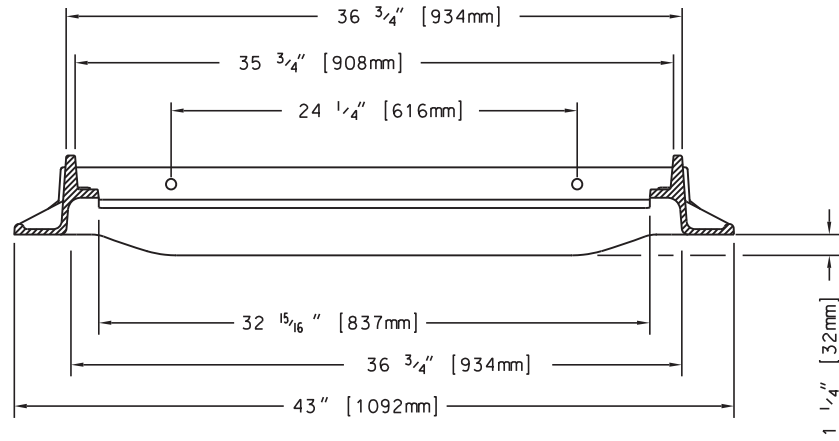
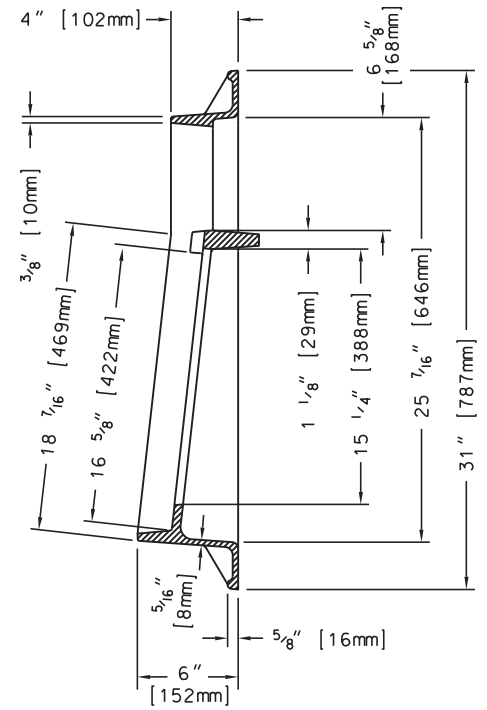
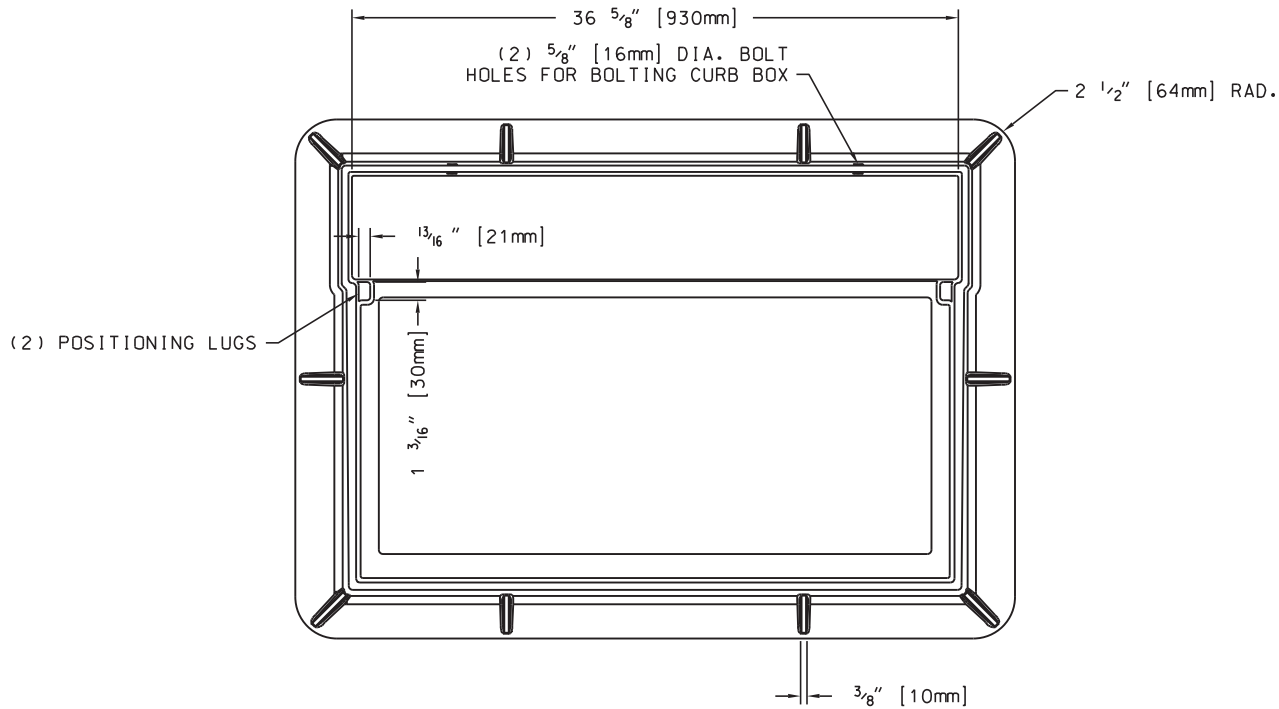
CITY OF MADISON
 ENGINEERING DIVISION

SAS FRAME & COVER

STANDARD DETAIL DRAWING 5.7.16

5.7.16

5.7.18



NOTES: ALL DIMENSIONS ARE SHOWN IN ENGLISH AND [METRIC].
 ALL DRAFT ANGLES ARE 5° UNLESS OTHERWISE SHOWN.
 MATERIAL: CAST GRAY IRON ASTM A-48, CLASS 35B
 FINISH: NOT PAINTED
 WEIGHT: APPROX. 155#

NEENAH FOUNDRY CASTINGS

1. R-3067 CURB INLET FRAME WITH DIAGONAL GRATE (TYPE R) SHALL BE USED FOR TYPE "H" INLETS AT ALL LOW POINTS AND WHERE LONGITUDINAL ROAD SLOPE IS LESS THAN 1%. GRATE PER STANDARD DETAIL DRAWING 5.7.20
2. R-3067-V CURB INLET FRAME WITH VANE GRATE (TYPE V) SHALL BE USED FOR "H" INLETS AT ALL LOCATIONS HAVING A LONGITUDINAL ROAD SLOPE EQUAL TO OR GREATER THAN 1%. GRATE PER STANDARD DETAIL DRAWING 5.7.21

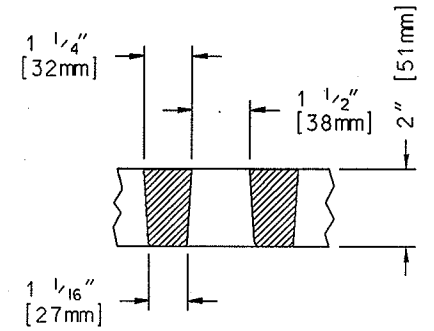
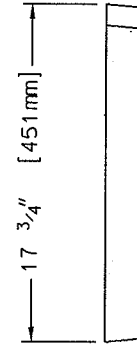
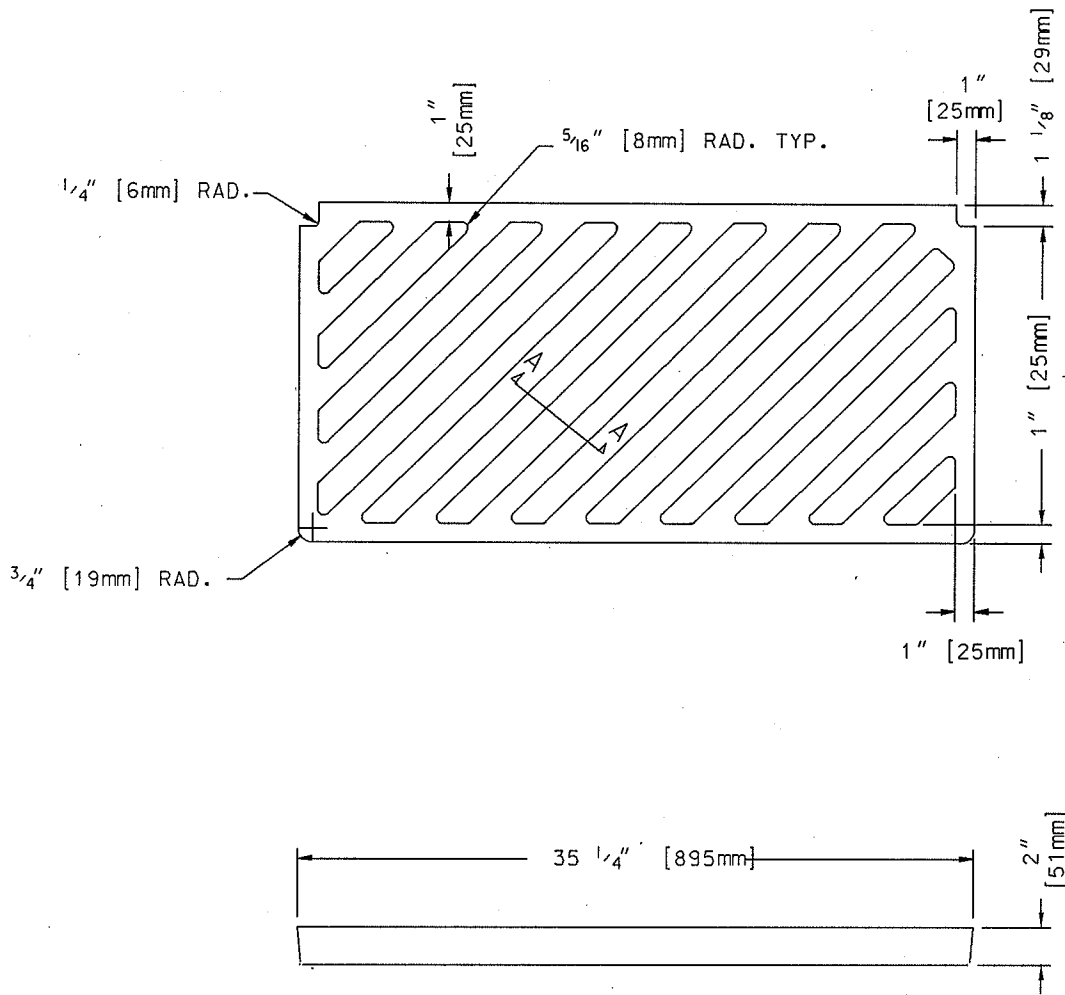
NOTE: ALL DIMENSIONS ARE SHOWN IN ENGLISH AND [METRIC].

GENERAL NOTES:

1. DETAILS OF CONSTRUCTION, MATERIALS, AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.
2. DETAIL DRAWINGS FOR PROPOSED ALTERNATE DESIGNS FOR INLET COVERS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PROVIDING THAT SUCH ALTERNATE DESIGNS MAKE PROVISION FOR EQUIVALENT CAPACITY AND STRENGTH.
3. ROUND FRAMES AND COVERS SHALL HAVE CONTINUOUSLY MACHINED BALL BEARING SURFACES TO PREVENT ROCKING AND RATTLING.
4. ACTUAL WEIGHT OF COVERS MAY VARY WITHIN 5 PERCENT (PLUS OR MINUS) OF THE APPROXIMATE WEIGHT.
5. INLETS SHALL BE DEPRESSED IN THE CURB FLOW LINE, SEE MADISON STANDARD DETAIL DRAWING 5.7.7

CITY OF MADISON ENGINEERING DIVISION
<h1>R-3067 FRAME</h1>
STANDARD DETAIL DRAWING 5.7.18

5.7.20



SECTION A-A

FREE OPEN AREA: 282 SQUARE INCHES
 NOTE: ALL DIMENSIONS ARE SHOWN IN ENGLISH AND [METRIC].
 MATERIAL: CAST GRAY IRON ASTM A-48, CLASS 35B
 FINISH: NO PAINT
 WEIGHT: 172#

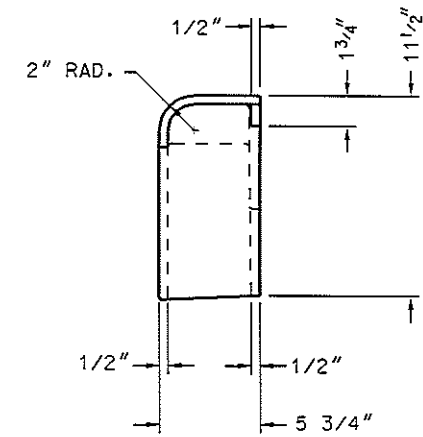
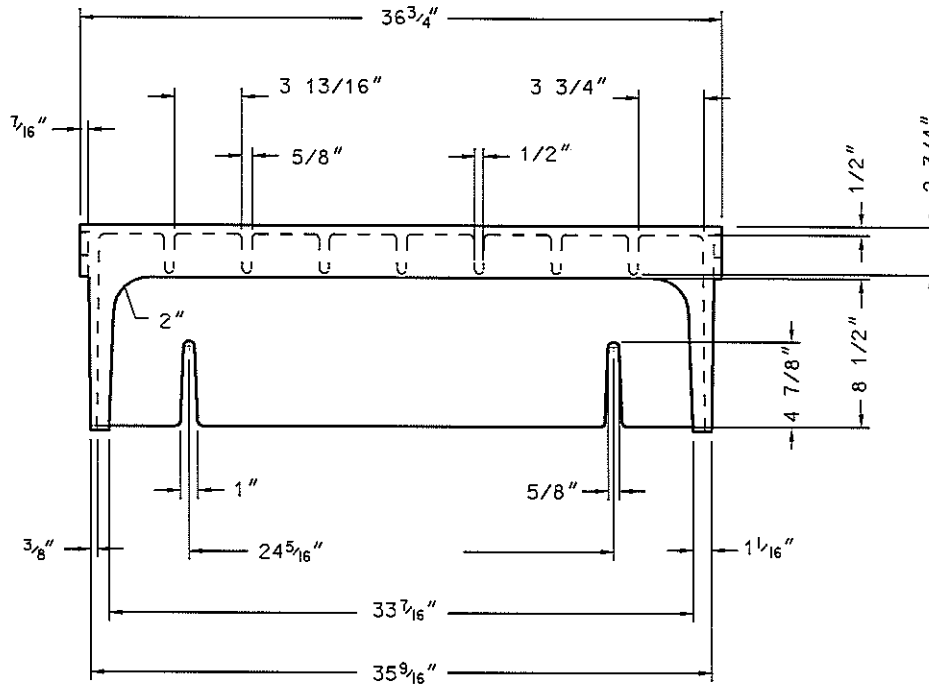
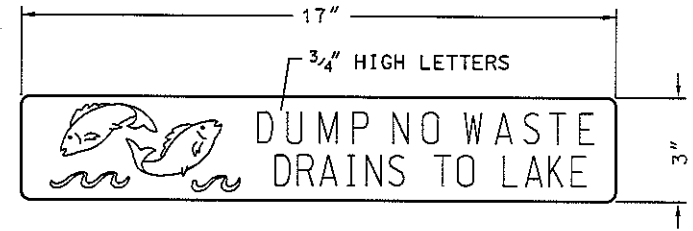
2004
 CITY OF MADISON
 ENGINEERING DIVISION

R-3067
 TYPE R GRATE

STANDARD DETAIL DRAWING 5.7.20

TYPE "C" CHECKERED TOP DESIGN

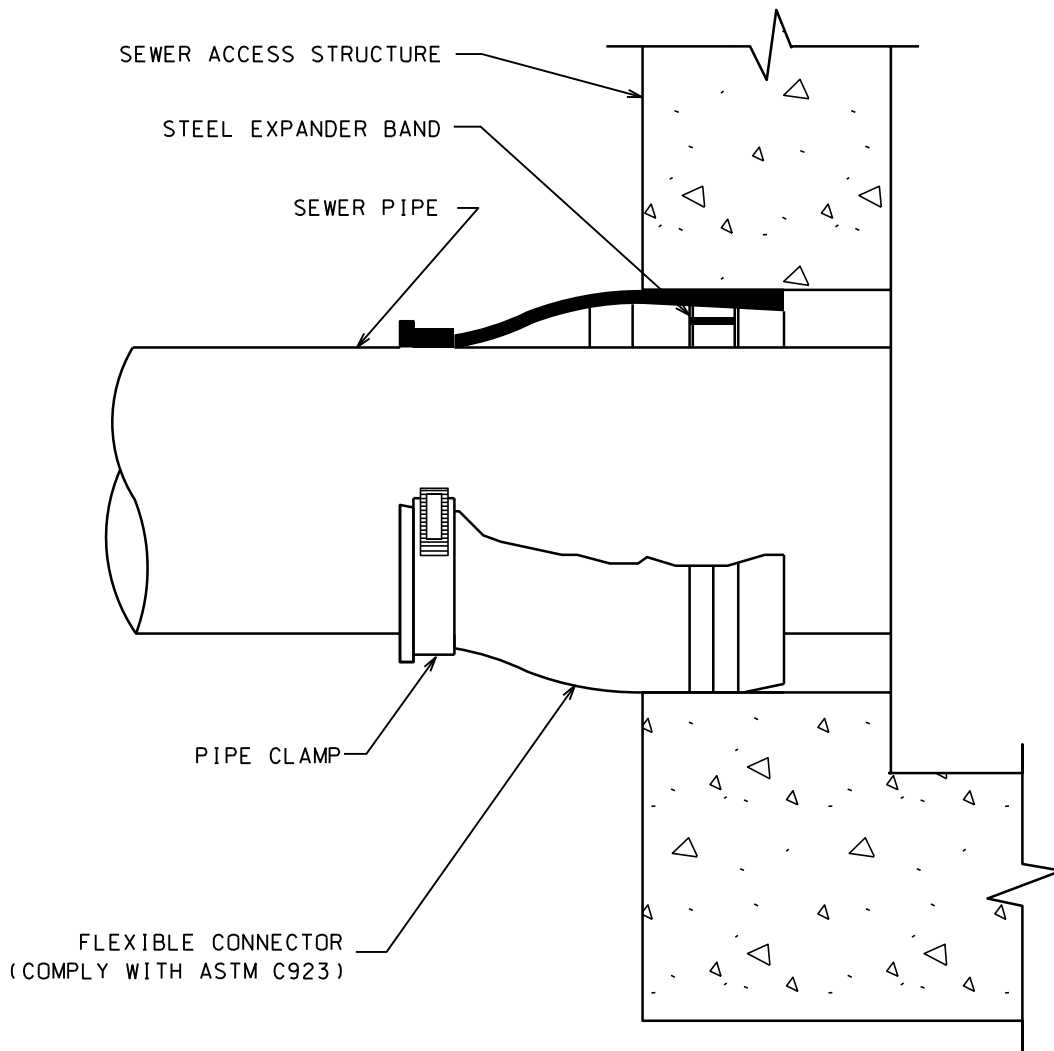
3/4" HIGH RAISED LETTERS
FLUSH W/ TOP SURFACE



5.7.22

NEENAH FOUNDRY PRODUCT NUMBER 3067 7004
MATERIAL: CAST GRAY IRON ASTM A-48, CLASS 35B
FINISH: NO PAINT
WEIGHT: 126#

2006
CITY OF MADISON ENGINEERING DIVISION
R-3067-7004
STANDARD DETAIL DRAWING 5.7.22

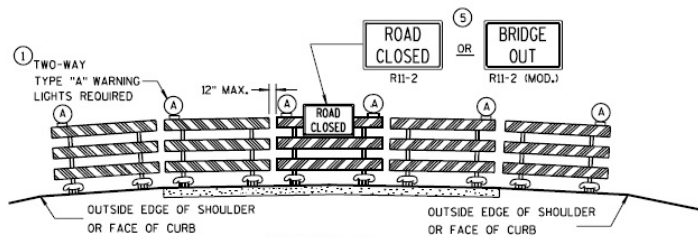


NOTES:

