BEACON ATHLETICS

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8233 Forsythia Ste 120 Middleton, WI 53562
Ph: 800 / 747 - 5985 Fax: 608 / 836 - 0724
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ATTACHMENT A:
BACKSTOP NETTING SYSTEM AND SUPPORT POLES
BASIS OF DESIGN

GENERAL NOTES

1. Maintain a minimum clear distance of 36" in front and in back of net to avoid damage. Repeated rubbing and pinching of the net against obstructions including but not limited to walls, light poles and fencing will cause tearing and net failure.

2. If the bottom of the net will be near the top of a chain link fence, care should be taken to protect the net from the top loops of the chain link fabric. Beacon Athletics recommends installing fence cap or slit drain tile along the top of the fence to cover the loops.

3. Provide Owner/end user with copy of drawings and type written instructions of cable and net installation for future net removal, storage and reinstallation.

ABBREVIATIONS

BOT	BOTTOM	GALV	GALVANIZED
CONC	CONCRETE	O.C.	ON CENTER
CL	CENTER LINE	SIM	SIMILAR
CLF	CHAIN LINK FENCE	SS	STAINLESS STEEL
CLR	CLEAR	T.O.F.	TOP OF FOOTING
DIA	DIAMETER	T.O.W.	TOP OF WALL
EA.	EACH	TYP	TYPICAL
EQ	EQUAL	ZP	ZINC PLATED
F.F.G.	FINISHED FIELD GRADE	PL	PLUM LINE

SHEET INDEX

SHOP DRAWINGS

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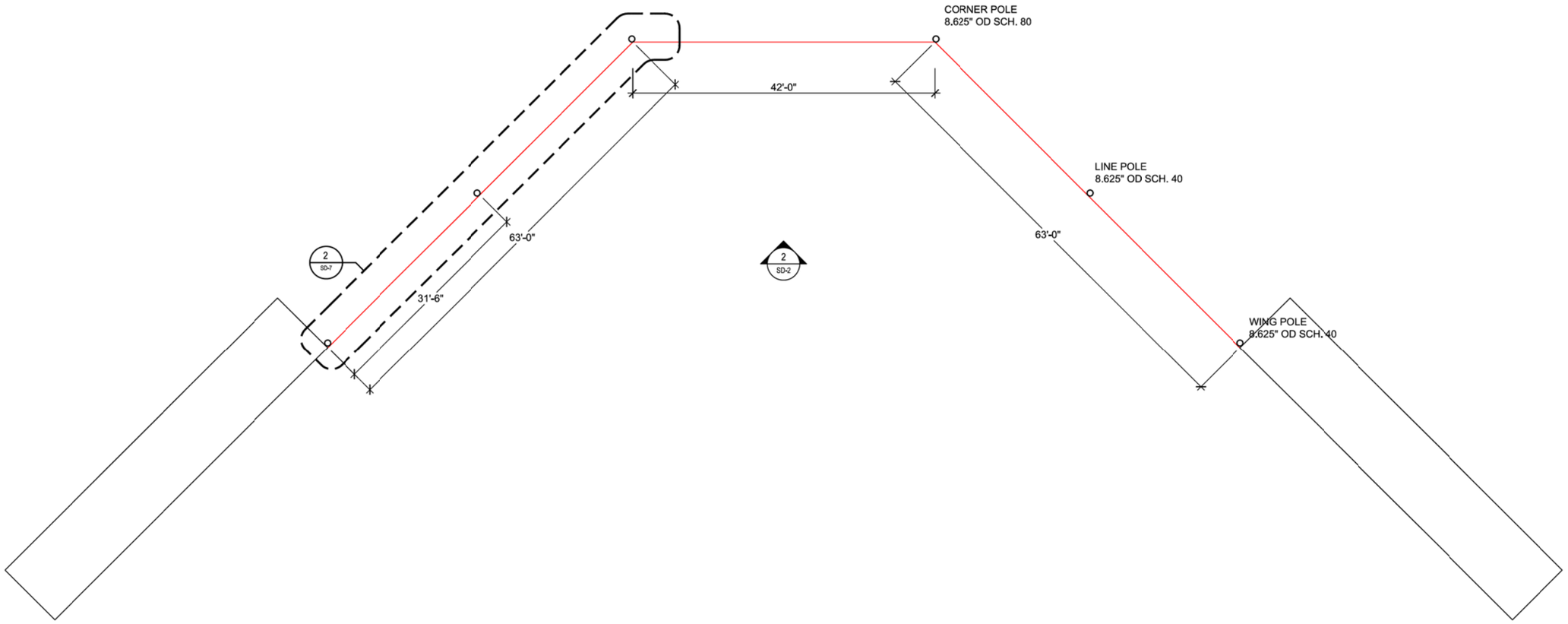
DRAWING TITLE:
BEACON INLINE BACKSTOP - PERMANENT MODEL# IL-P
TITLESHEET

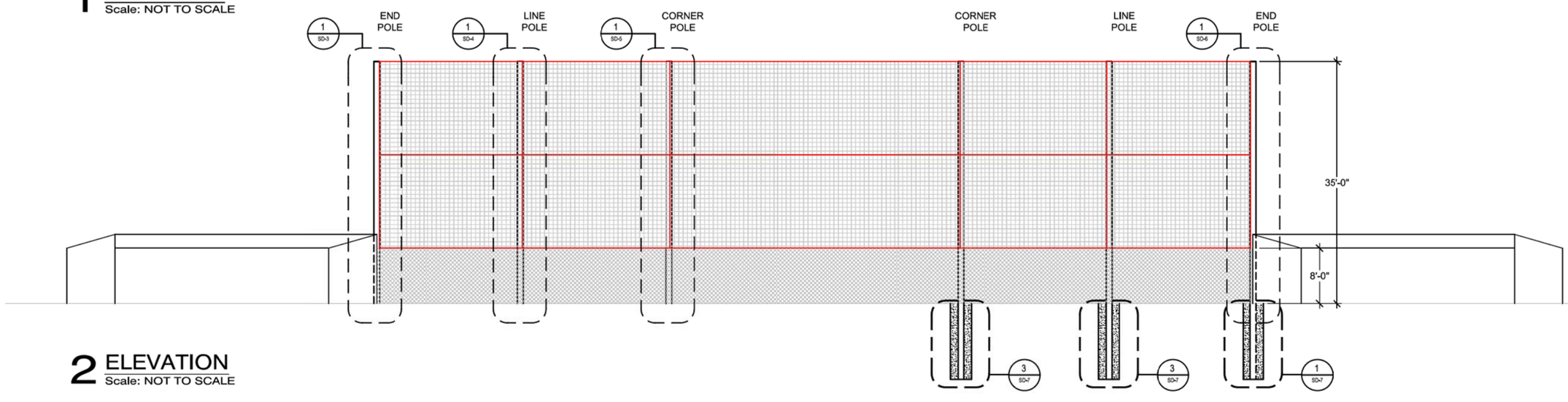
CUSTOMER NAME: CITY OF MADISON
PROJECT NAME: BOWMAN FIELD BASEBALL BACKSTOP RENOVATION
PROJECT LOCATION: MADISON, WI