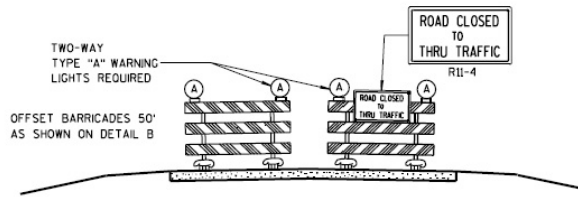
1. S.A.S. CONNECTIONS FOR SEWER MAINS SHALL BE MADE USING FLEXIBLE, WATERTIGHT CONNECTIONS SUCH AS KOR-N-SEAL I OR APPROVED EQUAL, UNLESS DIRECTED OTHERWISE BY ENGINEER.
2. ALL STAINLESS STEEL ELEMENTS OF CONNECTOR SHALL BE TOTALLY NON-MAGNETIC SERIES 304 STAINLESS, EXCLUDING THE WORM SCREW FOR TIGHTENING THE STEEL BAND AROUND THE PIPE WHICH SHALL BE SERIES 305 STAINLESS. THE WORM SCREW FOR TIGHTENING THE STEEL BAND SHALL BE TORQUED BY A BREAK-AWAY TORQUE WRENCH AVAILABLE FOR THE PRECAST S.A.S SUPPLIER AND SET FOR 60 - 70 INCH/LBS.
3. THE CONNECTOR SHALL BE INSTALLED IN THE S.A.S. WALL BY ACTIVATING THE EXPANDING MECHANISM IN STRICT ACCORDANCE WITH THE RECOMMENDATIONS OF THE CONNECTOR MANUFACTURER.
4. THE CONNECTOR SHALL BE OF A SIZE SPECIFICALLY DESIGNED FOR THE PIPE MATERIAL AND SIZE BEING UTILIZED ON THE PROJECT.
5. ALL COSTS SHALL BE CONSIDERED INCIDENTAL TO THE S.A.S. AND/OR PIPE. THE ENGINEER RESERVES THE RIGHT TO REQUIRE A "CONCRETE ENCASEMENT" CONNECTION AT NO ADDITIONAL EXPENSE IN THE EVENT OF DESIGN CHANGE.
6. FLEXIBLE, WATERTIGHT CONNECTIONS SHALL ALSO BE USED AS REQUIRED FOR STORM SEWER CONNECTIONS.

2016

CITY OF MADISON ENGINEERING DIVISION
FLEXIBLE PIPE TO S.A.S. CONNECTOR
STANDARD DETAIL DRAWING 5.7.31



DETAIL D
ROAD CLOSURE BARRICADE DETAIL
APPROACH VIEW



DETAIL E
LANE CLOSURE BARRICADE DETAIL
APPROACH VIEW

GENERAL NOTES

THE EXACT NUMBER, LOCATION, AND SPACING OF ALL SIGNS AND BARRICADES SHALL BE ADJUSTED TO FIT FIELD CONDITIONS AS APPROVED BY THE ENGINEER.

ANY SIGNS TEMPORARY OR EXISTING, WHICH CONFLICT WITH TRAFFIC CONTROL "IN USE" SHALL BE REMOVED OR COVERED AS NEEDED AND AS APPROVED BY THE ENGINEER.

THE SPACING BETWEEN TRAFFIC CONTROL SIGNS SHOULD BE ADJUSTED TO NOT CONFLICT WITH AND SHOULD PROVIDE A DESIRABLE MINIMUM OF 200 FEET CLEARANCE TO EXISTING SIGNS THAT WILL REMAIN IN PLACE.

BARRICADES THAT MUST BE MOVED FOR A WORK OPERATION SHALL BE IMMEDIATELY RE-ESTABLISHED UPON COMPLETION OF THE OPERATION OR, FOR CONTINUING OPERATIONS, AT THE END OF EACH WORKING DAY.

SIGNS THAT WILL BE IN PLACE LESS THAN 7 CONTINUOUS DAYS AND NIGHTS MAY BE MOUNTED ON PORTABLE SUPPORTS.

ALL TYPE III BARRICADES SHALL HAVE RAILS REFLECTORIZED ON BOTH FACES. STRIPES SHALL BE PROPERLY SLOPED DOWN TOWARD THE TRAFFIC SIDE OR AS SHOWN IN THE ROAD CLOSURE BARRICADE DETAIL D FOR FULL ROAD CLOSURES.

TYPE "A" LOW-INTENSITY FLASHING WARNING LIGHTS SHALL BE VISIBLE ON BOTH SIDES OF THE BARRICADE.

THE R11-2, R11-3, M4-9, R11-4 AND R10-61 SIGNS PLACED ON BARRICADES SHALL COVER NO MORE THAN THE TOP RAIL. THE SIGNS SHALL NOT COVER ANY PORTION OF THE MIDDLE OR BOTTOM RAILS.

THE REFLECTIVE SHEETING USED ON R11-2, R11-3, R11-4, R10-61 AND R1-1 SIGNS SHALL COMPLY WITH SUBSECTION 637.2.2.2 OF THE STANDARD SPECIFICATIONS.

"WO AND "MO" SIGNS ARE THE SAME AS "W" AND "M" SIGNS EXCEPT THE BACKGROUND IS ORANGE.

ALL SIGNS SHALL BE 48" X 48" UNLESS OTHERWISE NOTED BELOW:

- R11-2 SHALL BE 48" X 30".
- R11-3, R11-4 AND R10-61 SHALL BE 60" X 30".
- M4-9 SHALL BE 30" X 24".
- M3-X AND M4-B SHALL BE 24" X 12". (30" X 15" IF NEEDED TO MATCH EXISTING SIGNS.)
- M1-4, M1-5A, AND M1-6 SHALL BE 24" X 24". (36" X 36" IF NEEDED TO MATCH EXISTING SIGNS.)
- M05-1 AND M06-1 SHALL BE 21" X 21". (30" X 30" IF NEEDED TO MATCH EXISTING SIGNS.)
- D1-X SHALL BE AS SHOWN ON SPECIFIC PROJECT SIGNING DETAIL SHEETS.
- R1-1 SHALL BE 36" X 36".

- 1 TWO WARNING LIGHTS SHALL BE PROVIDED ON THE CENTER BARRICADE AND A MINIMUM OF ONE WARNING LIGHT SHALL BE PROVIDED ON EACH OF THE OTHER BARRICADES WITHIN THE ROADWAY LIMITS. SPACING OF THE WARNING LIGHTS SHALL BE UNIFORM TO THE EDGE OF ROADWAY AS SHOWN (APPROX. 8-FOOT LIGHT SPACING).
- 2 THESE SIGNS AND BARRICADES ARE NOT REQUIRED IF ROAD CLOSURE BEGINS AT INTERSECTION.
- 3 FOR ROAD CLOSURE WITHOUT LOCAL ACCESS TO PROJECT, SEE ROAD CLOSURE BARRICADE DETAIL D.
- 4 FOR ROAD CLOSURE WITH LOCAL ACCESS TO PROJECT, SEE LANE CLOSURE BARRICADE DETAIL E.
- 5 FOR BRIDGE OR CULVERT REPLACEMENTS, SUBSTITUTE "BRIDGE OUT" INSTEAD OF "ROAD CLOSED" ON R11-2 AND R11-3 SIGNS.
- 6 INSTALL DETOUR AND COMMUNITY GUIDE SIGNS AND ARROWS ONLY IF SPECIFIED IN THE CONTRACT. IF THERE ARE EXISTING ROUTE MARKER ASSEMBLIES THAT WILL REMAIN IN PLACE, ADJUST THE LOCATION OF THE DETOUR ROUTE SIGNS TO CORRESPOND WITH THE EXISTING ASSEMBLIES. MODIFY EXISTING SIGNS WHERE POSSIBLE. SEE SPECIFIC PROJECT DETOUR SIGNING DETAIL SHEETS. IF DETOUR SIGNS ARE BEING INSTALLED BY OTHERS, PLACE THE CONTRACTED TRAFFIC CONTROL SIGNS TO ALLOW FOR PLACEMENT OF ALL WARNING, DETOUR AND GUIDE SIGNS AS SHOWN.
- 7 "EAST" CARDINAL DIRECTION MARKERS AND RIGHT TURN ARROWS ARE SHOWN. USE OTHER CARDINAL DIRECTIONS AND ARROWS AS APPROPRIATE.

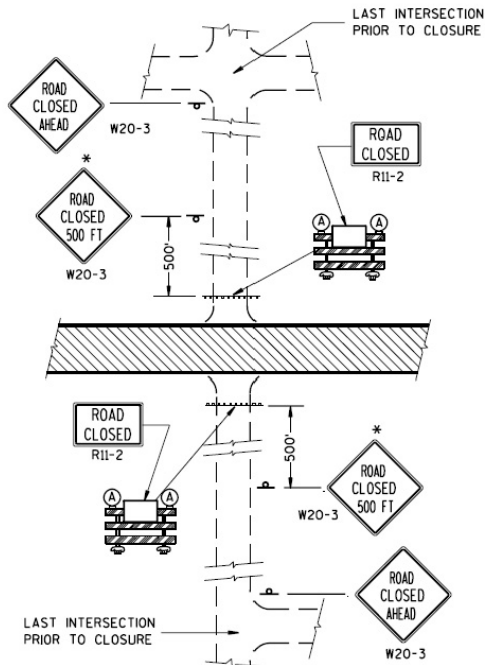
FEB 2005

CITY OF MADISON
ENGINEERING DIVISION

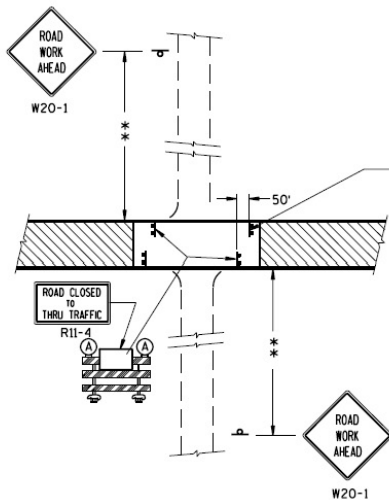
**BARRICADE AND SIGNS
FOR MAINLINE CLOSURES**

REFERENCED FROM:
STATE OF WISCONSIN
SDD 15 C 2-4B

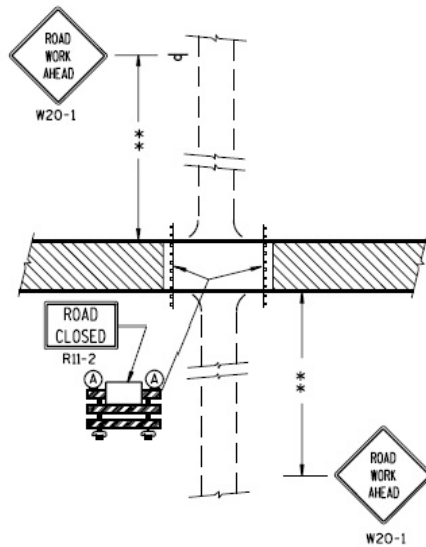
STANDARD DETAIL DRAWING # 6.31



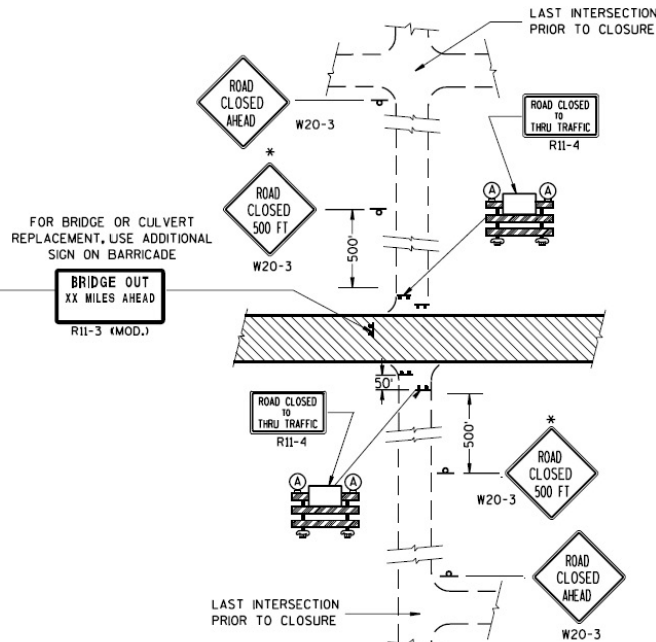
DETAIL 1
(NO ACCESS TO PROJECT)



DETAIL 3
(PUBLIC CROSS-TRAFFIC MAINTAINED. CONTRACTOR, LOCAL BUSINESS AND RESIDENT ACCESS).



DETAIL 2
(PUBLIC CROSS-TRAFFIC MAINTAINED. NO ACCESS TO PROJECT).



DETAIL 4
(CONTRACTOR, LOCAL BUSINESS AND RESIDENT ACCESS TO PROJECT)

GENERAL NOTES

THE EXACT NUMBER, LOCATION, AND SPACING OF ALL SIGNS AND BARRICADES SHALL BE ADJUSTED TO FIT FIELD CONDITIONS AS APPROVED BY THE ENGINEER.

ANY SIGNS TEMPORARY OR EXISTING, WHICH CONFLICT WITH TRAFFIC CONTROL "IN USE" SHALL BE REMOVED OR COVERED AS NEEDED AND AS APPROVED BY THE ENGINEER.

THE SPACING BETWEEN TRAFFIC CONTROL SIGNS SHOULD BE ADJUSTED TO NOT CONFLICT WITH AND SHOULD PROVIDE A DESIRABLE MINIMUM OF 200 FEET CLEARANCE TO EXISTING SIGNS THAT WILL REMAIN IN PLACE.

IF A "STOP" SIGN MUST BE REMOVED FOR A WORK OPERATION, A TEMPORARY "STOP" SIGN SHALL BE PLACED PRIOR TO THE SIGN REMOVAL, OR A FLAGGER SHALL BE PROVIDED UNTIL THE SIGN IS RE-ESTABLISHED.

BARRICADES THAT MUST BE MOVED FOR A WORK OPERATION SHALL BE IMMEDIATELY RE-ESTABLISHED UPON COMPLETION OF THE OPERATION OR, FOR CONTINUING OPERATIONS, AT THE END OF EACH WORKING DAY.

SIGNS THAT WILL BE IN PLACE LESS THAN 7 CONTINUOUS DAYS AND NIGHTS MAY BE MOUNTED ON PORTABLE SUPPORTS.

ALL TYPE III BARRICADES SHALL HAVE RAILS REFLECTORIZED ON BOTH FACES. STRIPES SHALL BE PROPERLY SLOPED DOWN TOWARD THE TRAFFIC SIDE OR AS SHOWN IN THE ROAD CLOSURE BARRICADE DETAIL D FOR FULL ROAD CLOSURES.

TYPE "A" LOW-INTENSITY FLASHING WARNING LIGHTS SHALL BE VISIBLE ON BOTH SIDES OF THE BARRICADE.

THE R11-2, R11-3 AND R11-4 SIGNS PLACED ON BARRICADES SHALL COVER NO MORE THAN THE TOP RAIL. THE SIGNS SHALL NOT COVER ANY PORTION OF THE MIDDLE OR BOTTOM RAILS.

THE REFLECTIVE SHEETING USED ON R11-2, R11-3 AND R11-4 SIGNS SHALL COMPLY WITH SUBSECTION 637.2.2.2 OF THE STANDARD SPECIFICATIONS.

ALL SIGNS SHALL BE 48" X 48" UNLESS OTHERWISE NOTED BELOW:

R11-2 SHALL BE 48" X 30".

R11-4 AND R11-3 SHALL BE 60" X 30".

*OMIT THE "ROAD CLOSED 500 FT." SIGN IF THE LAST INTERSECTION IS 500 FT. OR LESS FROM THE WORK ZONE.

**500' MAX. OR AT LAST INTERSECTION WHICHEVER IS CLOSER.

LEGEND

- ⊥ POST MOUNTED WARNING SIGN
- ▬ TYPE III BARRICADES
- Ⓐ TYPE "A" LOW INTENSITY FLASHING WARNING LIGHT (FOR NIGHT USE)
- ▨ WORK AREA

FEB 2005

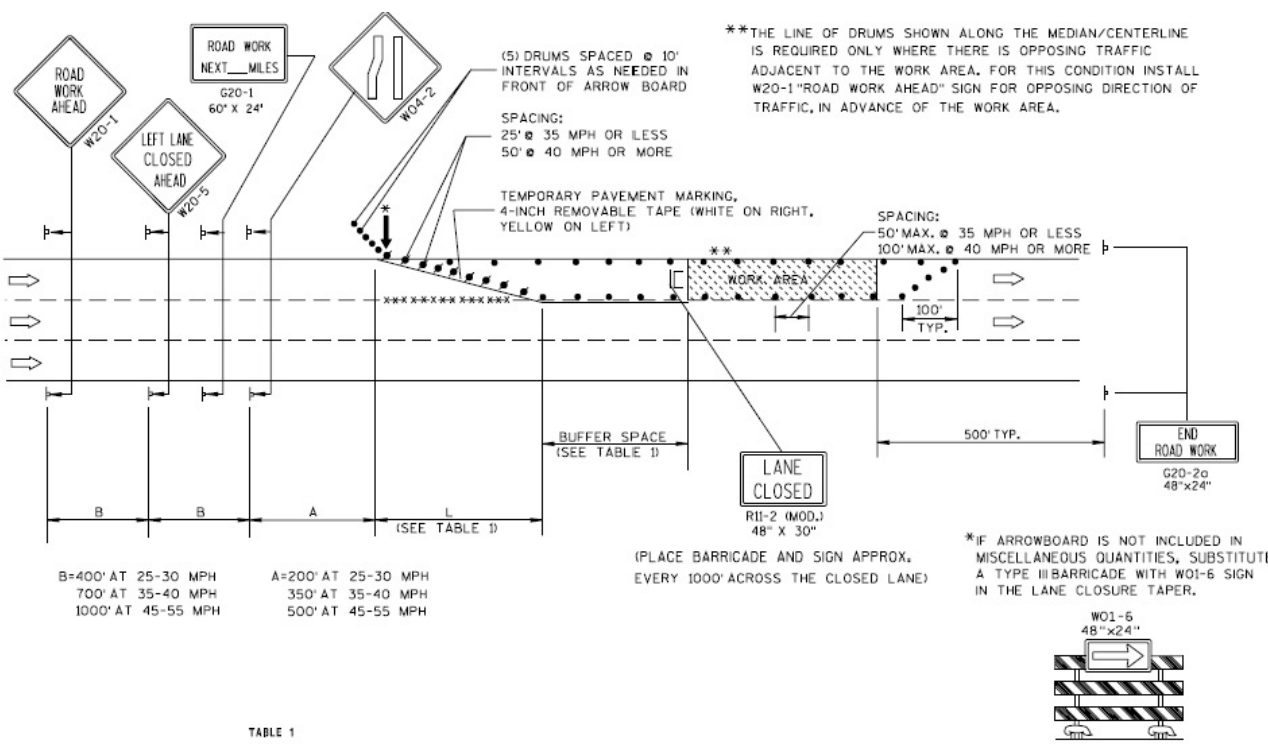
CITY OF MADISON
ENGINEERING DIVISION

**BARRICADES AND SIGNS
FOR SIDEROAD CLOSURES**

REFERENCED FROM:
STATE OF WISCONSIN
SDD 15 C 3-1

STANDARD DETAIL DRAWING # 6.32

6.33



GENERAL NOTES

THIS LANE CLOSURE DETAIL IS TYPICAL FOR CLOSING THE LEFT LANE. FOR A RIGHT LANE CLOSURE, REVERSE THE TRAFFIC CONTROL.

THIS DETAIL MAY BE USED FOR ROADWAYS WITH EITHER TWO OR THREE LANES IN EACH DIRECTION.

THE EXACT NUMBER, LOCATION, AND SPACING OF ALL SIGNS AND DEVICES SHALL BE ADJUSTED TO FIT FIELD CONDITIONS AS APPROVED BY THE ENGINEER.

THE SPACING BETWEEN TRAFFIC CONTROL SIGNS SHOULD BE ADJUSTED TO NOT CONFLICT WITH AND SHOULD PROVIDE A DESIRABLE MINIMUM OF 200 FEET CLEARANCE TO EXISTING SIGNS THAT WILL REMAIN IN PLACE.

ALL SIGNS ARE 48"x48" UNLESS OTHERWISE NOTED. IF NECESSARY DUE TO SPACE CONSTRAINTS IN URBAN AREAS, 36" X 36" SIGNS MAY BE USED IF APPROVED BY DISTRICT TRAFFIC UNIT.

"WO" SIGNS ARE THE SAME AS "W" SIGNS EXCEPT THE BACKGROUND IS ORANGE.

SIGNS THAT WILL BE IN PLACE LESS THAN 7 CONTINUOUS DAYS AND NIGHTS, OR THAT WILL BE PLACED IN A CLOSED LANE, MAY BE MOUNTED ON PORTABLE SUPPORTS.

ANY SIGNS TEMPORARY OR EXISTING, WHICH CONFLICT WITH TRAFFIC CONTROL "IN USE" SHALL BE REMOVED OR COVERED AS NEEDED AND AS APPROVED BY THE ENGINEER.

REMOVE PAVEMENT MARKINGS AND PLACE TEMPORARY PAVEMENT MARKING, REMOVABLE TAPE IF LANE CLOSURE IS TO BE IN PLACE FOR 7 OR MORE CONTINUOUS DAYS AND NIGHTS, ON UNDIVIDED ROADWAYS, OMIT THE SIGNS SHOWN ON LEFT SIDE OF ROAD.

W20-1, G20-1 AND G20-2A SIGNS ARE NOT REQUIRED IF THE LANE CLOSURE IS WITHIN A LARGER WORK ZONE WHERE THESE SIGNS ARE ALREADY PRESENT.

OMIT G20-1 SIGNS IF LENGTH OF WORK AREA IS 2 MILES OR LESS.

CONSIDER GEOMETRICS WHEN LOCATING SIGNS AND ARROWBOARDS SO THE APPROACHING DRIVER HAS A CLEAR VIEW OF THE ARROWBOARDS AND LANE CLOSURE DRUMS.

PLACE THE ARROWBOARD AS CLOSE AS POSSIBLE TO THE BEGINNING OF THE LANE CLOSURE TAPER, PREFERABLY ON THE SHOULDER OR TERRACE.

CHANNELIZING DEVICES PLACED ADJACENT TO WORK AREA SHALL BE PULLED BACK FROM THE TRAVEL LANE WHEN WORK IS NOT IN PROGRESS.

BARRICADES IN A CLOSED LANE THAT MUST BE MOVED FOR A WORK OPERATION SHALL BE IMMEDIATELY RE-ESTABLISHED UPON COMPLETION OF THE OPERATION OR, FOR CONTINUING OPERATIONS, AT THE END OF EACH WORKING DAY.

WARNING LIGHTS ARE NOT REQUIRED IF THE LANE CLOSURE IS A DAYTIME ONLY OPERATION.

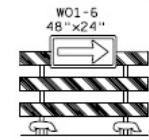
**THE LINE OF DRUMS SHOWN ALONG THE MEDIAN/CENTERLINE IS REQUIRED ONLY WHERE THERE IS OPPOSING TRAFFIC ADJACENT TO THE WORK AREA. FOR THIS CONDITION INSTALL W20-1 "ROAD WORK AHEAD" SIGN FOR OPPOSING DIRECTION OF TRAFFIC, IN ADVANCE OF THE WORK AREA.

SPACING:
25' @ 35 MPH OR LESS
50' @ 40 MPH OR MORE

SPACING:
50' MAX. @ 35 MPH OR LESS
100' MAX. @ 40 MPH OR MORE

(PLACE BARRICADE AND SIGN APPROX. EVERY 1000' ACROSS THE CLOSED LANE)

*IF ARROWBOARD IS NOT INCLUDED IN MISCELLANEOUS QUANTITIES, SUBSTITUTE A TYPE III BARRICADE WITH W01-6 SIGN IN THE LANE CLOSURE TAPER.



LEGEND

- ⊘ DRUM WITH/WITHOUT WARNING LIGHT, TYPE C (STEADY-BURN)
- ⊣ POST MOUNTED SIGN
- ↑ ARROW BOARD
- ⊣/⊣ TYPE III BARRICADE (8' EQUIVALENT) AND WARNING LIGHTS, TYPE A (FLASHING) WITH/WITHOUT SIGN
- ⇒ DIRECTION OF TRAFFIC FLOW
- xxxx REMOVING PAVEMENT MARKING (SEE GENERAL NOTES)

TABLE 1
TAPER AND BUFFER SPACE
FOR 12' LANE WIDTH

S	L	BUFFER SPACE
25	125'	55'
30	180'	85'
35	245'	120'
40	320'	170'
45	540'	220'
50	600'	280'
55	660'	335'

FOR LANE WIDTH OTHER THAN 12':
 L = WS AT 45 MPH OR GREATER
 L = $\frac{WS^2}{60}$ AT 40 MPH OR LESS
 L = TAPER LENGTH IN FEET
 S = NON-CONSTRUCTION SPEED LIMIT (MPH)
 W = WIDTH OF LANE CLOSURE

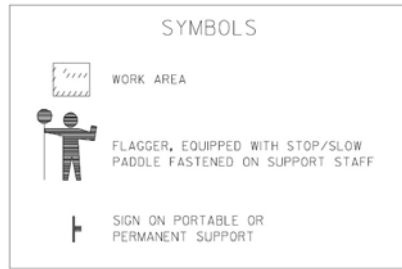
REFERENCED FROM:
STATE OF WISCONSIN
SDD 15 D 20-1

FEB 2005

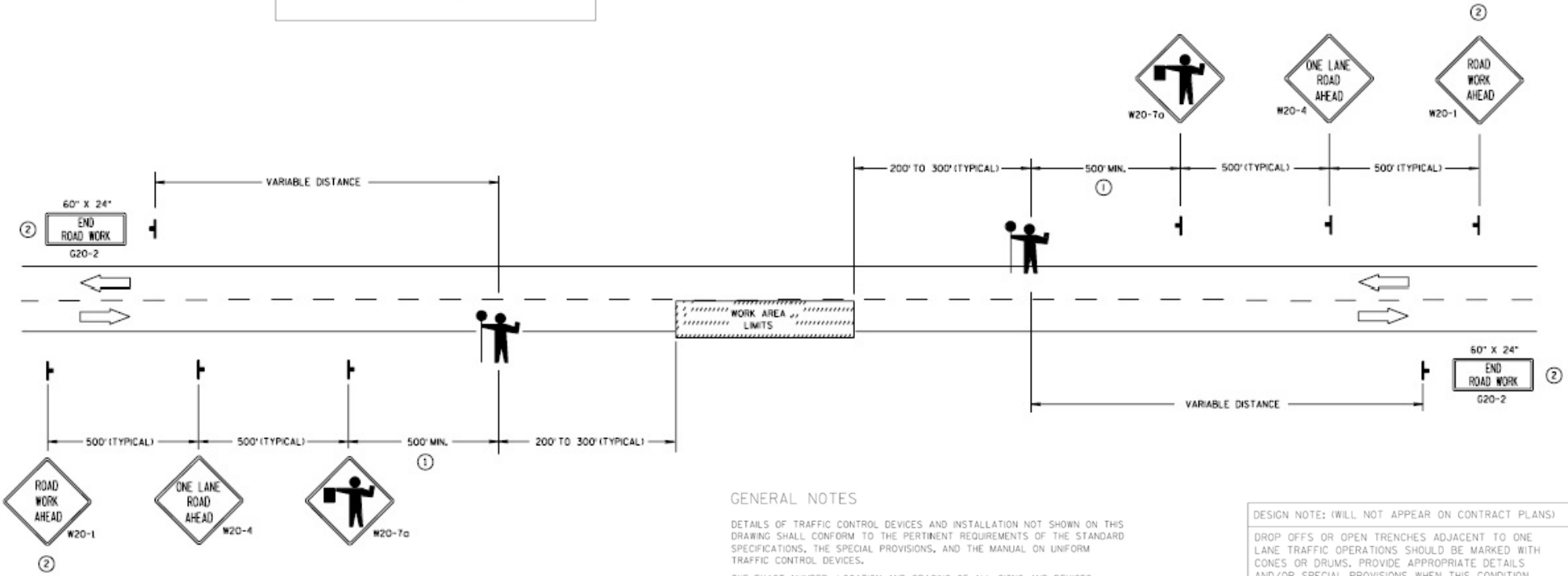
CITY OF MADISON
ENGINEERING DIVISION

**TRAFFIC CONTROL,
SINGLE LANE CLOSURE
NON-FREEWAY/EXPRESSWAY**

STANDARD DETAIL DRAWING # 6.33



USE OF THE "BE PREPARED TO STOP" SIGN IS OPTIONAL. WHEN USED, THIS SIGN SHALL BE LOCATED BETWEEN THE W20-7a AND W20-4 SIGNS. A 500' TYPICAL SPACING SHALL BE PROVIDED BETWEEN THE SIGNS.



GENERAL NOTES

DETAILS OF TRAFFIC CONTROL DEVICES AND INSTALLATION NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS, THE SPECIAL PROVISIONS, AND THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

THE EXACT NUMBER, LOCATION AND SPACING OF ALL SIGNS AND DEVICES (AND THE LOCATION OF ALL FLAGGERS) SHALL BE ADJUSTED TO FIT FIELD CONDITIONS AS DIRECTED BY THE ENGINEER.

THE FIRST ADVANCE WARNING SIGN SHOULD TYPICALLY BE LOCATED IN ADVANCE OF THE ANTICIPATED TRAFFIC BACKUP OR QUEUE.

WHEN A SIDE ROAD OR RAMP INTERSECTS THE FACILITY ON WHICH THE WORK IS BEING PERFORMED, ADDITIONAL TRAFFIC CONTROLS SHALL BE PROVIDED AS SPECIFIED IN THE PLANS AND/OR THE SPECIAL PROVISIONS OR AS DIRECTED BY THE ENGINEER.

FLAGGERS SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES. THEY SHALL BE EQUIPPED WITH STOP/SLOW PADDLES FASTENED ON SUPPORT STAFFS. WHEN THE FLAGGING OPERATION IS NOT IN EFFECT, THE "FLAGGER AHEAD", THE "ROAD WORK AHEAD" AND THE ONE LANE ROAD AHEAD" SIGNS SHALL BE COVERED OR REMOVED AND THE HIGHWAY RESTORED TO NORMAL OPERATION.

ALL SIGNS ARE 48" X 48" UNLESS OTHERWISE NOTED.

DESIGN NOTE: (WILL NOT APPEAR ON CONTRACT PLANS)

DROP OFFS OR OPEN TRENCHES ADJACENT TO ONE LANE TRAFFIC OPERATIONS SHOULD BE MARKED WITH CONES OR DRUMS. PROVIDE APPROPRIATE DETAILS AND/OR SPECIAL PROVISIONS WHEN THIS CONDITION IS EXPECTED.

THIS DETAIL IS APPROPRIATE FOR RURAL HIGH SPEED CONDITIONS. URBAN LOWER SPEED CONDITIONS REQUIRE A CLOSER SIGN SPACING.

- ① FOR A MOVING WORK OPERATION, SIGNING FOR BOTH DIRECTIONS SHALL BE REESTABLISHED (AS SIMULTANEOUSLY AS PRACTICAL) AT APPROXIMATELY 3500 FOOT INTERVALS IN THE MOVING WORK OPERATION OR AS DIRECTED BY THE ENGINEER.
- ② SIGN NOT REQUIRED IF FLAGGING OPERATION OCCURS WITHIN A SIGNED ROAD WORK ZONE AREA.

FEB 2005

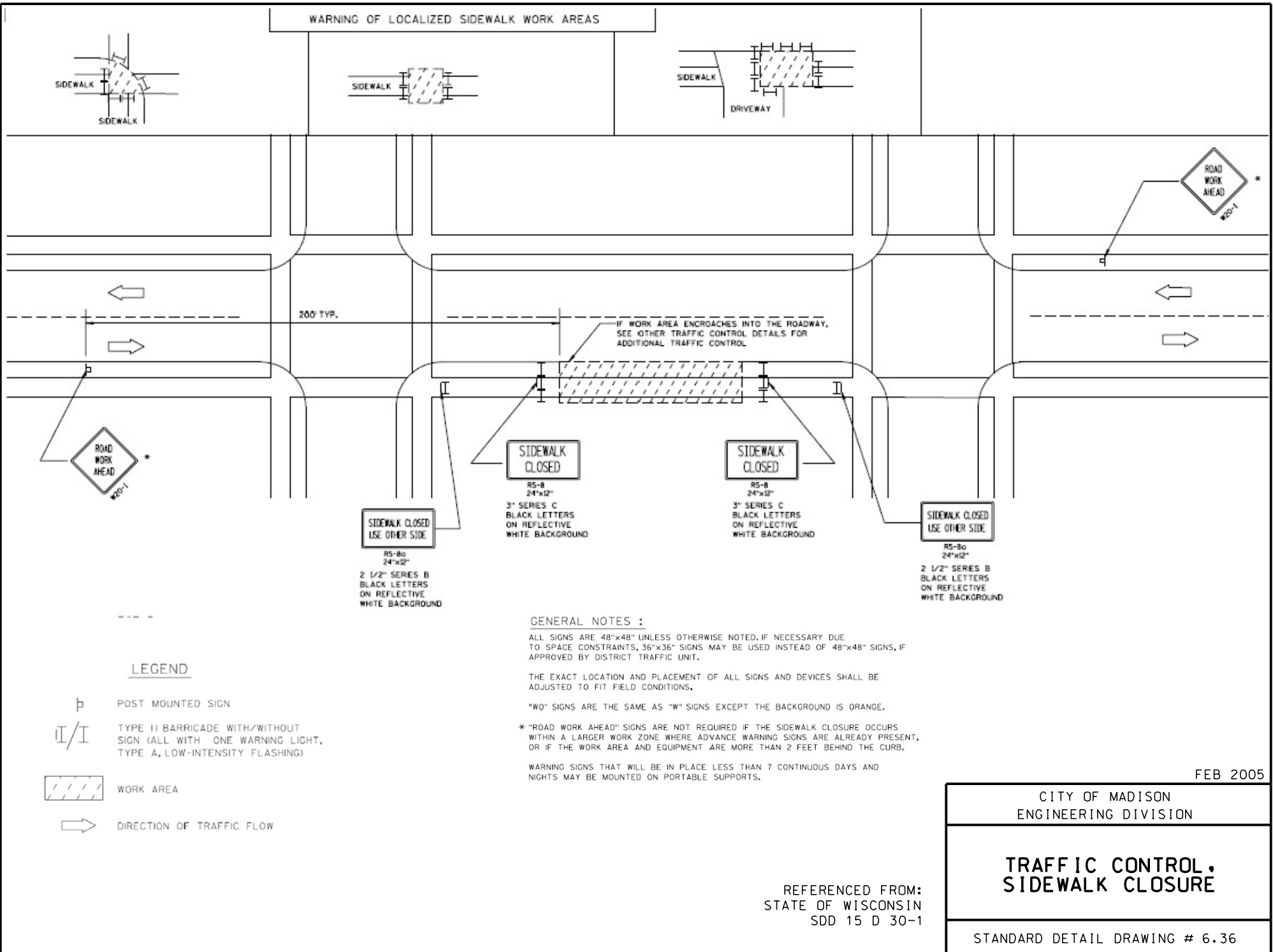
CITY OF MADISON
ENGINEERING DIVISION

**TRAFFIC CONTROL FOR
LANE CLOSURE (SUITABLE
FOR MOVING OPERATIONS)**

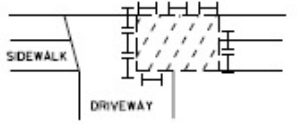
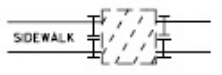
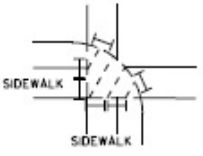
STANDARD DETAIL DRAWING # 6.35

REFERENCED FROM:
STATE OF WISCONSIN
SDD 15 C 12-2

6.36

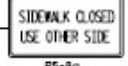
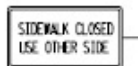


WARNING OF LOCALIZED SIDEWALK WORK AREAS



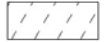



200' TYP.