REVISION #	DATE	BY

SCALE:	NO SCALE
DRAWN BY:	EH
DATE:	7/11/16
PROJECT NO:	**J16E8**
DRAWING NO:	***N4988-TS-1***



1 PLAN VIEW
Scale: NOT TO SCALE



2 ELEVATION
Scale: NOT TO SCALE

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DRAWING TITLE:
BEACON INLINE BACKSTOP - PERMANENT MODEL# IL-P
LAYOUT & ELEVATION

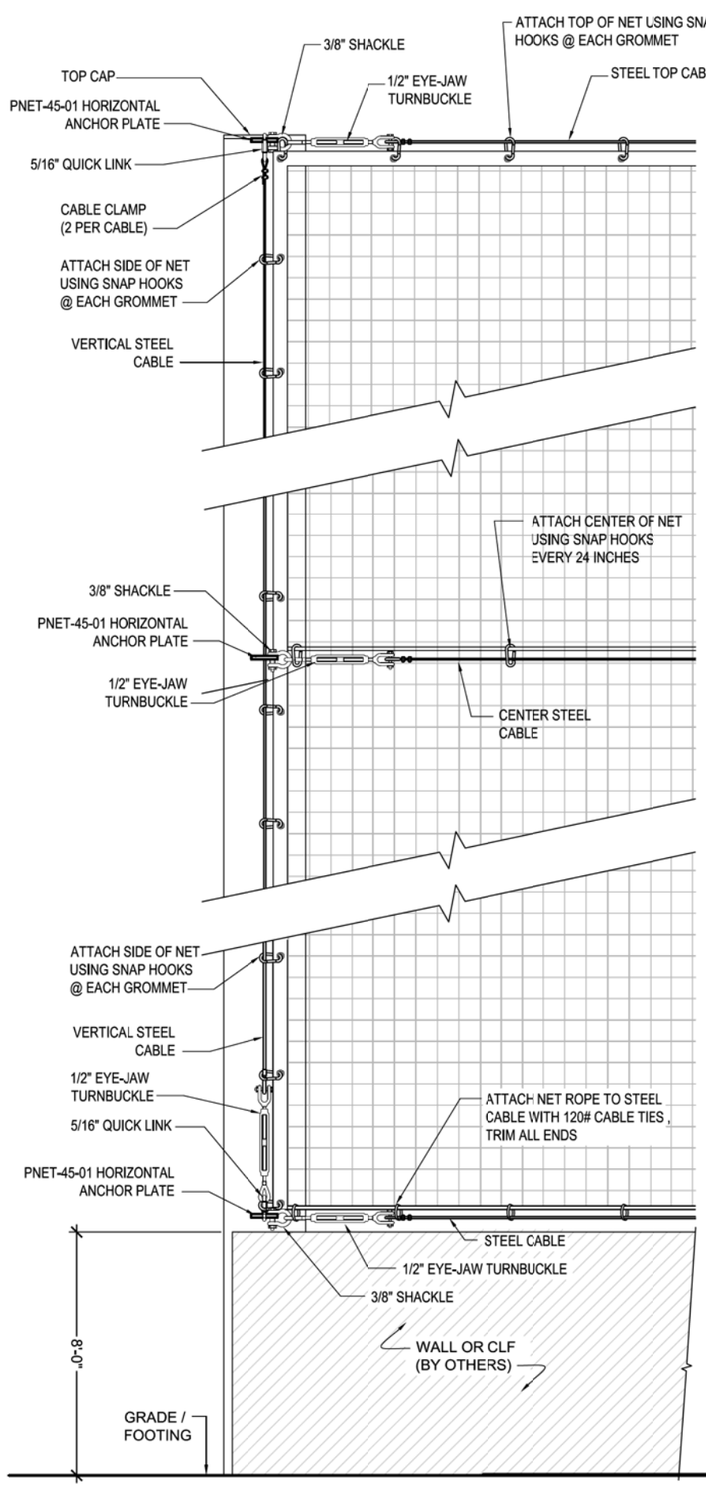
CUSTOMER NAME: CITY OF MADISON
PROJECT NAME: BOWMAN FIELD BASEBALL BACKSTOP RENOVATION
PROJECT LOCATION: MADISON, WI