IF WORK AREA ENCROACHES INTO THE ROADWAY, SEE OTHER TRAFFIC CONTROL DETAILS FOR ADDITIONAL TRAFFIC CONTROL



LEGEND

-  POST MOUNTED SIGN
-  TYPE II BARRICADE WITH/WITHOUT SIGN (ALL WITH ONE WARNING LIGHT, TYPE A, LOW-INTENSITY FLASHING)
-  WORK AREA
-  DIRECTION OF TRAFFIC FLOW

GENERAL NOTES :

- ALL SIGNS ARE 48"x48" UNLESS OTHERWISE NOTED, IF NECESSARY DUE TO SPACE CONSTRAINTS, 36"x36" SIGNS MAY BE USED INSTEAD OF 48"x48" SIGNS, IF APPROVED BY DISTRICT TRAFFIC UNIT.
- THE EXACT LOCATION AND PLACEMENT OF ALL SIGNS AND DEVICES SHALL BE ADJUSTED TO FIT FIELD CONDITIONS.
- "W0" SIGNS ARE THE SAME AS "W" SIGNS EXCEPT THE BACKGROUND IS ORANGE.
- * "ROAD WORK AHEAD" SIGNS ARE NOT REQUIRED IF THE SIDEWALK CLOSURE OCCURS WITHIN A LARGER WORK ZONE WHERE ADVANCE WARNING SIGNS ARE ALREADY PRESENT, OR IF THE WORK AREA AND EQUIPMENT ARE MORE THAN 2 FEET BEHIND THE CURB.
- WARNING SIGNS THAT WILL BE IN PLACE LESS THAN 7 CONTINUOUS DAYS AND NIGHTS MAY BE MOUNTED ON PORTABLE SUPPORTS.

FEB 2005

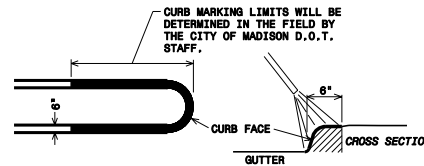
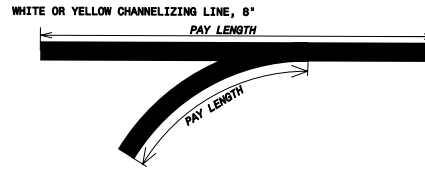
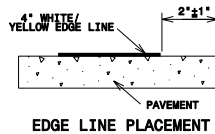
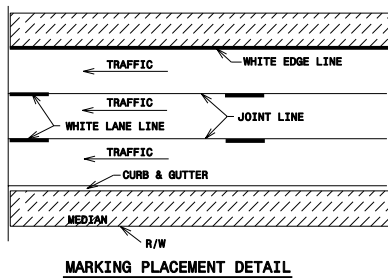
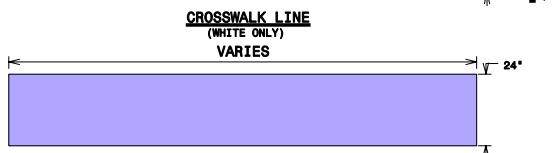
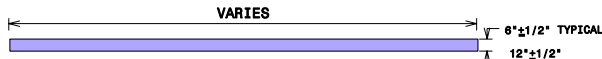
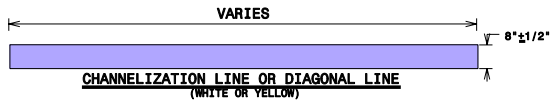
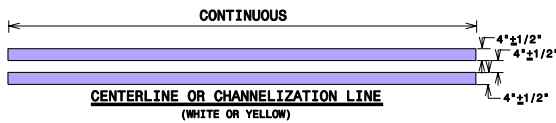
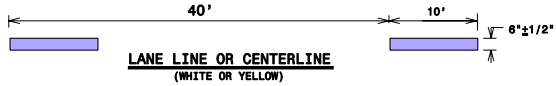
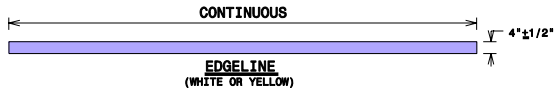
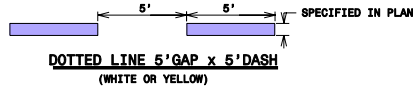
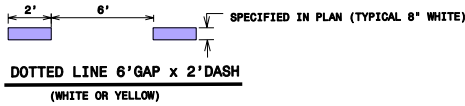
CITY OF MADISON
ENGINEERING DIVISION

TRAFFIC CONTROL,
SIDEWALK CLOSURE

REFERENCED FROM:
STATE OF WISCONSIN
SDD 15 D 30-1

STANDARD DETAIL DRAWING # 6.36

PERMANENT PAVEMENT MARKINGS



CURB & ISLAND MARKING DETAILS

GENERAL NOTES FOR EPOXY PAVEMENT MARKINGS

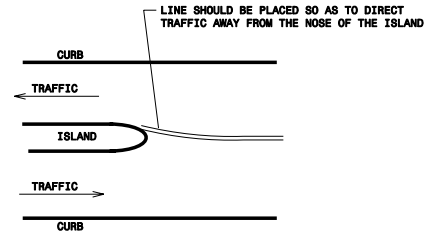
THE CONTRACTOR SHALL APPLY ALL MARKINGS IN ACCORDANCE WITH THE STATE OF WISCONSIN MANUAL ON TRAFFIC CONTROL DEVICES.

AT STREET INTERSECTIONS, MARKINGS START OR END AT THE MARKED CROSSWALK. THE PROPERTY LINE EXTENDED, IF THERE IS NO MARKED CROSSWALK.

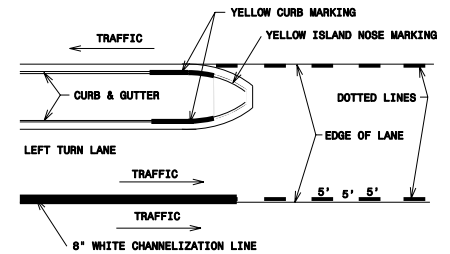
CROSSWALKS AND STOP BARS WILL BE PLACED NO CLOSER THAN 2' TO THE FACE OF CURB.

THE CONTRACTOR SHALL ADHERE TO THE TRAFFIC SPECIFICATION IN THE SPECIAL PROVISIONS AT ALL TIMES.

FOR MORE INFORMATION AND FULL SIZE PATTERNS FOR ARROWS & WORD LEGENDS ARE AVAILABLE AT THE CITY OF MADISON TRAFFIC ENGINEERING FIELD OPERATIONS FACILITY 1120 SAYLE ST. (608) 266-4767



ISLAND APPROACH



LEFT TURN LANE

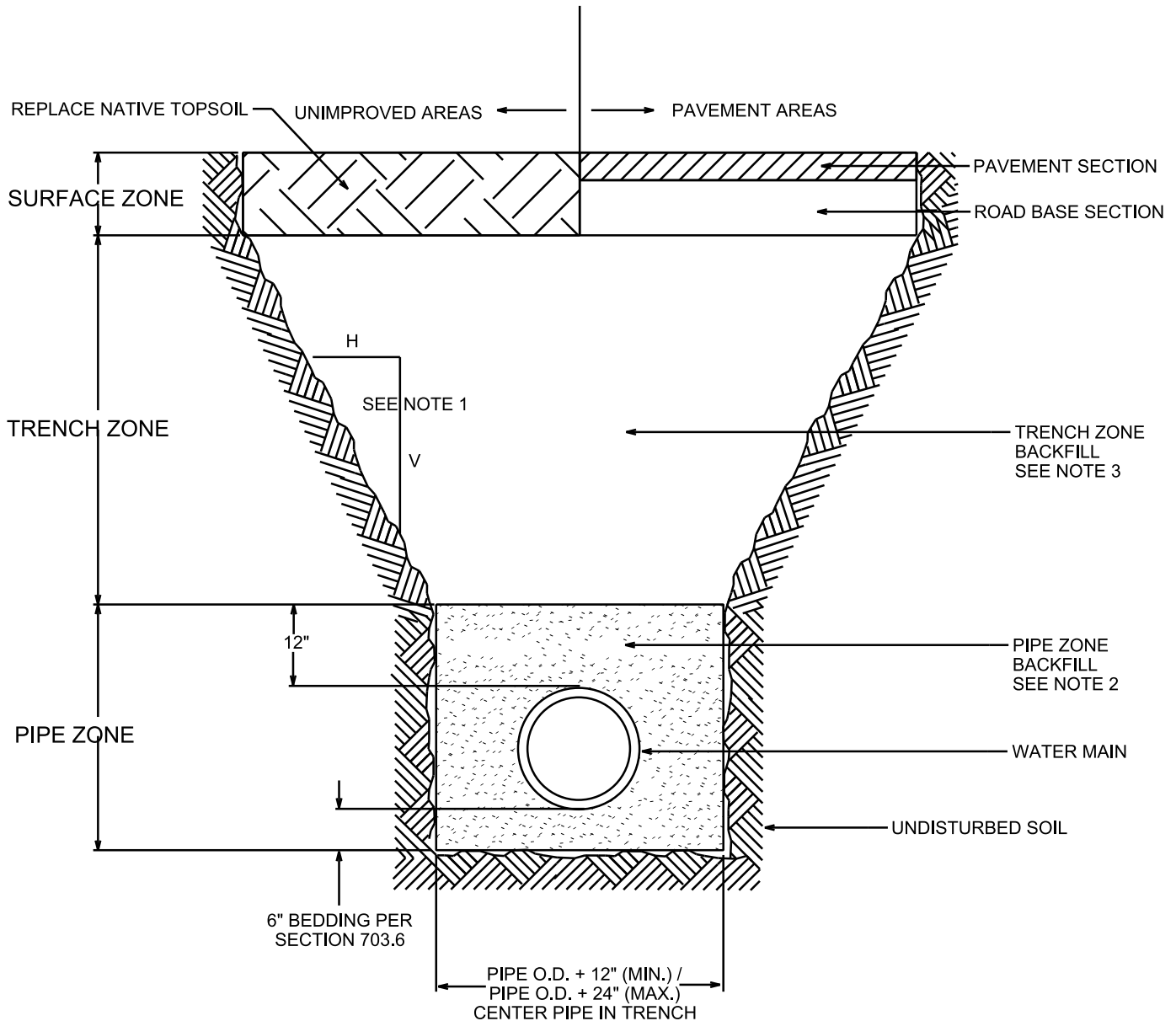
2009

CITY OF MADISON
ENGINEERING DIVISION

**PAVEMENT MARKING
DETAILS
PAGE 1**

STANDARD DETAIL DRAWING # 6.37

6.37



NOTES:

- 1) ALL EXCAVATION SHALL BE IN ACCORDANCE WITH THE WISCONSIN ADMINISTRATIVE CODE FOR "TRENCH EXCAVATION AND TUNNEL CONSTRUCTION" AND ANY ADDITIONAL REQUIREMENTS INCLUDING IN THE CONTRACT DOCUMENTS.
- 2) BACKFILL OPERATIONS SHALL COMPLY WITH SECTIONS 703.6 AND 202.2(B) OF THE STANDARD SPECIFICATIONS.
- 3) THE PIPE ZONE BEDDING MATERIAL SHALL CONSIST OF SELECT FILL SAND, LIMESTONE SCREENINGS, CLEAR STONE, OR WASHED GRAVEL.
- 4) SEE SECTION 703.6.1 FOR BACKFILL/COMPACTION REQUIREMENTS OF BEDDING/COVER MATERIAL IN THE PIPE ZONE.
- 5) TRENCH ZONE COMPACTION REQUIREMENTS:
 - ALL COMPACTION OPERATIONS SHALL COMPLY WITH SECTION 703.6.3
 - DENSITY REQUIREMENTS:
 1. FROM 2-FEET OVER THE PIPE TO WITHIN 3-FEET OF THE SUBGRADE:
A MINIMUM OF 90% OF MAXIMUM DENSITY.
 2. WITHIN 3-FEET OF THE BOTTOM OF SUBGRADE:
A MINIMUM OF 95% OF MAXIMUM DENSITY.

CITY OF MADISON
WATER UTILITY

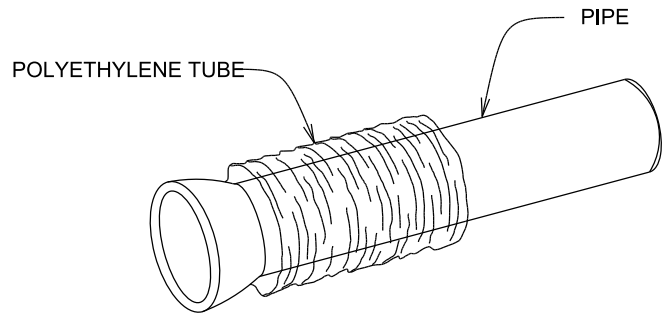
NOT TO SCALE

TYPICAL WATER PIPE TRENCH

FIELD INSTALLATION-POLYETHYLENE WRAP

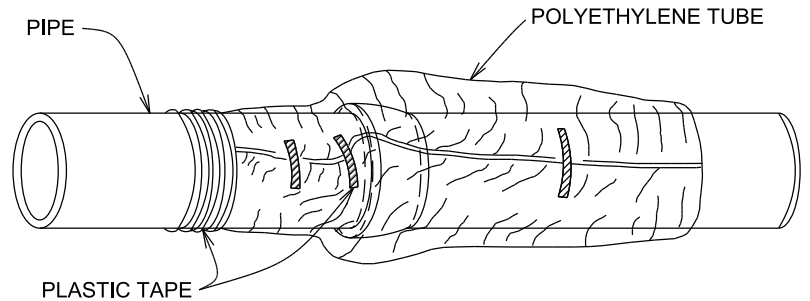
STEP-1

CLEAN SURFACE OF PIPE. CUT POLYETHYLENE TWO FEET LONGER THAN THE PIPE (8 MIL MIN.). PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH. DIG BELL HOLES AT JOINTS, LOWER PIPE.



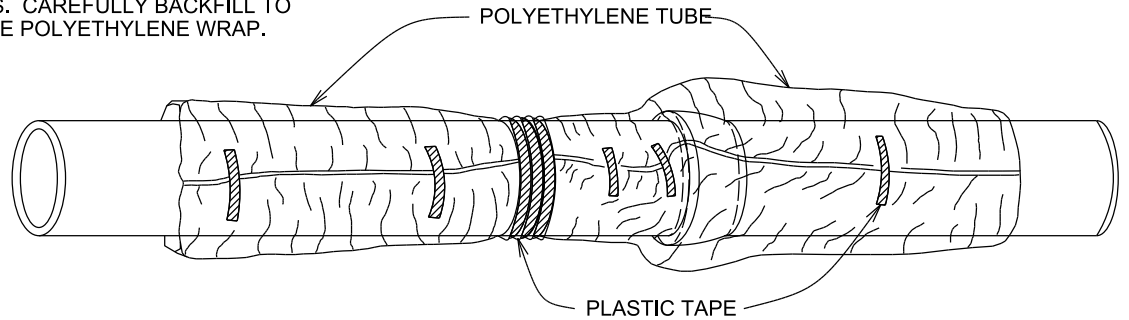
STEP-2

LIFT ENOUGH TO PULL THE TUBE OVER THE PIPE. TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TURNS OF TWO-INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END.



STEP-3

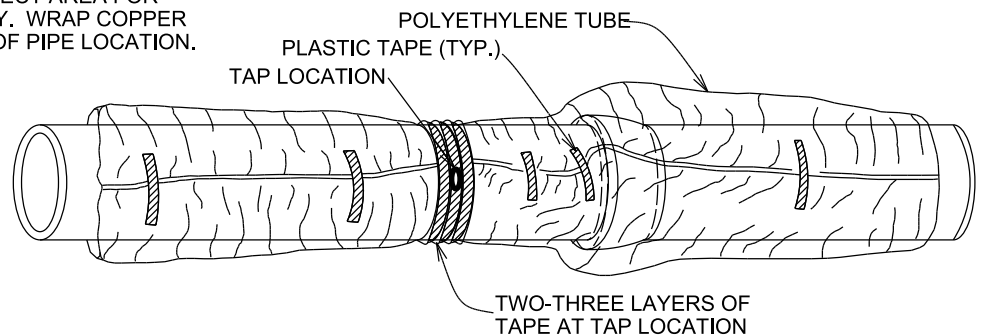
ADJACENT TUBE OVERLAPS FIRST TUBE AND IS SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE AND HELD IN PLACE BY MEANS OF PIECES OF THE PLASTIC TAPE AT APPROX. THREE FOOT INTERVALS. REPAIR ANY TEARS WITH TAPE OR SECURED POLYWRAP PATCHES. CAREFULLY BACKFILL TO AVOID DAMAGING THE POLYETHYLENE WRAP.

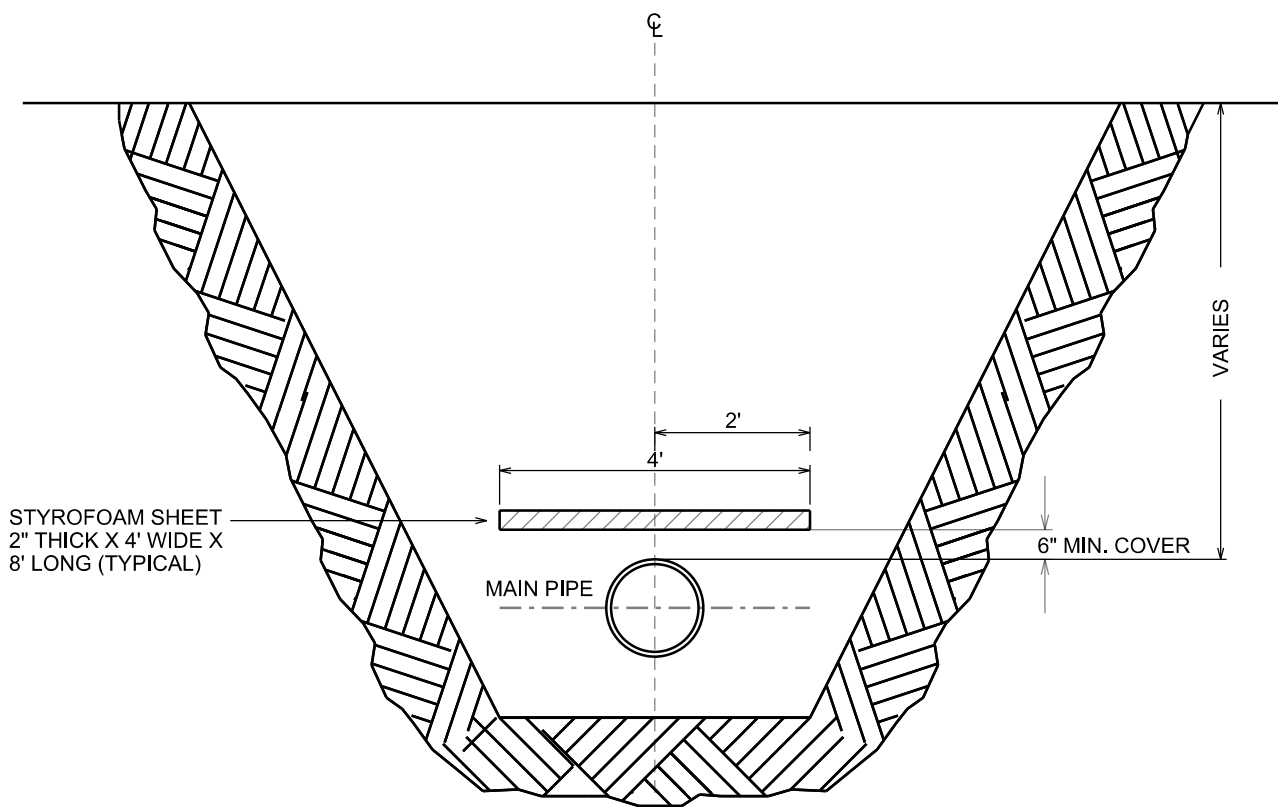


TAPPING POLYETHYLENE WRAP

STEP-1

WRAP TWO OR THREE LAYERS OF TAPE COMPLETELY AROUND PIPE WHERE TAPPING MACHINE WILL BE PLACED. MOUNT TAPPING MACHINE ON TAPED AREA AND TAP DIRECTLY THROUGH THE TAPE AND POLYETHYLENE WRAP. INSTALL CORPORATION STOP. INSPECT AREA FOR DAMAGE AND REPAIR IF NECESSARY. WRAP COPPER SERVICE LINE WITHIN THREE FEET OF PIPE LOCATION.



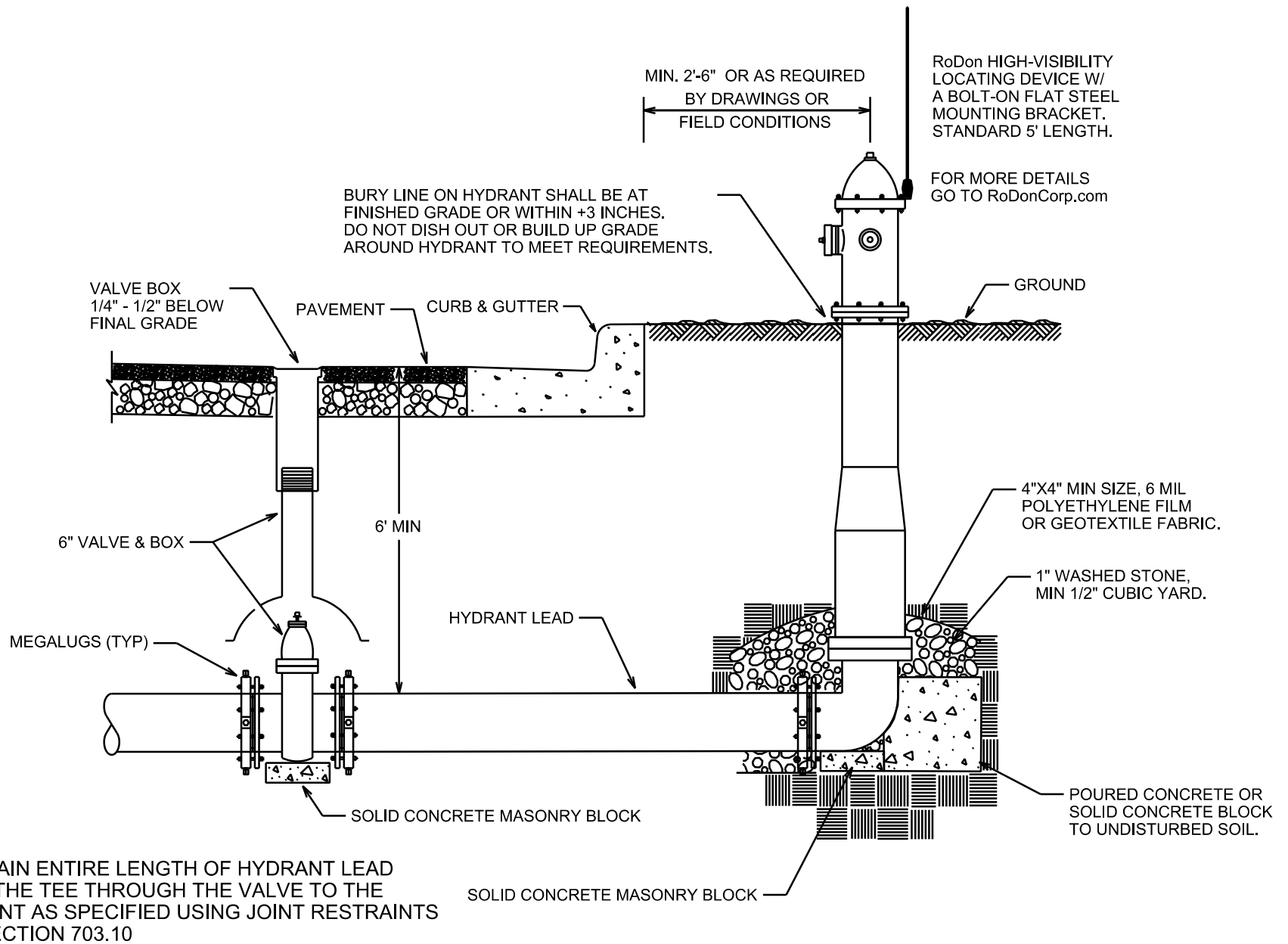


NOTE: ALL STYROFOAM TO BE 2" THICK
HIGH DENSITY POLYSTYRENE BOARD

CITY OF MADISON
WATER UTILITY

NOT TO SCALE

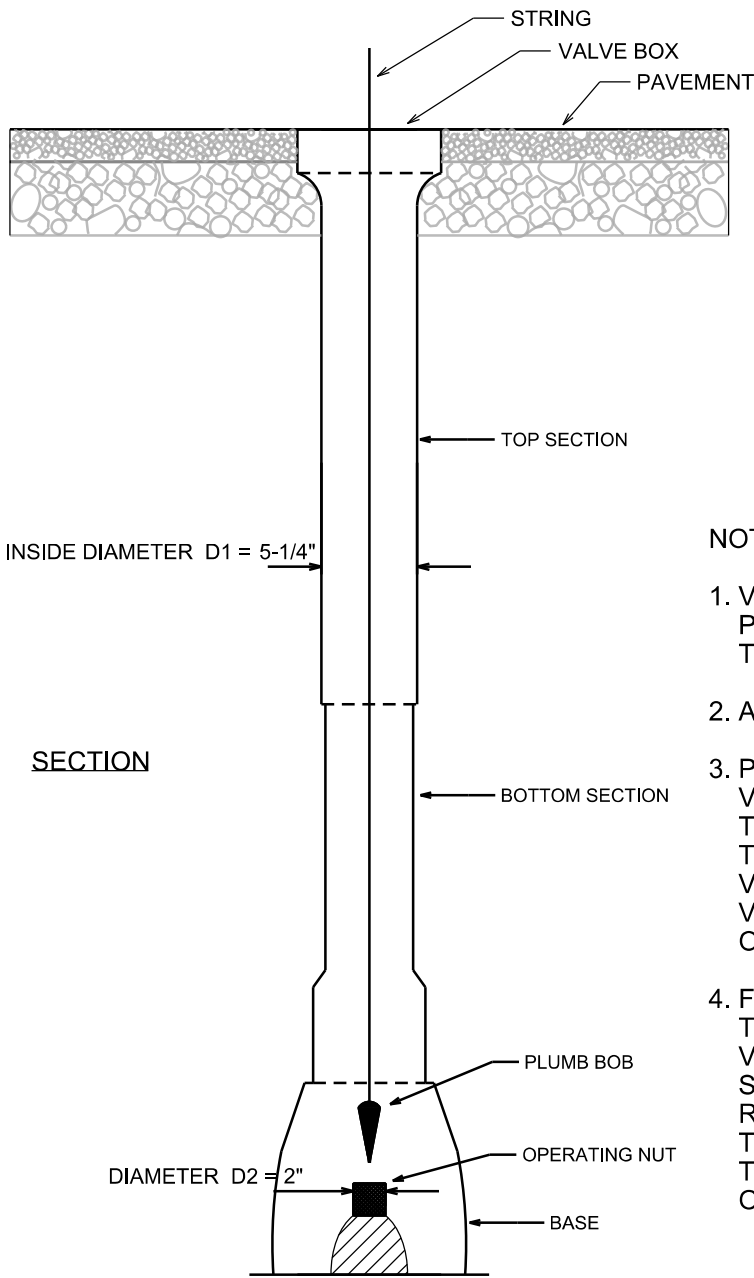
TYPICAL STYROFOAM
INSTALLATION



CITY OF MADISON
WATER UTILITY

NOT TO SCALE

TYPICAL HYDRANT INSTALLATION

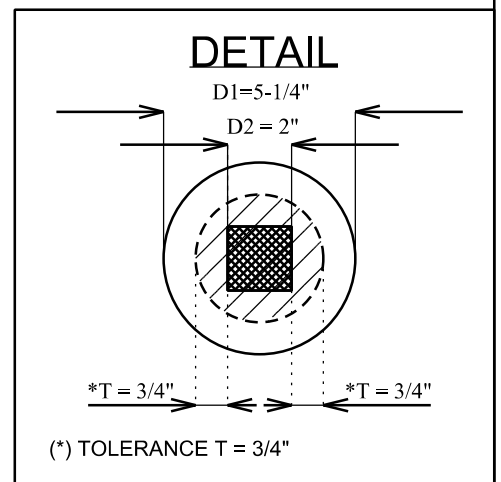
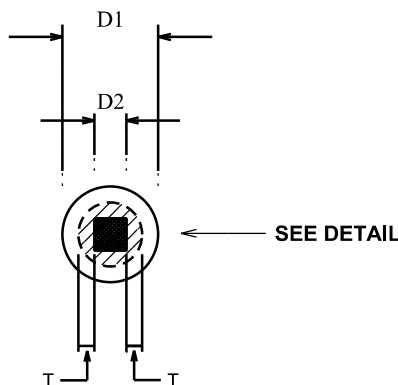


NOTES:

1. VALVE BOX SHALL BE LOCATED PLUMB AND CENTERED WITH RESPECT TO THE VALVE OPERATING NUT.
2. ALLOWABLE TOLERANCE SHALL BE 3/4"
3. PLUMBNESS AND ALIGNMENT SHALL BE VERIFIED WITH A PLUMB BOB, LOCATING THE VALVE NUT WITHIN THE ALLOWABLE TOLERANCE, AND CONFIRMING THAT THE VALVE IS OPERATIONAL WITHOUT THE VALVE KEY TOUCHING THE INSIDE EDGE OF THE VALVE BOX.
4. FOR STREETS WITH SLOPE GREATER THAN 3% THAT DOES NOT ALLOW EASY PLUMBNESS VERIFICATION, THE VALVE BOX STRAIGHTNESS SHALL BE VISUALLY ASSESSED VERIFYING ITS RELATIVE CENTERED POSITION, CONFIRMING THAT THE VALVE IS OPERATIONAL WITHOUT THE VALVE KEY TOUCHING THE INSIDE EDGE OF THE VALVE BOX AND RESTRICTING ITS USE.

SECTION

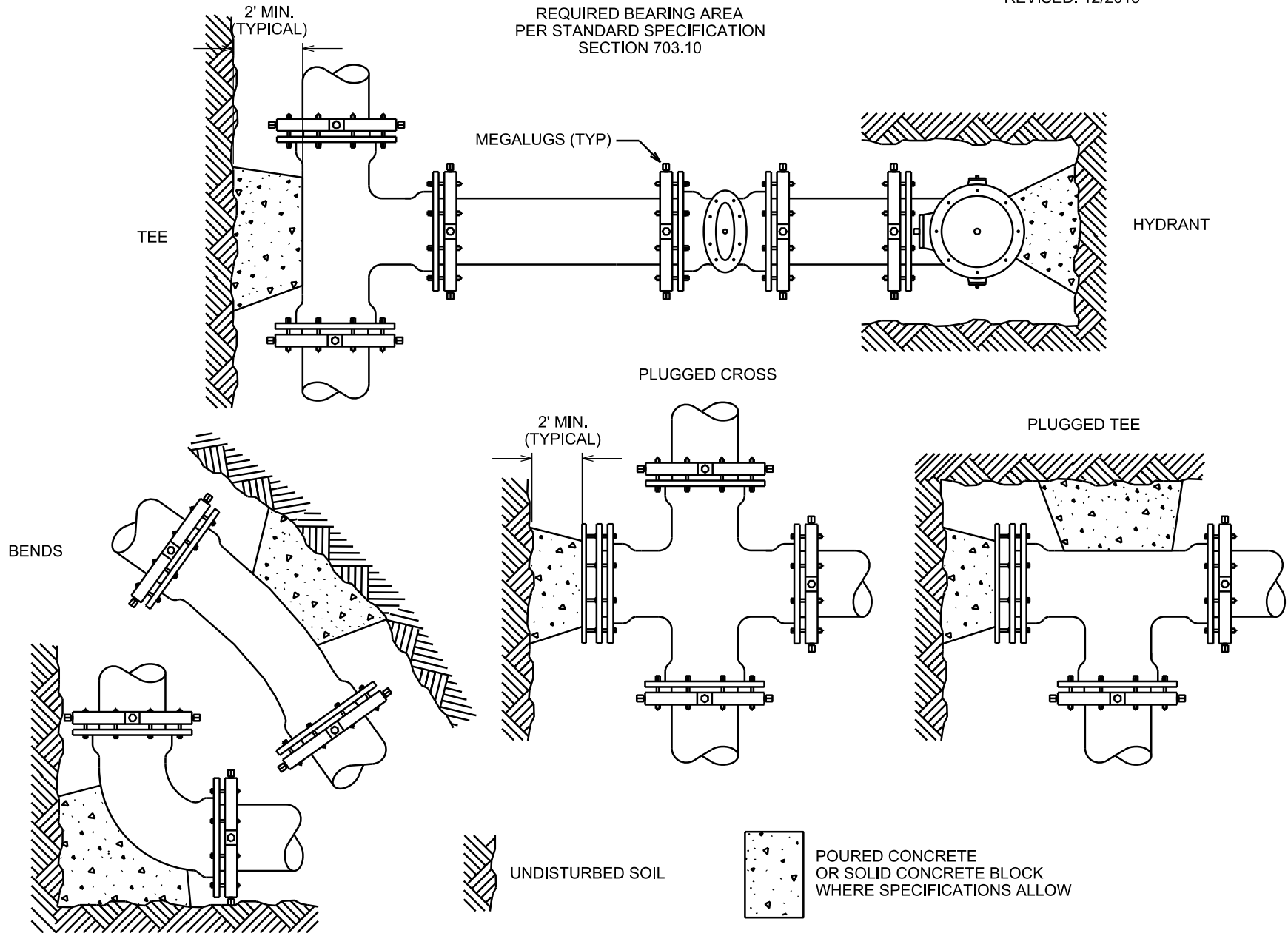
CROSS SECTION



CITY OF MADISON
WATER UTILITY

NOT TO SCALE

WATER VALVE BOX ALIGNMENT

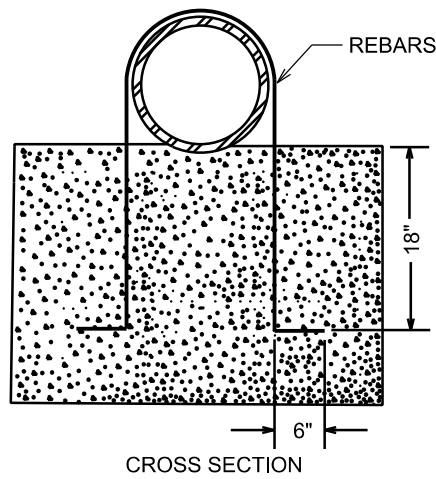
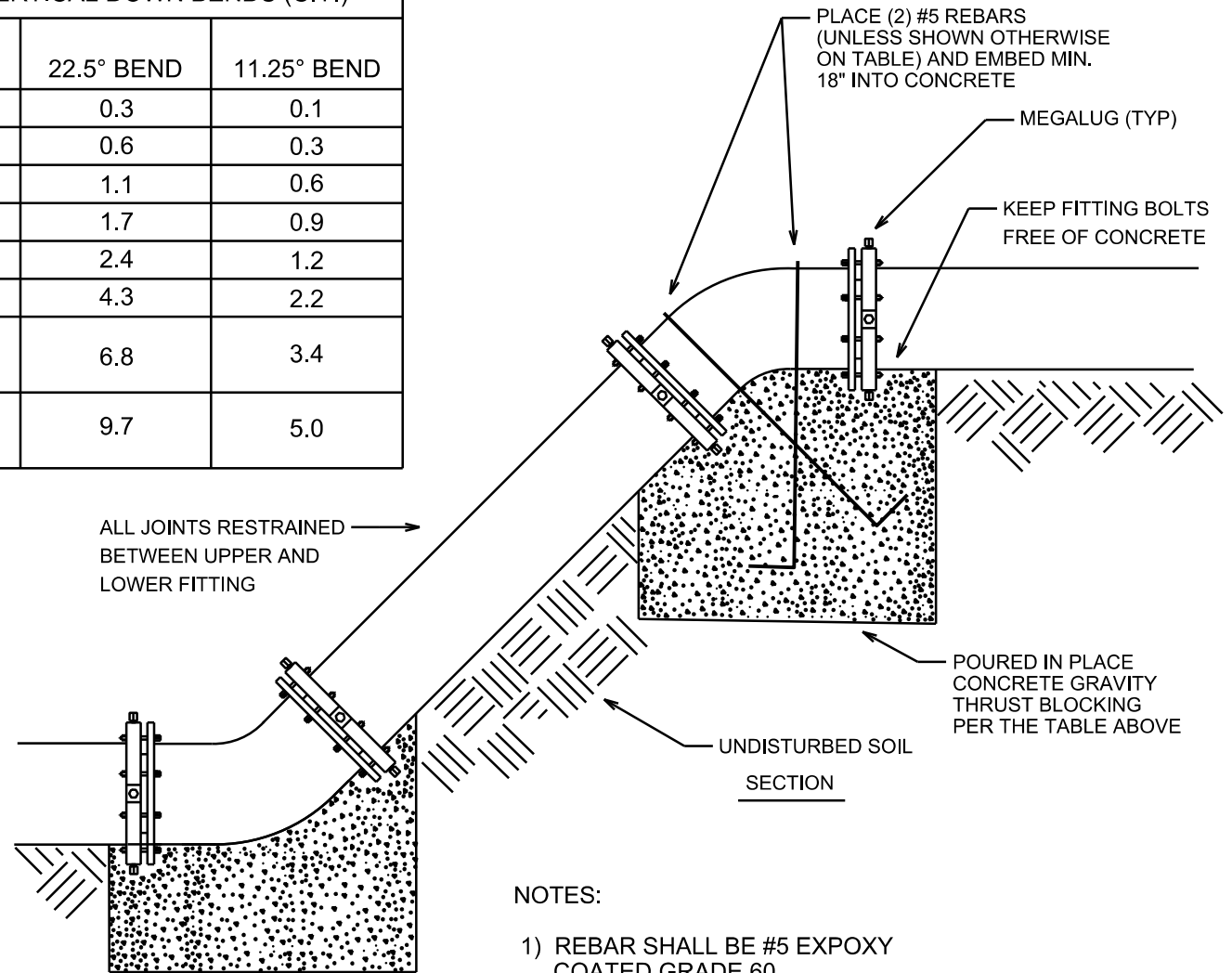