REVISION #	DATE	BY

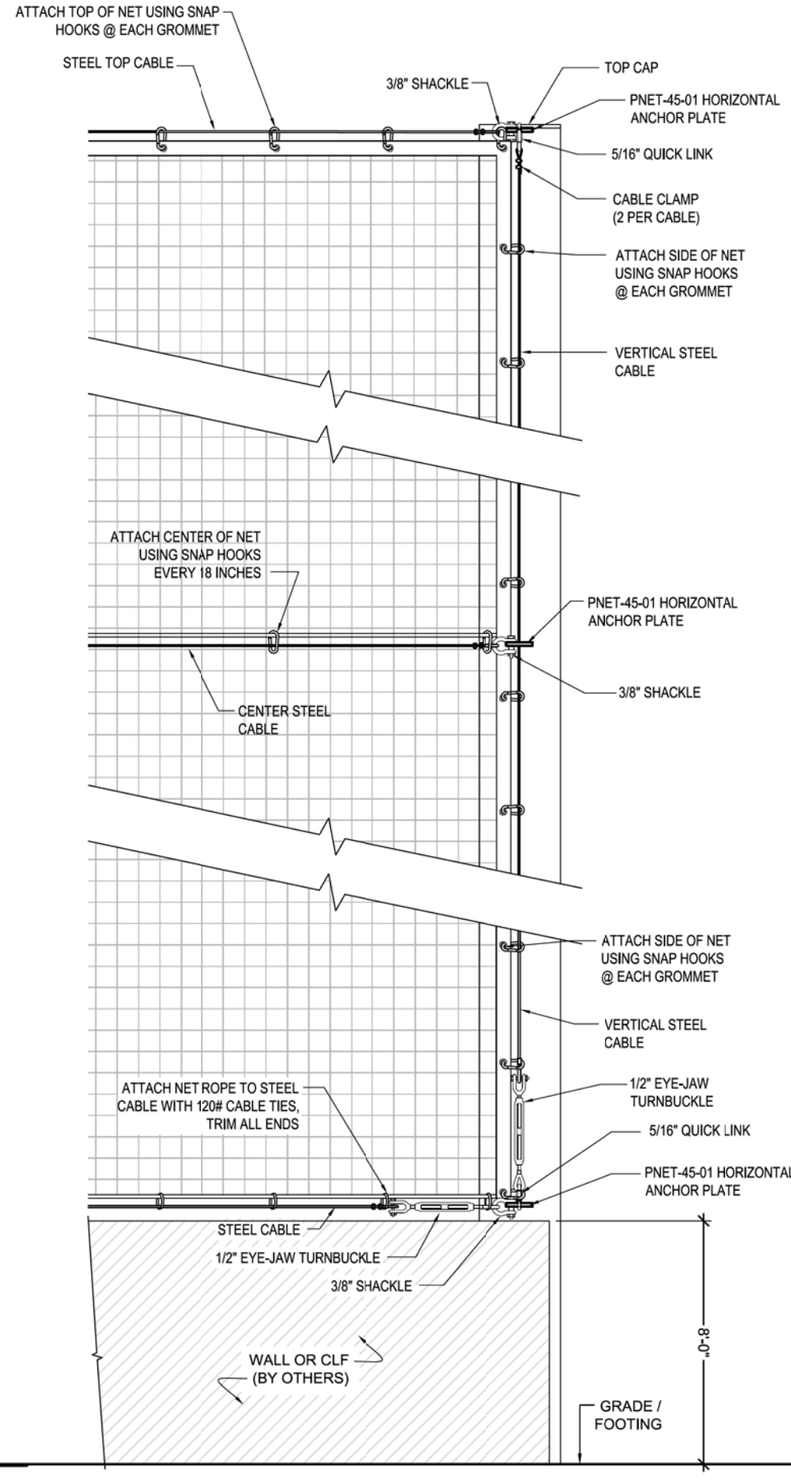
SCALE:	SEE DWG
DRAWN BY:	EH
DATE:	7/11/16

PROJECT NO:
J16E8

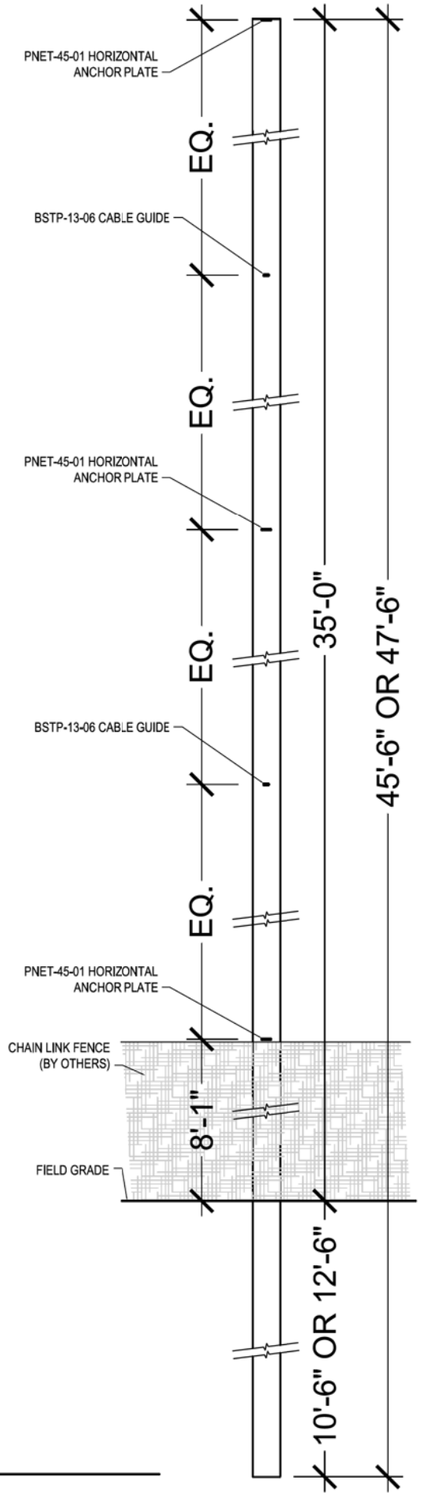
DRAWING NO:
N4988-SD-2



1 FIRST BASE END POLE DETAIL
Scale: NOT TO SCALE



2 THIRD BASE END POLE DETAIL
Scale: NOT TO SCALE



3 POLE ELEVATION
Scale: NOT TO SCALE

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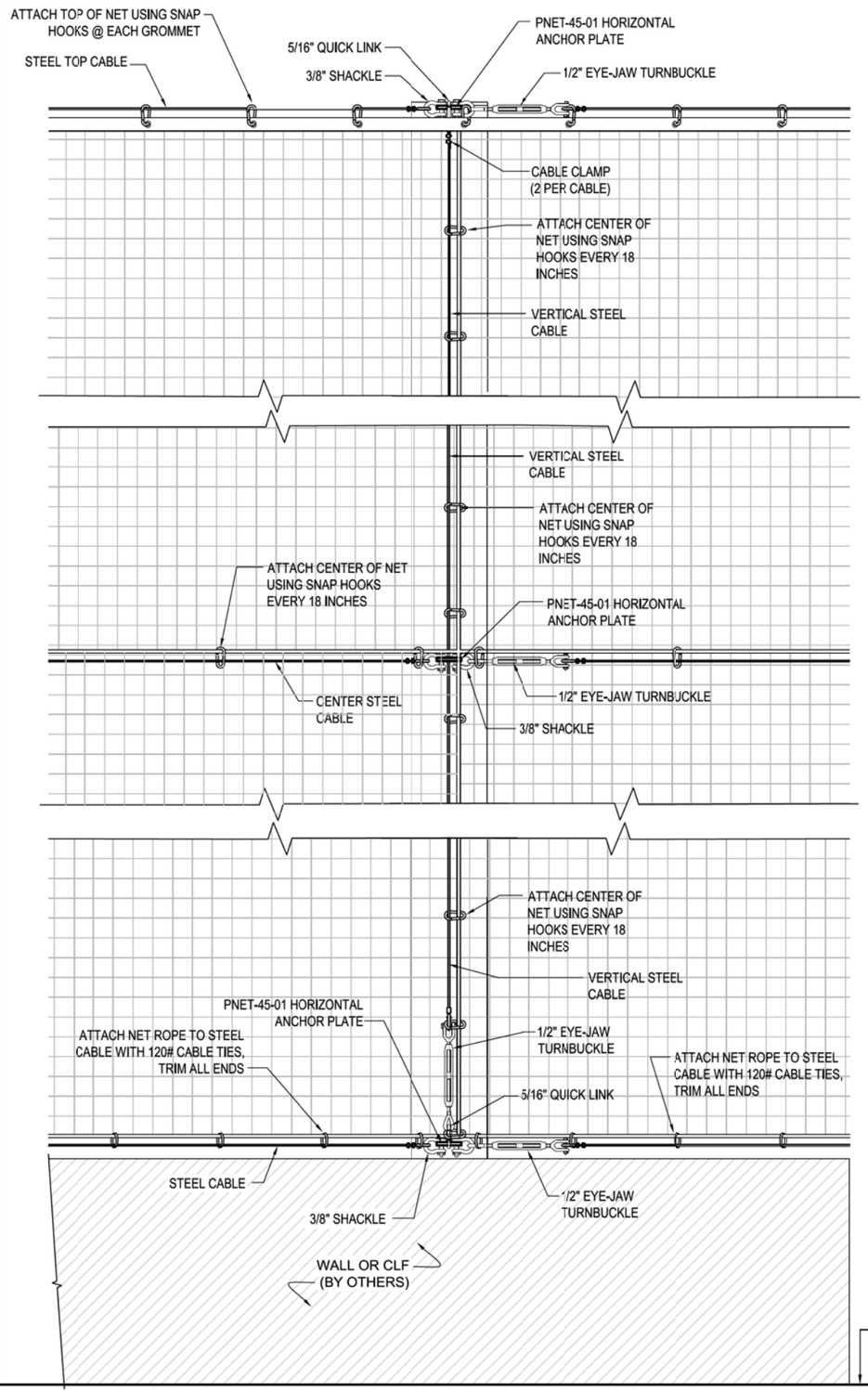
DRAWING TITLE:
BEACON INLINE BACKSTOP - PERMANENT MODEL# IL-P
FIRST & THIRD BASE END POLE DETAIL AND POLE ELEVATION

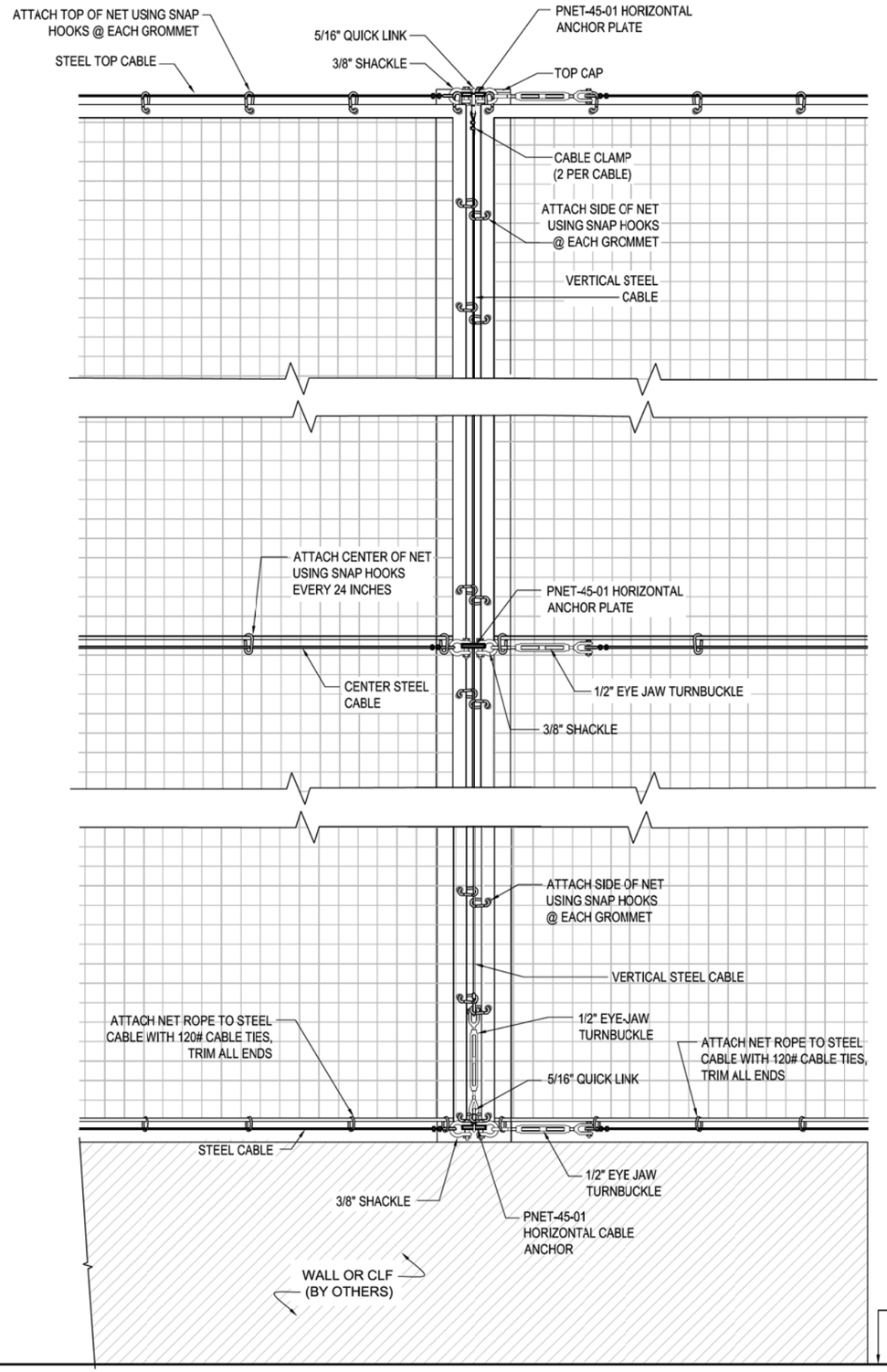
CUSTOMER NAME: CITY OF MADISON
PROJECT NAME: BOWMAN FIELD BASEBALL BACKSTOP RENOVATION
PROJECT LOCATION: MADISON, WI