CITY OF MADISON
WATER UTILITY

NOT TO SCALE

STANDARD CONCRETE BLOCK
THRUST RESTRAINT

VOLUME REQUIREMENT FOR VERTICAL DOWN BENDS (C.Y.)				
FITTING SIZE (IN)	90° BEND	45° BEND	22.5° BEND	11.25° BEND
4	0.7	0.5	0.3	0.1
6	1.6	1.1	0.6	0.3
8	2.8	2.0	1.1	0.6
10	4.4	3.1	1.7	0.9
12	6.4	4.5	2.4	1.2
16	11.3	8.0	4.3	2.2
20	17.7 3 BARS	12.5 3 BARS	6.8	3.4
24	25.4 6 BARS	18.0 4 BARS	9.7	5.0



ALL JOINTS RESTRAINED BETWEEN UPPER AND LOWER FITTING

POURED IN PLACE CONCRETE THRUST BLOCKING PER HORIZONTAL RESTRAINT REQUIREMENTS

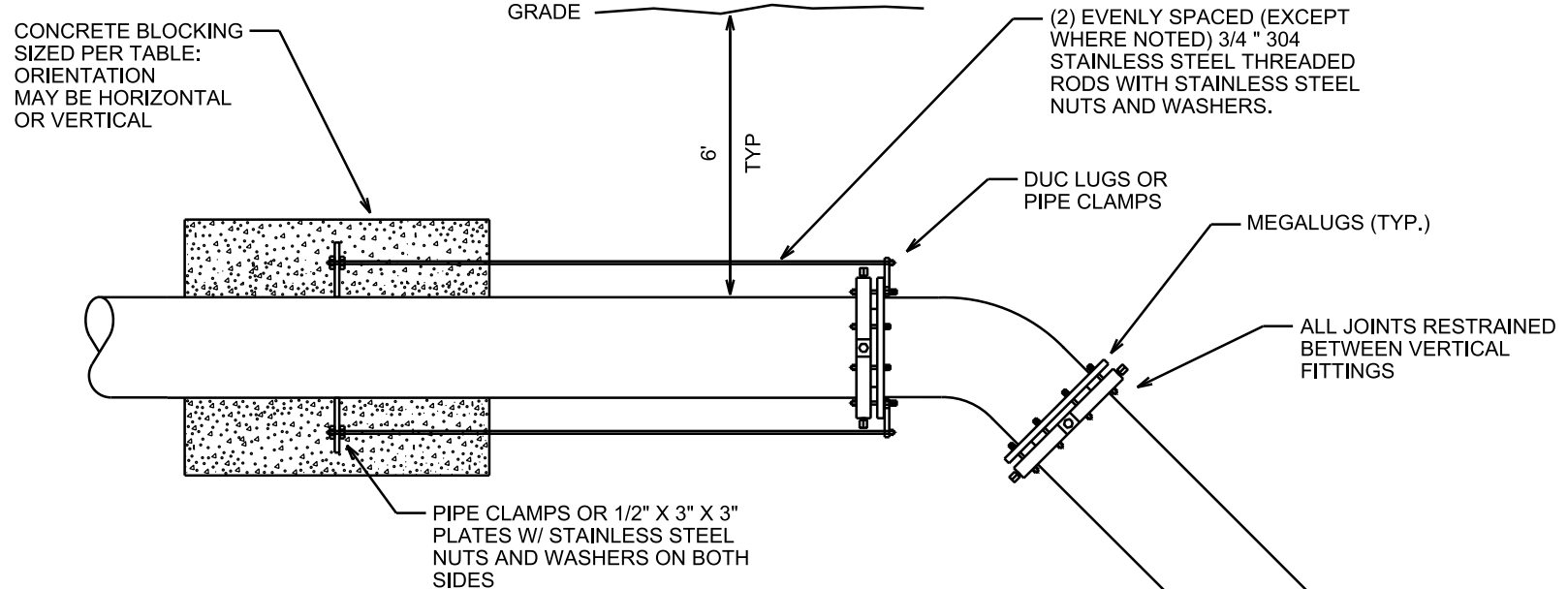
NOTES:

- 1) REBAR SHALL BE #5 EPOXY COATED GRADE 60
- 2) CONCRETE SHALL BE MIN. 3,000 PSI COMPRESSIVE STRENGTH
- 3) ABOVE VALUES ARE BASED ON 150 PSI TEST PRESSURE FOR OTHER TEST PRESSURES PROPORTION AS FOLLOWS: $BLOCK\ VOLUME = TEST\ PRESSURE / 150 \times TABLE\ VALUE$

CITY OF MADISON
WATER UTILITY

NOT TO SCALE

GRAVITY BLOCK THRUST RESTRAINT
FOR VERTICAL BENDS



VOLUME OF POURED CONCRETE BLOCKING (C.Y.) *				
FITTING SIZE (IN)	90° BEND	45° BEND	22.5° BEND	11.25° BEND
4	0.1	0.1	0.1	0.1
6	0.3	0.2	0.1	0.1
8	0.7	0.4	0.2	0.1
10	1.3	0.8	0.3	0.1
12	2.1	1.3	0.6	0.2
16	4.6	2.9	1.3	0.5
20	8.2 4 RODS	5.4 3 RODS	2.3	0.9
24	13.0 5 RODS	8.4 4 RODS	3.8	1.5

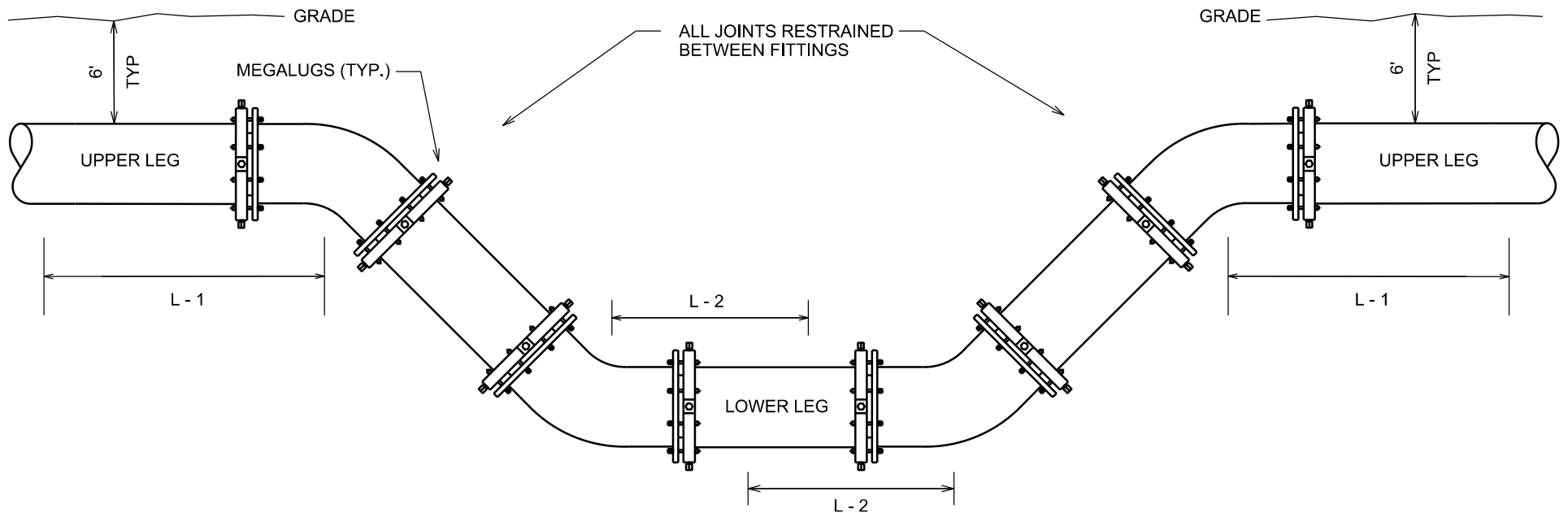
* CONCRETE SHALL BE A MIN. 3000 PSI COMPRESSIVE STRENGTH

NOTE:
THIS METHOD MAY ONLY BE USED WHERE SPECIFIED OR WITH ENGINEER'S APPROVAL

CITY OF MADISON
WATER UTILITY

NOT TO SCALE

ROD & CONCRETE BLOCK THRUST RESTRAINT
FOR VERTICAL BENDS



L - 1: RESTRAINED JOINT LENGTH
UPPER LEG OF VERTICAL BEND

L - 2: RESTRAINED JOINT LENGTH
LOWER LEG OF VERTICAL BEND

FITTING SIZE (IN)	90° BEND		45° BEND		22.5° BEND		11.25° BEND	
	L - 1 (FT)	L - 2 (FT)	L - 1 (FT)	L - 2 (FT)	L - 1 (FT)	L - 2 (FT)	L - 1 (FT)	L - 2 (FT)
4	34	30	16	3	8	2	4	1
6	47	43	21	4	11	2	6	1
8	60	56	27	5	13	3	7	2
10	72	68	31	6	16	3	8	2
12	84	80	37	7	18	4	9	2
16	108	104	46	10	23	5	12	3
20	132	128	56	12	28	6	14	3
24	154	150	66	13	32	7	16	4

NOTES:

SOURCE: Adapted from the EBAA Iron Restraint Length Calculator, Version 6.3
 Materials = Poly Wrapped Ductile Iron Pipe
 Soil Type = GM (Silty Gravels, Gravel-Sand-Silt Mixtures)
 Test Pressure = 150 PSI

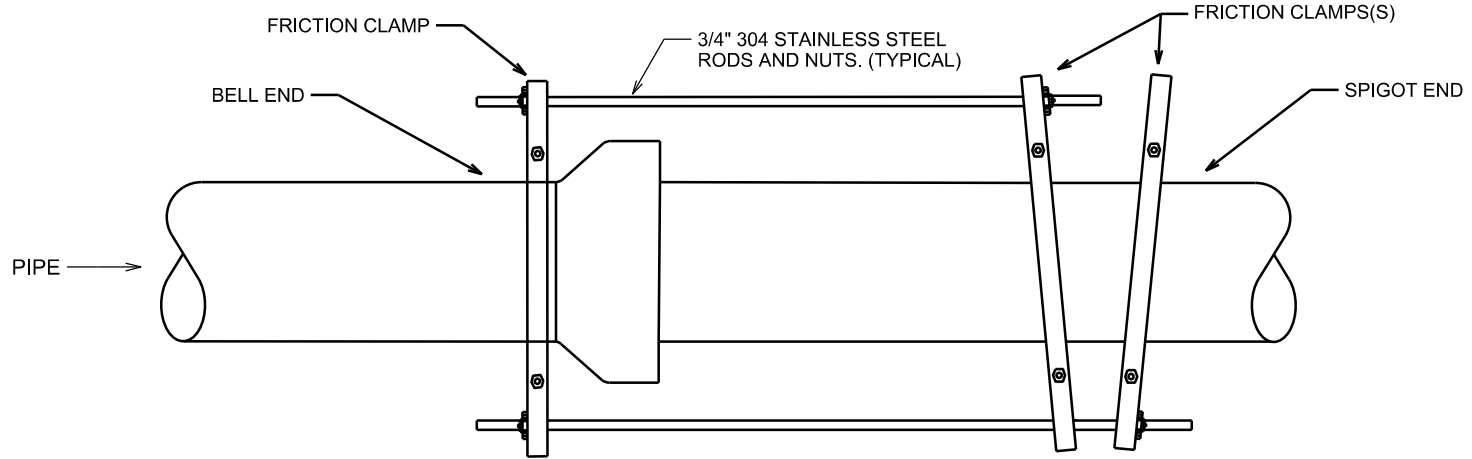
Safety Factor = 1.5
 Trench Type = 4
 High Side Depth = 6'
 Low Side Depth = 8'

CITY OF MADISON
WATER UTILITY

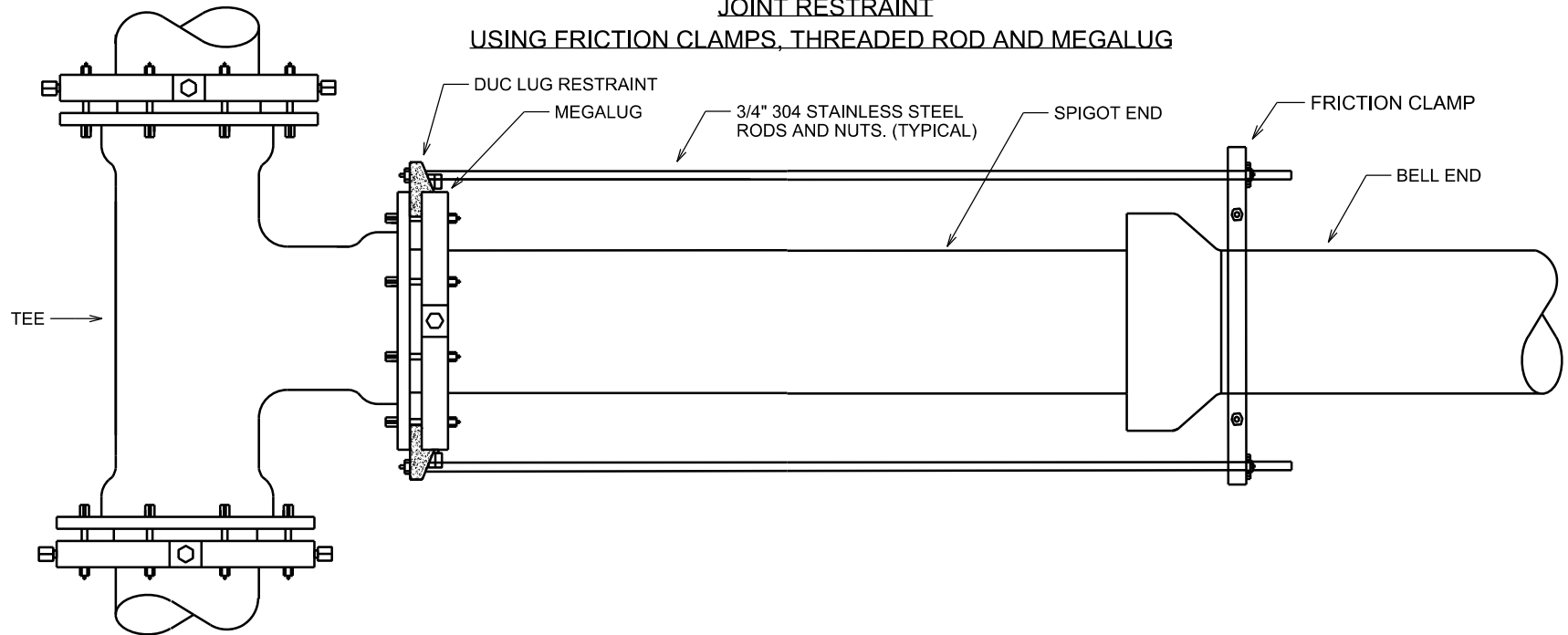
NOT TO SCALE

JOINT RESTRAINT LENGTHS
FOR VERTICAL BENDS

**JOINT RESTRAINT
USING FRICTION CLAMPS AND THREADED ROD**



**JOINT RESTRAINT
USING FRICTION CLAMPS, THREADED ROD AND MEGALUG**

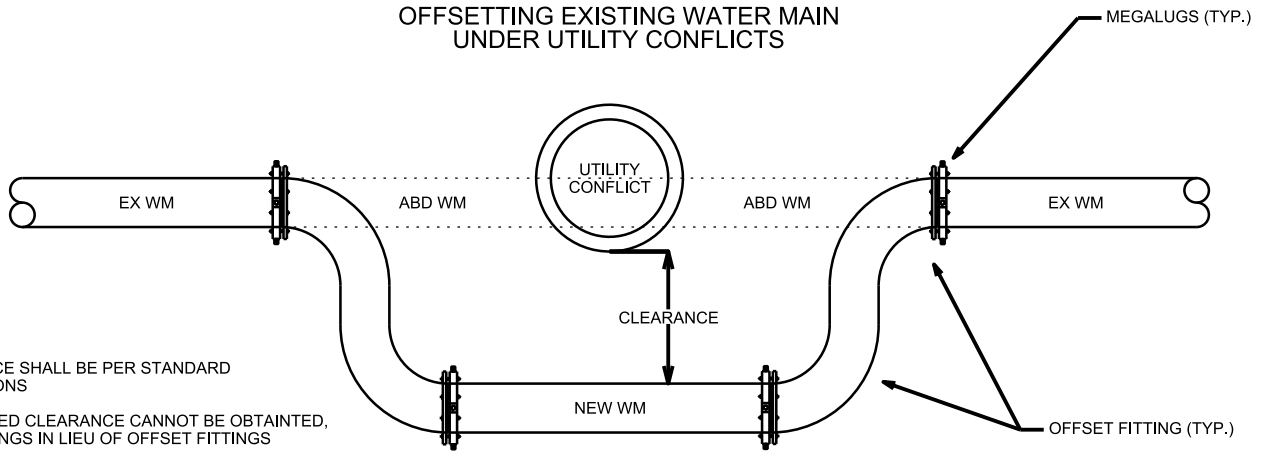


CITY OF MADISON
WATER UTILITY

NOT TO SCALE

THREADED ROD - JOINT RESTRAINT

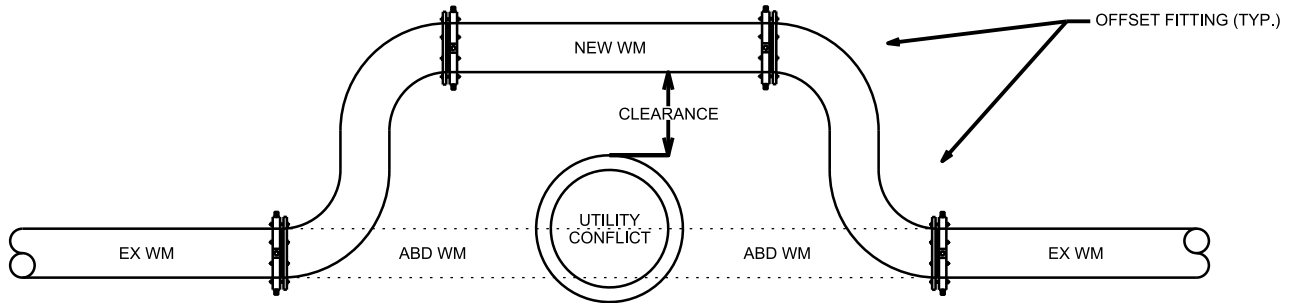
OFFSETTING EXISTING WATER MAIN UNDER UTILITY CONFLICTS



NOTES:

- 1) CLEARANCE SHALL BE PER STANDARD SPECIFICATIONS
- 2) IF REQUIRED CLEARANCE CANNOT BE OBTAINED, USE 45° FITTINGS IN LIEU OF OFFSET FITTINGS
- 3) 11.25°, 22.5°, OR 90° FITTINGS NOT ALLOWED WITHOUT APPROVAL
- 4) INSULATE AS REQUIRED PER STANDARD SPECIFICATIONS
- 5) FITTINGS CONNECTED TO EX WM WITH CUT-IN CONNECTIONS PER STANDARD SPECIFICATIONS
- 6) NEW PIPE SHALL HAVE NO JOINTS BETWEEN FITTINGS

OFFSETTING EXISTING WATER MAIN OVER UTILITY CONFLICTS



NOTES:

- 1) CLEARANCE SHALL BE PER STANDARD SPECIFICATIONS
- 2) IF REQUIRED CLEARANCE CANNOT BE OBTAINED, USE 45° FITTINGS IN LIEU OF OFFSET FITTINGS
- 3) 11.25°, 22.5°, OR 90° FITTINGS NOT ALLOWED WITHOUT APPROVAL
- 4) INSULATE AS REQUIRED PER STANDARD SPECIFICATIONS
- 5) FITTINGS CONNECTED TO EX WM WITH CUT-IN CONNECTIONS PER STANDARD SPECIFICATIONS
- 6) NEW PIPE SHALL HAVE NO JOINTS BETWEEN FITTINGS

CITY OF MADISON
WATER UTILITY

NOT TO SCALE

OFFSETTING EXISTING WATER MAIN
UNDER UTILITY CONFLICTS

SECTION 41 22 00

CRANES AND HOISTS

PART 1 - GENERAL

The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.1 WORK INCLUDED

- A. Equipment items as listed below by Equipment Identifier:
 - 1. 5050 Crane, bridge, top running, 5 ton (Ref. Part 2.1)
- B. Roughing-in, installation of equipment, and final connection of utilities, with labor, services, and incidentals necessary for complete and operational equipment installation.
- C. Wiring, and switching between equipment and utilities.