REVISION #	DATE	BY

SCALE:	SEE DWG
DRAWN BY:	EH
DATE:	7/11/16
PROJECT NO:	**J16E8**
DRAWING NO:	***N4988-SD-3***



1 LINE POLE DETAIL
Scale: NOT TO SCALE



2 CORNER POLE DETAIL
Scale: NOT TO SCALE

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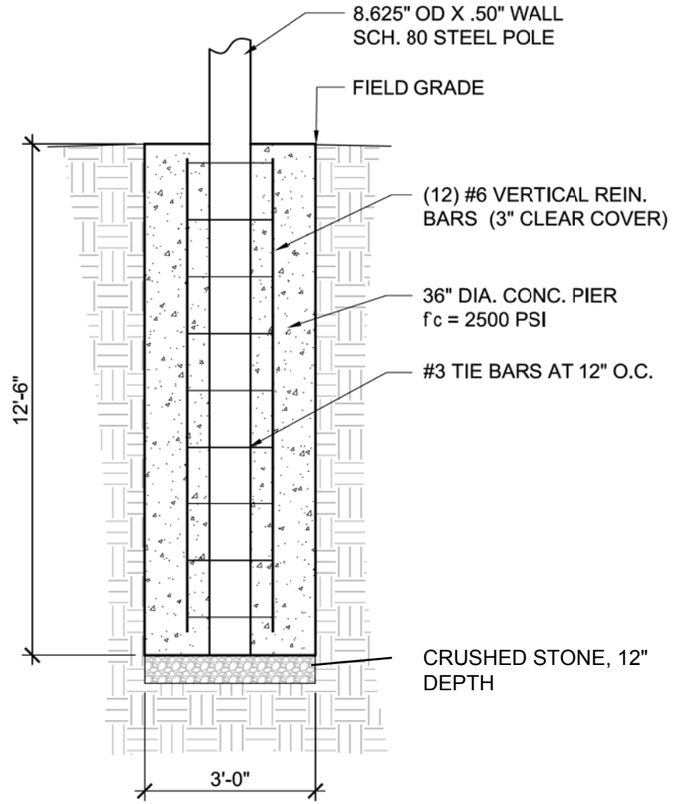
DRAWING TITLE:
BEACON INLINE BACKSTOP - PERMANENT MODEL# IL-P
LINE & CORNER POLE DETAIL

CUSTOMER NAME: CITY OF MADISON
PROJECT NAME: BOWMAN FIELD BASEBALL BACKSTOP RENOVATION
PROJECT LOCATION: MADISON, WI

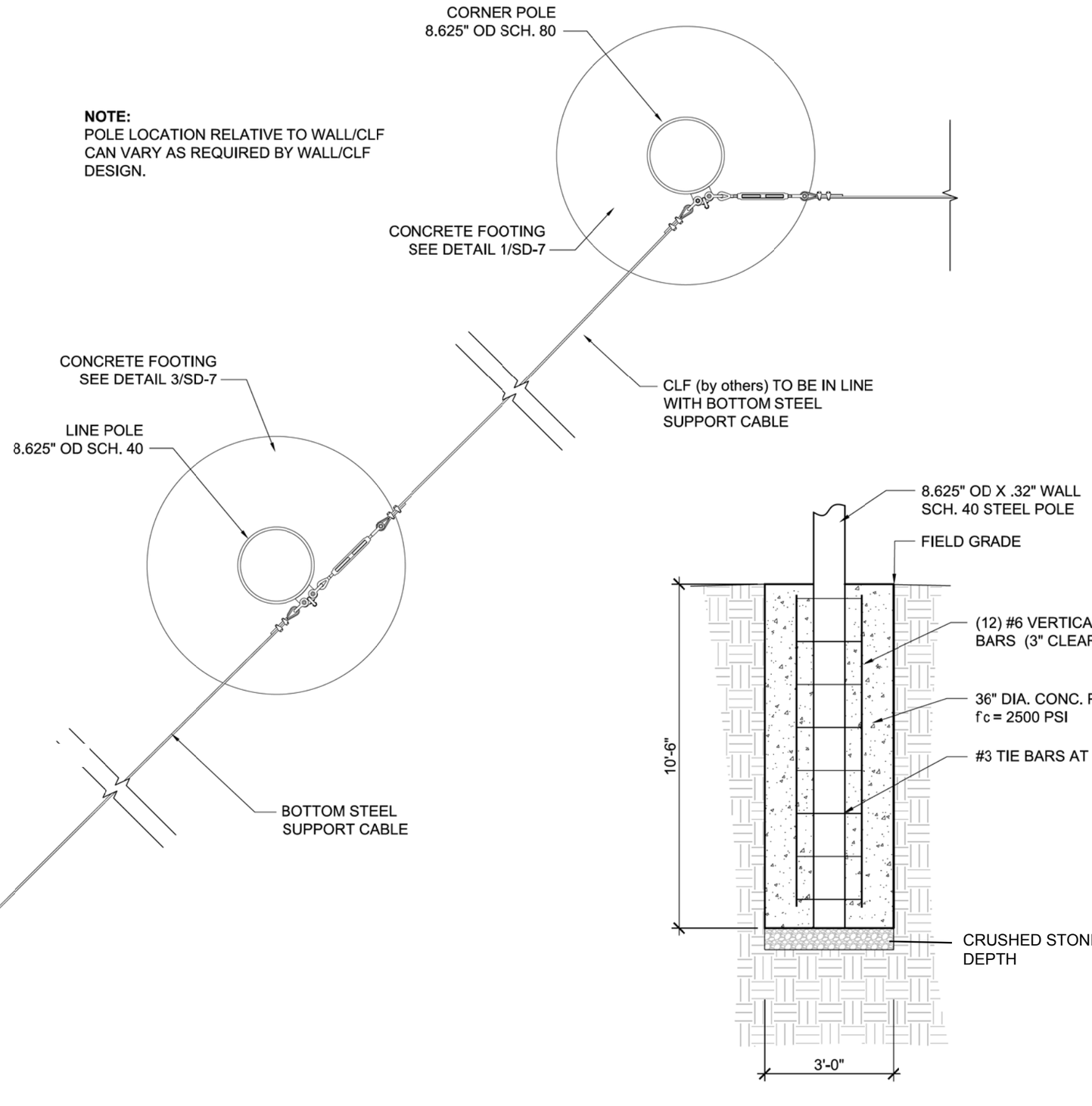
REVISION #	DATE	BY

SCALE:	SEE DWG
DRAWN BY:	EH
DATE:	7/11/16
PROJECT NO:	**J16E8**
DRAWING NO:	***N4988-SD-4***



1 CORNER POLE FOOTING DETAIL
Scale: NOT TO SCALE

NOTE:
POLE LOCATION RELATIVE TO WALL/CLF CAN VARY AS REQUIRED BY WALL/CLF DESIGN.