1.2 QUALITY ASSURANCE

- A. Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.
- B. Manufacturer's Representative:
 - 1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out, and start up.
 - 2. Training: Provide technical representative to provide training to Owner's maintenance personnel in operation and maintenance of specified equipment.
 - 3. Quality standards shall meet or exceed ISO-9001.

1.3 SUBMITTALS

- A. Product Data: Submit Product Data in accordance with Division 1 of these specifications.
- B. Operations and Maintenance Manual:
 - 1. Submit Operations and Maintenance Manuals in accordance with Division 1- General Requirements of these specifications.
 - 2. Provide complete parts, operating, and maintenance manual covering equipment at time of installation.
 - 3. Description of system and components.
 - 4. Schematic diagrams of electrical, plumbing, and compressed air system.
 - 5. Manufacturer's printed operating instructions.
 - 6. Printed listing of periodic preventive maintenance items and recommended frequency to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.
- C. Shop Drawings: Submit Shop Drawings in accordance with Division 1.

1.4 PRODUCT SUBSTITUTIONS

- A. Follow requirements specified in Division 1 - General Requirements.
- B. Additional costs resulting from substitution of products other than those specified, by model number, including drawing changes and construction, will be at the expense of the Contractor.
- C. Substitution Approval: Prior to delivery or installation, submittals for each equipment item by Equipment Identifier shall be provided in accordance with Division 1 - General Requirements. Acceptance will be based on the technical requirements herein as determined by Owner and Architect.

1.5 WARRANTY

- A. Warrant work specified herein for one year from substantial completion against defects in materials, functions, and workmanship.

- B. Warranty shall include materials and labor necessary to correct defects.
- C. Defects shall include, but not be limited to noisy, rough or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish. Defects shall not include damage due to neglect, misuse, or situations resulting from non-performance of a manufacturer's recommended preventive maintenance schedule.
- D. Submit warranties in accordance with Division 1 - General Requirements of these specifications.
- E. All parts shall be readily available locally in the United States.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid and/or dusty conditions.
- B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Equipment Identifier of this specification.
- C. Provide equipment and material specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

PART 2 - PRODUCTS

2.1 CRANE, BRIDGE, TOP RUNNING

Equipment Identifier: 5050

- A. Manufacturer's Reference:
 - 1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish minimal acceptable standards of quality, features, performance, and construction.

a. Konecranes
b. Tempe, AZ (602) 267-8191
c. Model No.: CXTSks5-TON

- 2. Alternate manufacturers: *Contingent upon compliance with these specifications* and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, *may* be considered as equal.

a. Demag Cranes and Components, Cleveland, OH (440) 248-2400
b. R&M Materials, Springfield, OH (937) 525-5100

- B. General Requirements:
 - 1. Top running double girder electric overhead traveling cranes shall be designed, manufactured, and tested as per Crane Manufacturers Association of America (CMAA) Specification #70, Revised 2000.
 - 2. Top running and under running single girder electric overhead traveling cranes shall be designed and manufactured as per CMAA Specification #74, Revised 2000.
 - 3. In addition the crane design and installation shall meet all the applicable local, state, and federal laws and OSHA regulations having jurisdiction.
 - 4. Cranes shall operate in the given spaces and shall match the runway dimensions and rails indicated. Crane design shall maximize hook coverage, hook vertical travel, and clear hook height.
 - 5. The crane shall be designed and manufactured to meet the appropriate service conditions based on the particular application. The crane service class shall be clearly indicated by the manufacturer at the time the crane proposal is submitted.
- C. Capacities/Dimensions:
 - 1. Overall dimensions:
 - a. Span: (verify exact span in field prior to fabrication)

- b. Runway length: Verify exact runway length in field prior to fabrication.
 - c. Clear hook height: 20 feet
- 2. Lift: Hoist design shall maximize hook coverage, hook vertical travel (i.e. end approach), and clear hook height (i.e. headroom). The use of a low headroom hoist is mandatory.
 - 3. Lifting capacity: 10,000 pounds
 - 4. Lower load block or assembly of hook, swivel bearing sheaves, pins and frames suspended by the hoisting ropes shall not be considered part of the rated capacity.
 - 5. CMAA service class: Crane shall be designed and constructed to CMAA Specification #70 (revised 1994) for Class "C" service requirements and operation in a non-hazardous environment.
 - 6. Lift: Hoist design shall maximize hook coverage, hook vertical travel (i.e. end approach), and clear hook height (i.e. headroom). The use of a low headroom hoist is mandatory.
 - 7. Rated speeds (FPM) $\pm 10\%$:
 - a. Hoist: Maximum high 20; Minimum low 3.2 FPM
 - b. Trolley: Maximum high 65; Minimum low 65 FPM
 - c. Bridge: Maximum high 100; Minimum low 100 FPM
- D. Features/Performance/Construction:
- 1. Hoists and trolleys:
 - a. Hoist design shall maximize hook coverage, hook vertical travel (i.e. end approach), and clear hook height (i.e. headroom).
 - b. All top running and under-running single girder cranes shall utilize low headroom electric wire rope hoists.
 - c. All hoists/trolleys shall be supplied with two-speed hoisting contractor controls and inverter trolley speed controls (steeples or programmed two-speed) to minimize load swing and ensure accurate load positioning.
 - d. Any proposed equivalent must meet or exceed the dimensional and performance specification of the above-mentioned products.
 - e. Unless otherwise specified, hoists shall be single revved. Lateral hook drift shall not exceed 1/8 inch per foot of vertical travel, or true vertical lift.
 - f. The drum to rope diameter ratio shall be a minimum of 30:1 to minimize rope flex and significantly extend rope life. Drum shall be made from steel and supported on heavy-duty anti-friction bearings; groove depth shall be at least 35 percent of rope diameter. The rope drum shall be equipped with a rope guide and spring loaded roller to help keep the rope aligned in the grooves of the drum at all times.
 - g. Gear reducers shall be integral components of standard hoists or hoist/ trolley units of manufacturers regularly engaged in the design and manufacturing of hoists or hoist/trolley units for Class C cranes. The hoist gearbox must be mounted on angle to the drum to achieve zero gear lash and insure long gear bearing life. The gear reduction units shall be fully enclosed in oil-tight housing. Operation shall be smooth and quiet.
 - h. Hoisting gears shall be hardened and ground. Gears and pinions shall be spur, helical, or herringbone type only, and shall be forged, steel; open-type gearing is not acceptable. Gears and pinions shall be manufactured to AGMA 2001-B Quality Class 11 or better precision per {AGMA 390.03a} {AGMA 2000-A}. Gear reducer shall not incorporate a mechanical load brake; the gear reducer shall not require regular internal maintenance (such as mechanical load brake adjustment) and frequent lubricant changes due to friction material contamination and high running temperatures.
 - i. If a secondary brake is required the brake shall be installed in such a way as to provide redundant braking at each brake application. Secondary brakes, which are not regularly activated and may become inoperative due to lack of use, are not acceptable.
 - j. The secondary brake shall be a self adjusting DC disc type rated at a minimum of 150 percent of rated motor torque not including regeneration type braking.
 - k. Each hoist shall be equipped with an electro-mechanical load-limiting device that shall prevent lifting more than 110 percent of the rated load.
 - l. Hooks shall be made of forged alloy steel (34rMo4 Class T). Hooks shall be fitted with spring loaded safety latches designed to preclude inadvertent displacement of slings from the hook saddle and have 360 degree rotation on anti-friction bearings. Painting

- or welding shall not be performed on the hook. Hook nut shall be secured with a removable type set screw or other similar fastener; nut shall not be welded. Hooks shall be designed and commercially rated with safety factors in accordance with CMAA.
- m. Bottom block shall be totally enclosed in a steel housing. Rope sheaves shall be supported on heavy-duty anti-friction bearings. Load blocks shall be of steel construction. Load blocks shall be provided with hot-rolled or forged steel fixed crosshead separate from the sheave pin with swivel mounting for forged steel hook. Each lubrication fittings for sheave pins shall be independent type recessed within the sheave pin or adequately guarded to prevent damage.
 - n. Sheaves shall be of steel or ductile iron (240 to 302 BHN hardness). Sheaves grooves shall be accurately machined, smoothly finished, and free of surface defects. The sheave to rope diameter ratio shall be a minimum of 20:1 to minimize rope flex and extended rope life.
 - o. Wire rope shall be constructed from galvanized steel having a steel core and a minimum safety factor of 5. (Hoisting ropes shall be the rated capacity load plus the load block weight divided by the number of rope parts, and shall not exceed 20 percent of the certified breaking strength of rope.) Ropes shall be suited to meet the service requirements. Rope socketing or U-bolt clip connections shall be equal to or greater than the rope lengths. Hoisting ropes shall be secured to hoist drum so that no less than two wraps of rope remain at each anchorage of hoist drum at the extreme low position (limit switch stop).
 - p. Trolley shall be complete with a drive arrangement with a minimum of two-wheel driven by an integral electric motor. Drive mechanism shall run in totally enclosed oil bath. Drive gears shall conform to AGMA 2001-B Quality Class 11 or better. Stop limit switches must be provided for drive mechanism. Acceleration and deceleration controls shall meet requirements specified in this section. Trolley motor shall be inverter duty motor with minimum class "F" insulation. Motors shall have quick disconnect plugs for easy maintenance. Speed shall be infinitely variable from 0 to 50 FPM.
 - q. Trolley braking system shall be automatically set when controls are released or power is interrupted. Brakes shall be sealed, dust proof and shall require no adjustment over a million cycles and last the life of the hoist under normal use.
2. Bridge components:
- a. High-strength bolted connections shall utilize SAE Grade 5 bolts with corresponding lockwashers, nuts, etc., conforming to requirements of AISC S329 bolts. Bolts, nuts, and washers shall conform to ASTM 325 bolts. Galvanized bolts are not acceptable.
 - b. Bridge girders shall be constructed from A36 welded box girders, or A36 Structural beams. Girder shall be notched at ends and bolted to top of end trucks with horizontal connection plate utilizing shear rings to absorb horizontal shear forces and to maintain squareness. No "in shear" connections between girders and trucks will be allowed.
 - c. Bridge end trucks to be constructed of welded box shapes, formed into a rigid tubular housing. Trucks to be equipped with removable rail sweep on each end as well as energy-absorbing bumper. Wheel assemblies shall consist of flat tread, double-flanged, high-quality nodular iron or forged steel wheels, having anti-friction bearing assemblies with whole wheel assembly readily removed for easy repair. Drive wheels shall have rotating axles; idler wheels may be of fixed axle type. End connections shall be made with high-strength bolts.
 - d. Bridge drives shall be A-4 drive arrangement as specified in MHI CMAA 70. Bridge drive shall consist of a single electric motor mechanically connected through gear reduction and drive shafts to each drive wheel. Gears shall conform to applicable AGMA standards. Gear reducers shall be oil tight and fully enclosed with pressure or splash type lubrication to reduce maintenance and improve reliability.
 - e. Bridge braking system shall be provided with a spring-applied and electrically released disc brake for each bridge drive motor. Brakes shall have a torque rating of at least 50 percent of bridge drive motor rated torque. Brakes shall be self-adjusting for wear.
 - f. Wheels shall be manufactured of steel or nodular iron. Wheel treads and flanges shall be rim toughened to between 220 and 300 Brinell hardness number. Bridge and trolley wheels shall be double-flanged. Trolley wheels shall have straight treads. Bridge wheels

- shall have straight treads. Wheel shall be equipped with heavy-duty anti-friction bearings - no bushings shall be allowed.
- g. Where applicable, cranes shall be designed to preclude leakage of lubricants onto the lifted loads or the floor. Equipment and components, which cannot be made leak-proof, shall be fitted with suitable drip pans. Drip pans shall be manufactured of stainless steel and designed to permit removal of collected lubricant.
 - h. Electrically controlled brakes shall be fail-safe spring set when power is interrupted. Brakes shall be released with a mainline contractor POWER-OFF push button or a master switch for the associated drive. Brakes shall automatically stop when there is a power failure.
 - i. Runway (track-type) limit switches shall be provided for crane bridge motion to stop the bridge motion. Trip mechanisms for bridge motion shall be located on crane runway to trip switch before bumper contacts stop. When the switch is tripped, the switch shall permit opposite travel in the direction of stop and then automatically reset.
3. Welding: Welders, welding operations and welding procedures shall be qualified or pre-qualified in accordance with AWS D14.1. The surface of parts to be welded shall be free from rust, scale, paint, grease or other foreign matter. Minimum preheat and interpass temperatures shall conform to the requirements of AWS D14.1. Welding shall be performed in accordance with written procedures, which specify the Contractor's standard dimensional tolerances for deviation from camber and sweep. Such tolerances shall not exceed those specified in accordance with AWS D14.1. Allowable stress ranges shall be in accordance with MHI CMAA 70. Welding of girders and beams shall conform to AWS D14.1.
4. Markings, labels, and warnings:
- a. Two capacity plates including the crane capacity in tons are required, one secured to each side of bridge crane. Each capacity plate shall be fabricated of steel or a quality/fade-resistant stick-on label with letters large enough to be easily read from the floor. Capacity plates shall be placed in a location visible to pendant operator's position after the crane has been installed.
 - b. Readable warning labels shall be affixed to each lift block or control pendant in a readable position in accordance with ASME B30.16, ASME B30.2 and ASME B30.17. The word "warning" or other legend shall be designed to bring the label to the attention of the following information concerning safe-operating procedures: operating the hoist when the hook is not centered under the hoist; operating hoist with twisted, kinked or damaged rope; with a rope that is not properly seated in its hoist drum groove; lifting people; lifting loads over people; and removing or obscuring the warning label.
5. Crane runway rail: Manufacturer to provide crane runway rail to match end truck wheel assembly with crane stop.
- E. Electrical and Control Requirements:
- 1. Cranes shall be designed to be operated from a 460 VAC, 3 phase, 60 Hz, alternating current system power source.
 - 2. The hoist/trolley shall be CAS (US) approved and/ or UL approved to NEMA 3R protection. Hoist control enclosure shall be rated NEMA 4.
 - 3. Hoisting motors shall be two-speed/two winding squirrel cage type with a speed ratio of 6:1. Hoisting motors effective duty shall be 50 percent ED (30 minute rated) or higher with minimum class "F" insulation. One thermal sensitive device embedded in hoist motor windings shall be provided. Thermal-sensitive device and associated circuits shall be self-restoring (automatic reset). Motors shall be designed specifically for crane and hoist duty.
 - 4. The hoist motor shall be positioned inside the drum to minimize heat build up by directing airflow over the motor in close proximity to the motor housing. The cooling effect of the hoist drum surrounding the motor shall be an acceptable means of directing this airflow, and keeping damaging motor heat to a minimum.
 - 5. Hoist controls shall be full magnetic type, specifically selected for hoisting service. The trolley shall be supplied with variable frequency drive (VFD) controls for two-step or infinitely variable speed control for smooth acceleration and deceleration; minimal load swing and accurate load placement.