2 ENLARGED PLAN VIEW
Scale: NOT TO SCALE

3 LINE AND END POLE FOOTING DETAIL
Scale: NOT TO SCALE

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www.BeaconAthletics.com

DRAWING TITLE:
BEACON INLINE BACKSTOP - PERMANENT MODEL# IL-P
ENLARGED PLAN VIEW & FOOTING DETAILS

CUSTOMER NAME: CITY OF MADISON
PROJECT NAME: BOWMAN FIELD BASEBALL BACKSTOP RENOVATION
PROJECT LOCATION: MADISON, WI

REVISION #	DATE	BY

SCALE:	SEE DWG
DRAWN BY:	EH
DATE:	7/11/16
PROJECT NO:	**J16E8**
DRAWING NO:	***N4988-SD-5***

RICE ENGINEERING
105 School Creek Trail | Luxemburg, WI 54217
(P) 920.845.1042 | (F) 920.845.1048

Bowman Field
Barrier Netting Calculations

Project Location:
Madison, Wisconsin
REI Project # R16-06-044

Prepared for:
Beacon Athletics - Middleton, WI
9/19/2016

Design Criteria:

1. Design Loads per IBC 2009.
2. Steel tubes to be minimum **A500 Gr. B, Fy = 42 ksi.**
3. Field and shop welding shall be **E70 or better.**
4. Concrete rebar shall be **grade 60**.
5. Concrete strength is assumed to be **f'c = 3,000 psi un-cracked, normal weight.**
6. Design of material separation to prevent reaction between dissimilar materials **not designed by Rice Engineering Inc.**

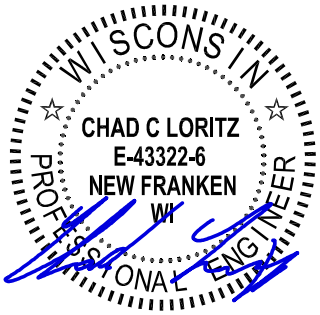
Page:	Description:	Date:	Revision:
E1	Elevation & Plan	6/15/16	
1	Wind Loads	6/15/16	
2	Net Loading	6/15/16	
3	Cable Forces – Y	6/15/16	
4	Cable Forces +Y	6/15/16	
5	Algor Deflection –Y	6/15/16	
6	Algor Deflection +Y	6/15/16	
7	Cable Strength	6/15/16	
A1	Backstop Foundation Sch 40	6/15/16	9/19/16
A2	Backstop Foundation Sch 80	6/15/16	9/19/16

Disclaimer:

This Certification is limited to the structural design of structural components of this Barrier Netting system.
It does NOT include responsibility for:

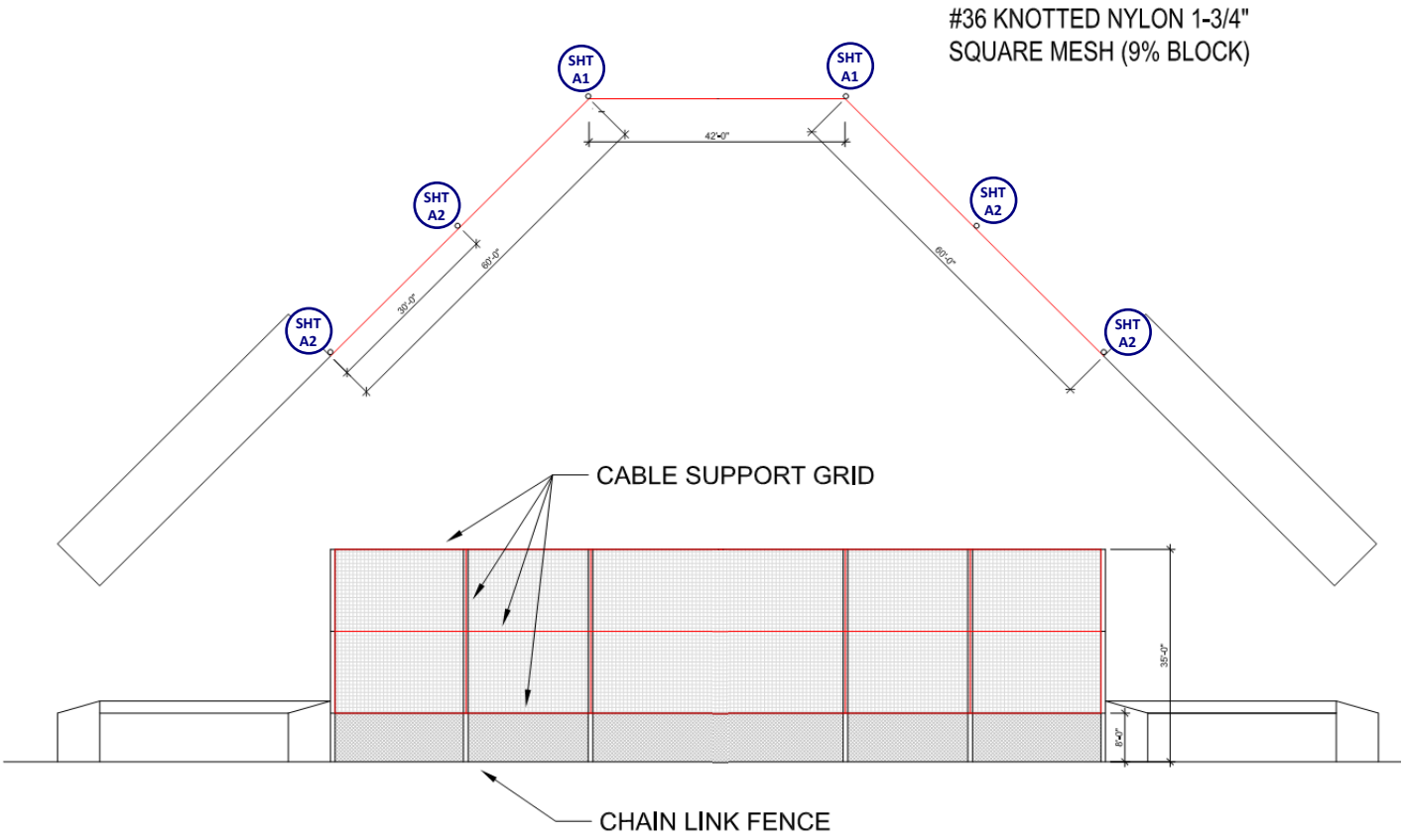
- Structural design of hardware, clevises, and turnbuckles.
- Design of material separation to prevent reaction between dissimilar materials.
- Design of air and water infiltration prevention.
- The manufacture, assembly, or installation of the system.
- Quantities of materials or dimensional accuracy of drawings

Engineers Design Approval Stamp:



09/19/2016
COA: 2394-11

Elevation	Detail Ref.	Sheet No: E1



RICE ENGINEERING Template: REI-MC-5201	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Bowman Field**	Job No:	R16-05--324	
			Engineer: CCL	Sheet No:	E1
			Date: 6/15/16	Rev:	
			Chk By:	Date:	