6. Hoist shall be equipped with a geared adjustable upper and lower limit switch to limit extreme upper and lower travel of the bottom block assembly. Geared limit switch shall have four positions with the following functions- lower limit, upper slowdown, upper limit, and phase reversal supervision. The upper-most limit shall be wired to the down circuit in such manner to prevent hoisting in the event of a phase reversal.
 7. Bridge motors shall be inverter duty motors with minimum class "F" insulation. Motors shall have quick-disconnect plugs for easy maintenance. Travel motors shall have a duty of 40 percent or higher. Motor enclosure shall be TENV (totally enclosed non-ventilated). Provide slow down and stop limit switches at each end of the bridge to insure safe operation. Speed shall be infinitely variable from 0 to 100 FPM.
 8. A main line disconnect consisting of a combination circuit breaker (50,000 AIC) and non-reversing starter, starter without overloads (mainline contractor) in NEMA Type 4X enclosure shall be provided. Mainline disconnect shall be controlled by a control circuit so that all crane motions will be stopped upon mainline under voltage, overload, control circuit fuse failure, or operation of POWER-OFF push button. Mainline disconnect shall be equipped with energy isolating devices designed to accept lockout devices.
 9. Pendant control station enclosure shall be NEMA 4X Type. Physical size of pendant shall be held to a minimum. A separate cable of corrosion-resistant chain consisting of a minimum 6.4 millimeters (1/4 inch) wire shall be provided. Cable shall be integral with pendant control wire.
 10. Push button control enclosure shall be NEMA 4X. Thermal overloads to be provided for all motors. Hoist to be equipped with overload cut-off device. Hoist and trolley control functions to be combined with pushbutton control functions for crane motions.
 11. Reduced voltage at pendant push button.
 12. Operation push buttons shall be heavy-duty; type with distinctively felt operation positions, which meet requirements of NEMA 4X. Pendant control buttons shall be momentary push buttons. Push buttons (except the POWER- OFF button) shall be recessed type to avoid accidental operation. Diameter of buttons shall be a size, which will make operation possible with a thumb while holding the pendant with the same hand. Nameplates shall be provided adjacent to each push button. In a multi-speed application, dual-position push buttons shall have a definite click-indent position for each speed. Pendant shall include a separate set of pushbuttons for each motion and for POWER-OFF. Push buttons shall be as follows:
 - a. POWER-OFF
 - b. POWER-ON
 - c. Hoist-Up
 - d. Hoist-Down
 - e. Bridge-{East} {West}
 - f. Trolley-{North} {South}
 13. Bridge span conductor system shall be the rigid conductor/collector type. Cable loops shall not drop below the hook high position. Outdoor crane bridge festoon system hardware shall be corrosion resistant.
 14. Pendant festoon system shall consist of a support rail, cables, junction boxes, cable cars, and accessories. Cable loops shall not drop below the hook high position. Pendant control car shall be provided with NEMA Type 12 junction box. Outdoor crane pendant festoon system hardware shall be corrosion resistant.
 15. Main power electrification system shall provide power to crane starter/ disconnect circuit breakers.
- F. Accessories:
1. Crane runway rail to match end truck wheel assembly with crane stop.
 2. Crane runway conductor system shall be covered conductor bar system type designed and manufactured to meet UL requirements. Protective covers shall be the rigid or flexible self-closing type designed to cover all live conductors and shall be shaped to prevent accidental contact with conductors. Collectors shall be heavy-duty sliding shoe type compatible with the electrification system. Two tandem designed collector heads shall be provided for each conductor rail to provide redundancy.
 3. A solid-waste electronic warning horn shall be provided on the crane. Any bridge or trolley motion shall be accompanied by a continuous series of alternating tones.

4. Control panels shall be provided with a 120-volt lamp fixture with an unbreakable lens and switch. Two floodlights shall be provided to illuminate the work area under the crane. Floodlights shall be metal halide (400 watt) industrial luminaries. Each floodlight shall be totally enclosed, vapor-tight design, gasketed, and shall be provided with a heat-resistant glass lens. Floodlights shall be spaced and attached to underside of crane to provide uniform lighting.

G. Utility Requirements:

1. Electrical:											
a.	<table border="1"> <thead> <tr> <th>Connection Requirements</th> <th>Power</th> </tr> </thead> <tbody> <tr> <td>Voltage</td> <td>460</td> </tr> <tr> <td>Phase</td> <td>3</td> </tr> <tr> <td>HP</td> <td>---</td> </tr> <tr> <td>Amps</td> <td>15</td> </tr> </tbody> </table>	Connection Requirements	Power	Voltage	460	Phase	3	HP	---	Amps	15
Connection Requirements	Power										
Voltage	460										
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b.	<table border="1"> <tr> <td>Connection Type</td> <td>Provide disconnect</td> </tr> </table>	Connection Type	Provide disconnect								
Connection Type	Provide disconnect										

- H. Finish: Bridge crane including bridge, trolley, hoist, and all attached items shall be painted in accordance with the manufacturer's standard practices. Items such as surfaces in contact with the electrical collector bars in contact with the collector shoes and nameplates shall not be painted.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.
 B. Inspect delivered equipment for damage from shipping and exposure to weather. Compare delivered equipment with packing lists and specifications to assure receipt of all equipment items and specified accessories.

3.2 INSTALLATION

- A. Perform work under direct supervision of Foreman of Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect or designated representative.
 B. Install equipment in accordance with plans, shop drawings, and manufacturer's instructions:
 1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level (or slight slope as required by instructions), plumb, and at right angles to adjacent work.
 2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.
 3. Anchorage: Attach equipment as directed by Architect or designated representative. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.
 C. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.3 TESTING

- A. After final installation is complete and prior to authorizing payment, specified equipment shall be checked with specifications in the presence of the Architect or designated representative using acceptance procedures provided by the manufacturer. Testing report shall be submitted to the Architect or designated representative.

3.4 CLEANUP

- A. Touch-up damage to painted finishes.
 B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.
 C. Clean area around equipment installation and remove packing and installation debris from job site.

- D. Notify Architect or designated representative when installation and cleanup is 100% complete and ready for final observation (punchlist).

3.5 TRAINING

- A. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.
 - 1. 5050 Crane, bridge, top running, 5 ton; 3 hours (minimum)
- B. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

END OF SECTION 41 22 00

SECTION 41 34 23

SPRAY PAINTING BOOTHS

PART 1 - GENERAL

The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.1 WORK INCLUDED

- A. Equipment items as listed below by Equipment Identifier:
 - 1. 6120 Booth, paint, side, downdraft with heated air makeup (Ref. Part 2.1)
 - 2. 6163 Room, mixing, paint (Ref. Part 2.2)
- B. Modifications to utilities, ducting, roof penetrations, roughing-in, installation of equipment, and final connection of utilities, with labor services, and incidentals necessary for complete and operational equipment installation as a result of expansion/relocation of booth.

1.2 QUALITY ASSURANCE

- A. Experience: Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.
- B. Manufacturer's Representative:
 - 1. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check out, and start up.
 - 2. Training: Provide technical representative to provide training to Owner's maintenance personnel in operation and maintenance of specified equipment.

1.3 SUBMITTALS

- A. Product Data: Submit Product Data in accordance with Section 01300 of these specifications
- B. Operations and Maintenance Manual:
 - 1. Submit Operations and Maintenance Manuals in accordance with Division 1- General Requirements of these specifications.
 - 2. Provide complete parts, operating, and maintenance manual covering equipment at time of installation.
 - 3. Description of system and components.
 - 4. Schematic diagrams of electrical, plumbing, and compressed air system.
 - 5. Manufacturer's printed operating instructions.
 - 6. Printed listing of periodic preventive maintenance items and recommended frequency to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.
- C. Shop Drawings: Submit Shop Drawings in accordance with Section 01300.

1.4 PRODUCT SUBSTITUTIONS

- A. Follow requirements specified in Division 1 – General Requirements.
- B. Additional costs resulting from substitution of products other than those specified, by model number, including drawing changes and construction, will be at the expense of the Contractor.
- C. Substitution Approval: Prior to delivery or installation, submittals for each equipment item by Equipment Identifier shall be provided in accordance with Division 1 - General Requirements. Acceptance will be based on the technical requirements herein as determined by Owner and Architect.

1.5 WARRANTY

- A. Warrant work specified herein for one year from substantial completion against defects in materials,

functions, and workmanship specified herein.

- B. Warranty shall include materials and labor necessary to correct defects.
- C. Submit warranties in accordance with Division 1 - General Requirements of these specifications.
- D. All parts shall be readily available locally in the United States.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in manufacturer’s containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid and/or dusty conditions.
- B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Equipment Identifier of this specification.

1.7 LABELING

- A. Manufacturer shall securely attach in a prominent location, on each major item of equipment, a non-corrosive nameplate showing manufacturer’s name, address, model number, serial number, and pertinent utility or operating data.
- B. All electrical equipment and materials shall be new and shall be listed by Underwriter’s Laboratories, Inc. (UL) in categories for which standards have been set by that agency and labeled as such in the manufacturer’s plant.

PART 2 - PRODUCTS

2.1 BOOTH, PAINT, SIDE DOWNDRAFT, WITH HEATED AIR MAKEUP
Equipment Identifier: 6120

- A. Manufacturer’s Reference:
 - 1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer’s name and model to establish minimal acceptable standards of quality, features, performance, and construction.

<ul style="list-style-type: none"> a. Global Finishing Solutions, LLC b. Osseo WI (800) 848-8738 c. Model No.: PRFMP-301409-BT

- 2. Alternate manufacturers: *Contingent upon compliance with these specifications* and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers *may* be considered as equal.

<ul style="list-style-type: none"> a. AFC Finishing Solutions, Oroville, CA (800) 331-7744 b. Spray Systems, Pamona, CA (909) 623-6944

- B. Capacities/Dimensions:

- 1. Overall dimensions:

Dimensions (inches)			
	Length	Width	Height
a. Equipment	215	414-1/4	148-1/4

- 2. Booth working dimensions: 30 feet wide by 14 feet long by 9 feet high

- C. Features/Performance/Construction:

- 1. Paint booth shall be of side downdraft design to create a conventional vertical and horizontal flow of air to effectively remove particulate matter from the spraying area.

2. Paint booth shall include 34 inches heavy duty exhaust unit 15,000 CFM 1 inch W.C. - internal s.p.
3. Paint booth shall include intake motor 10 HP, exhaust motor 7.5 HP, TEFC motors with variable pitch drive sheave.
4. Paint booth shall include one each exhaust fan to exhaust chamber adapters.
5. Paint booth shall include a NEMA/12 pre-wired control panel with main breaker disconnect, magnetic motor starter, motor fuse protection, lighting contactor, lighting fuse protection, terminal strips for field welding, system operating lights, air make-up temp select, and UL industrial listing.
6. Paint booth shall be designed and provided in accordance with all local codes, OSHA, and NFPA regulations.
7. Structure: Paint booth shall be constructed of a minimum 18 gauge galvanized sheet steel. Panels shall be pre-punched, companion flanged for easy assembly, and reinforced with a 6 inch I-beam.
8. Paint booth shall include one each ceiling type intake plenum chamber and single exhaust chambers.
9. Paint booth shall include a quantity of two man access doors, 3 feet by 7 feet with an 18 by 48 inches observation window, and one set of 3 wing entry door 9 feet 8 inch width by 8 feet 10 inch height.
10. Lighting: Shall be supplemented with 24 each, interior access, open type, 48 inches, 4-tube fluorescent light fixtures. Fixtures to be 120 VAC and vapor proof.
11. Paint booth shall include a RAM 30 Direct Fired Heater air make-up unit with the following:
 - a. H2 unit arrangement
 - b. 100 percent replacement air
 - c. 15,000 SCFM/0.25 duct SP/0.55 total ESP/RPM: 490A
 - d. Electric current: 440-480/60/3 three-wire
 - e. ETL lable
 - f. Indoor safety switch (disconnect)
 - g. Unit location: Indoor installation
 - h. 15 HP motor - open drip proof - high efficiency EPACT
 - i. 1,200,000 BTUH / 90 temperature rise (degrees F)
 - j. Gas pressure: 14 inches (natural gas)
 - k. Gas controls: Two main gas valves - one motorized, one solenoid
 - l. Temperature control system: 401M, Maxitrol
 - m. Inlet damper with two-position motor and interlock
 - n. Hood with 1 inch cleanable filter with birdscreen
 - o. G90 galvanize casing - painted
 - p. Flame failure unit shutdown
 - q. Pillow block bearings
 - r. Adjustable drivers
 - s. Extra set of N.O. contacts
 - t. Gas pressure gauge
 - u. Square D starter
 - v. Remote switching panels
 - w. One set intake filters
 - x. One set exhaust filters and one set grids
 - y. One lot necessary assembly hardware and installation drawings

D. Utility Requirements:

1. Electrical:											
a.	<table border="1"> <thead> <tr> <th>Connection Requirements</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>Voltage</td> <td>460</td> </tr> <tr> <td>Phase</td> <td>3</td> </tr> <tr> <td>HP</td> <td>17.5</td> </tr> <tr> <td>Amps</td> <td>35</td> </tr> </tbody> </table>	Connection Requirements	Unit	Voltage	460	Phase	3	HP	17.5	Amps	35
Connection Requirements	Unit										
Voltage	460										
Phase	3										
HP	17.5										
Amps	35										
b.	Connection Type Provide disconnect										
2. Plumbing:											
a.	<table border="1"> <thead> <tr> <th colspan="2">Natural Gas:</th> </tr> </thead> <tbody> <tr> <td>Connection (inches)</td> <td>1-1/4 NPT</td> </tr> <tr> <td>Capacity (BTU)</td> <td>1,200,000</td> </tr> </tbody> </table>	Natural Gas:		Connection (inches)	1-1/4 NPT	Capacity (BTU)	1,200,000				
Natural Gas:											
Connection (inches)	1-1/4 NPT										
Capacity (BTU)	1,200,000										
3. Mechanical:											
a.	<table border="1"> <thead> <tr> <th colspan="2">Venting:</th> </tr> </thead> <tbody> <tr> <td>Connection (inches)</td> <td>34</td> </tr> <tr> <td>Volume (CFM)</td> <td>15,000</td> </tr> <tr> <td>Stack Type</td> <td>---</td> </tr> </tbody> </table>	Venting:		Connection (inches)	34	Volume (CFM)	15,000	Stack Type	---		
Venting:											
Connection (inches)	34										
Volume (CFM)	15,000										
Stack Type	---										

2.2 ROOM, MIXING, PAINT
Equipment Identifier: 6163

A. Manufacturer's Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish minimal acceptable standards of quality, features, performance, and construction.

a.	Global Finishing Solutions
b.	Osseo, WI (800) 848-8738
c.	Model No.: UMRW-091509-4

2. Alternate manufacturers: *Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers may be considered as equal.*

a.	AFC Finishing Systems, Oroville, CA (800) 331-7744
b.	Spray Systems, Inc., Pomona, CA (909) 623-6944

B. Capacities/Dimensions:

1. Overall dimensions:

Dimensions (inches)			
	Length	Width	Height
a. Equipment	108	180	132

2. Room working dimensions: 9 feet wide by 9 feet 7 inches tall by 15 feet long

3. Liquid quantity:

- a. Quantity of liquid to be stored shall not exceed 60 gallons to comply with 1997 UFC section 7903.2.1.6 and 2007 NFPA 33 section 8.3.4, if the mixing room is adjacent and within 6 feet of the spray booth.
- b. Quantity of liquid to be stored shall not exceed 300 gallons if the mixing room is adjacent and 6 feet or more from the spray booth 2007 NFPA 33 section 8.3.5.

4. Exhaust fan:

- a. Motor: 1/2 HP
- b. Capacity: 1150 CFM at 1/2 inch s.p.

C. Features/Performance/Construction:

1. Room:

- a. Clean air shall be introduced into the room through intake filters located at the front of the enclosure and is exhausted through a plenum at the rear of the room. Air is pulled horizontally from the front of the room through the entry working depth.
- b. Mixing room shall be specifically designed for the removal of harmful vapors and filtering of air prior to outdoor exhaust.
- c. Mixing room shall be designed and provided in accordance with all local codes, OSHA, and NFPA regulations.

2. Exhaust System:

- a. Room shall have one 10 inch heavy-duty blade wheel blower, rated at 1150 CFM at 1/2 inch W.C. - internal s.p. The motor shall feature a heavy gauge steel frame, double sealed ball bearings that are mechanically locked on the shaft end, and bolt on motor base for easy removal.

3. Exhaust fan ductwork:

- a. The paint booth shall include one 12 inch diameter exhaust ductwork for a 27 foot 8 inch high pitched roof, including 3 feet sections of standard exhaust ducts, one three foot sections of standard exhaust duct with inspection door, pitched roof flange, automatic roof ventilator, and guy wire kit. Exhaust ductwork shall be supplied by manufacturer or as specified and detailed by manufacturer.
- b. Exhaust ductwork design and installation must maintain UL listing of booth.

4. Structure: Mixing room shall be constructed of a minimum 18 gauge galvanized sheet steel. Panels shall be pre-punched and companion flanged for easy assembly. A convenient 4 inch deep containment base shall be built in. Must comply with NFPA 33 Section 5.1.4

5. Lighting: Shall be supplemented with four each, interior access, open type, four-tube fluorescent light fixtures. Fixtures to be dual voltage 110/277 VAC with 85 percent color corrected tubes included.

6. Doors: There shall be two access doors 36 inches wide by 84 inches tall with an 18 inch wide by 24 inch tall clear tempered glass observation window. One of the doors shall allow access to the spray booth, the other shall allow access to the shop.

7. Operational and safety equipment: 20 by 20 by 1 inch tackified intake filters with internal wire grids shall be supplied.

D. Utility Requirements:

1. Electrical:											
a.	<table border="1"> <thead> <tr> <th>Connection Requirements</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>Voltage</td> <td>120</td> </tr> <tr> <td>Phase</td> <td>1</td> </tr> <tr> <td>HP</td> <td>1/2</td> </tr> <tr> <td>Amps</td> <td>30</td> </tr> </tbody> </table>	Connection Requirements	Unit	Voltage	120	Phase	1	HP	1/2	Amps	30
Connection Requirements	Unit										
Voltage	120										
Phase	1										
HP	1/2										
Amps	30										
b.	<table border="1"> <tr> <td>Connection Type</td> <td>Provide disconnect</td> </tr> </table>	Connection Type	Provide disconnect								
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2. Mechanical:											
a.	<table border="1"> <thead> <tr> <th colspan="2">Venting:</th> </tr> </thead> <tbody> <tr> <td>Connection (inches)</td> <td>12</td> </tr> <tr> <td>Volume (CFM)</td> <td>1150</td> </tr> </tbody> </table>	Venting:		Connection (inches)	12	Volume (CFM)	1150				
Venting:											
Connection (inches)	12										
Volume (CFM)	1150										

PART 3 - EXECUTION

3.1 INSPECTION

- A. Coordinate location of rough-in work and utility stub-outs to assure match with the equipment being installed.
- B. Inspect delivered equipment for damage from shipping and exposure to weather. Compare delivered equipment with packing lists and specifications to assure receipt of all equipment items and specified accessories.
- C. Report in writing to the Architect any damaged, missing or incomplete scheduled equipment and improper rough-in work or utility stub-outs.

3.2 INSTALLATION

- A. Manufacturer shall be responsible for complete operational equipment installation.
- B. Perform work under direct supervision of Foreman of Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect or designated representative.
- C. Install equipment in accordance with plans, shop drawings, and manufacturer's instructions.
 - 1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level (or slight slope as required by instructions), plumb and at right angles to adjacent work.
 - 2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.
 - 3. Anchorage: Attach equipment as directed by Architect or designated representative. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.
- D. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.3 TESTING

- A. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with specification in the presence of the Architect or designated representative using acceptance procedures provided by the manufacturer. Testing report shall be submitted to the Architect or

designated representative.

3.4 CLEANUP

- A. Touch-up damage to painted finishes.
- B. Wipe and clean equipment of any oil, grease and solvents, and make ready for use.
- C. Clean area around equipment installation and remove packing or installation debris from job site.
- D. Notify Architect or designated representative when installation and cleanup is 100% complete and ready for final observation (punchlist).

3.5 TRAINING

- A. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.
 - 1. 6120 Booth, paint, side, downdraft with heated air makeup; 2 hours (minimum)
- B. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

END OF SECTION 41 34 23