Net Wind Load	Detail Ref.	Sheet No: 1

Inputs:

Building Category	I	Table 1-1
Element Height	$z := 35$ ft	
Exposure	$E := "C"$	
Wind Velocity	$V := 90$ mph	Figure 6-1,
Topographic Factor	$K_{zt} := 1.0$	Figure 6-4
Directionality Factor	$K_d := 0.85$	Table 6-4
Gust Factor:	$G := 0.85$	
Force Coefficient:	$C_f := 1.2$	Figure 6-22
Importance Factor:	$I_w = 0.87$	

Calculations:

All Calculations Below This Line Are Automatic

Velocity pressure Coefficients:

$K_{zz} = 0.88$ psf

Velocity pressures:

$q_z := 0.00256 \cdot K_{zz} \cdot K_{zt} \cdot K_d \cdot V^2 \cdot I_w = 13.42$

Calculated Pressures (ASD):

$W := q_z \cdot G \cdot C_f = 13.69$ psf

Other Structures		All Heights
Figure 29.5-2	Force Coefficients, C_f	Open Signs & Lattice Frameworks

ϵ	Flat-Sided Members	Rounded Members	
		$D\sqrt{q_z} \le 2.5$ ($D\sqrt{q_z} \le 5.3$)	$D\sqrt{q_z} > 2.5$ ($D\sqrt{q_z} > 5.3$)
< 0.1	2.0	1.2	0.8
0.1 to 0.29	1.8	1.3	0.9
0.3 to 0.7	1.6	1.5	1.1

Notes:

1. Signs with openings comprising 30% or more of the gross area are classified as open signs.
2. The calculation of the design wind forces shall be based on the area of all exposed members and elements projected on a plane normal to the wind direction. Forces shall be assumed to act parallel to the wind direction.
3. The area A_f consistent with these force coefficients is the solid area projected normal to the wind direction.
4. Notation:

   ϵ: ratio of solid area to gross area;

   D: diameter of a typical round member, in feet (meters);

   q_z: velocity pressure evaluated at height z above ground in pounds per square foot (N/m^2).

RICE ENGINEERING
Template: REI-MC-5850

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Luxemburg, WI 54217
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www.rice-inc.com

Project Description: **Bowman Field**

Job No:	R16-05--324		
Engineer:	CCL	Sheet No:	1
Date:	6/15/16	Rev:	
Chk By:		Date:	

Net Loading	Detail Ref.	Sheet No: 2

Inputs:

Net Properties: #36 Knotted Nylon

$WT_{net} := 0.043$ psf — *Net weight per ft. sq.*

$\%Solid := 0.09$ — *Ratio of solid to total area*

$F_{max} := 320$ lb — *max. breaking strength*

$Net_{spa} := 1.75$ in — *o.c. spacing of strands*

Net Geometry:

$CNodes := 12$ in — *spacing of model nodes*

$SNodes := 12$ in

$Angle := 45deg$ — *Avg. Angle of sides*

Net Dimensions:

$L_{center} := 42$ ft

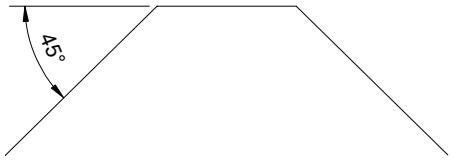
$h_{center} := 27$ ft

$L_{sides} := 60$ ft

$h_{sides} := 27$ ft

Design Wind Load:

$WL := 13.69$ psf



Calculations: *All Calculations Below This Line Are Automatic*

Dead Load Calculations:

$A_{center} := L_{center} \cdot h_{center} = 1134$ ft^2

$WT_{center} := A_{center} \cdot WT_{net} = 48.76$ lbs

$A_{sides} := L_{sides} \cdot h_{sides} = 1620$ ft^2

$WT_{sides} := A_{sides} \cdot WT_{net} = 69.66$ lbs

Model Load Calculations:

Center Net:

$WL_n := WL \cdot \%Solid = 1.23$ psf

$F_{wlc} := WL_n \cdot A_{center} = 1397.2$ lbs

$N_1 := \frac{L_{center} \cdot 12}{CNodes} = 42$

$N_2 := \frac{h_{center} \cdot 12}{CNodes} = 27$

$N_{tot1} := N_1 \cdot N_2 = 1134$

$F_{node} := \frac{F_{wlc}}{N_{tot1}} = 1.23$ lbs — *Load per model node*

Side Nets:

$WL_n := WL \cdot \%Solid = 1.23$ psf

$F_{wls} := WL_n \cdot A_{sides} \cdot \sin(Angle) = 1411.39$ lbs

$N_3 := \frac{L_{sides} \cdot 12}{SNodes} = 60$

$N_4 := \frac{h_{sides} \cdot 12}{SNodes} = 27$

$N_{tot2} := N_3 \cdot N_4 = 1620$

$F_{node} := \frac{F_{wls}}{N_{tot2}} = 0.87$ lbs — *Load per model node*

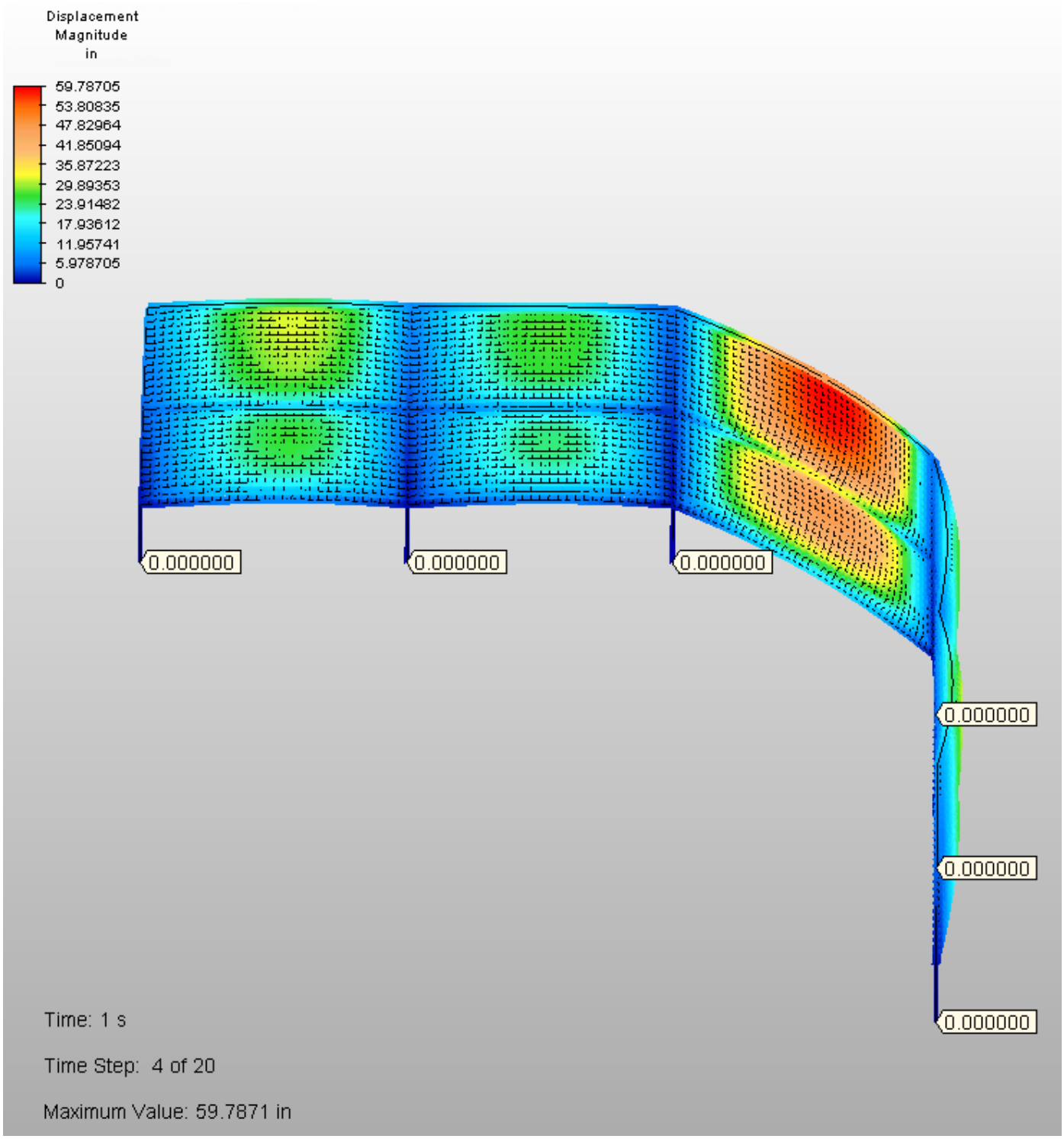
RICE ENGINEERING
Template: REI-MC-5852

105 School Creek Trail
Luxemburg, WI 54217
Phone: (920)845-1042
Fax: (920)845-1048
www.rice-inc.com

Project Description: **Bowman Field**

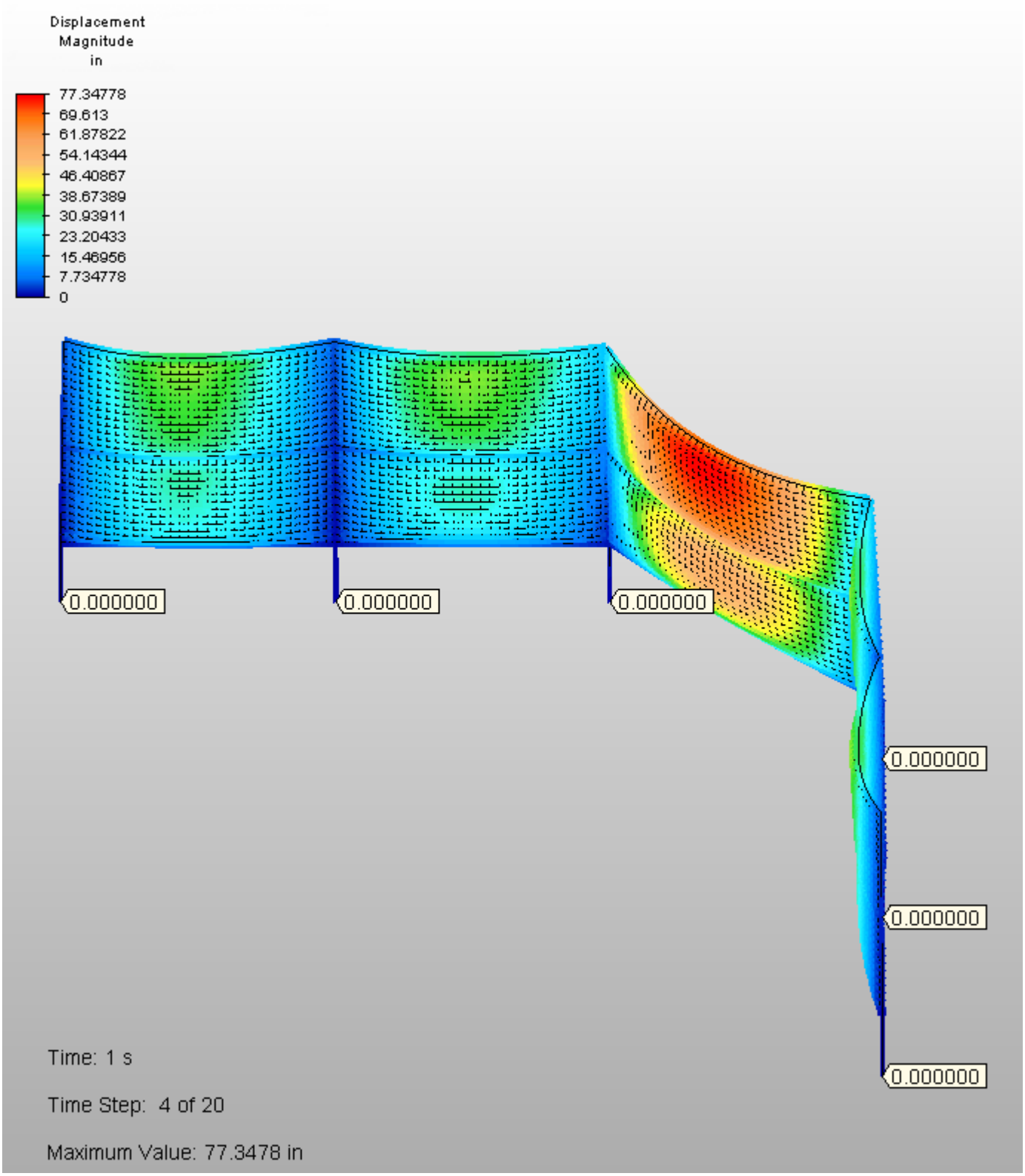
Job No:	R16-05--324		
Engineer:	CCL	Sheet No:	2
Date:	6/15/16	Rev:	
Chk By:		Date:	

Deflection - Y	Detail Ref.	Sheet No: 3



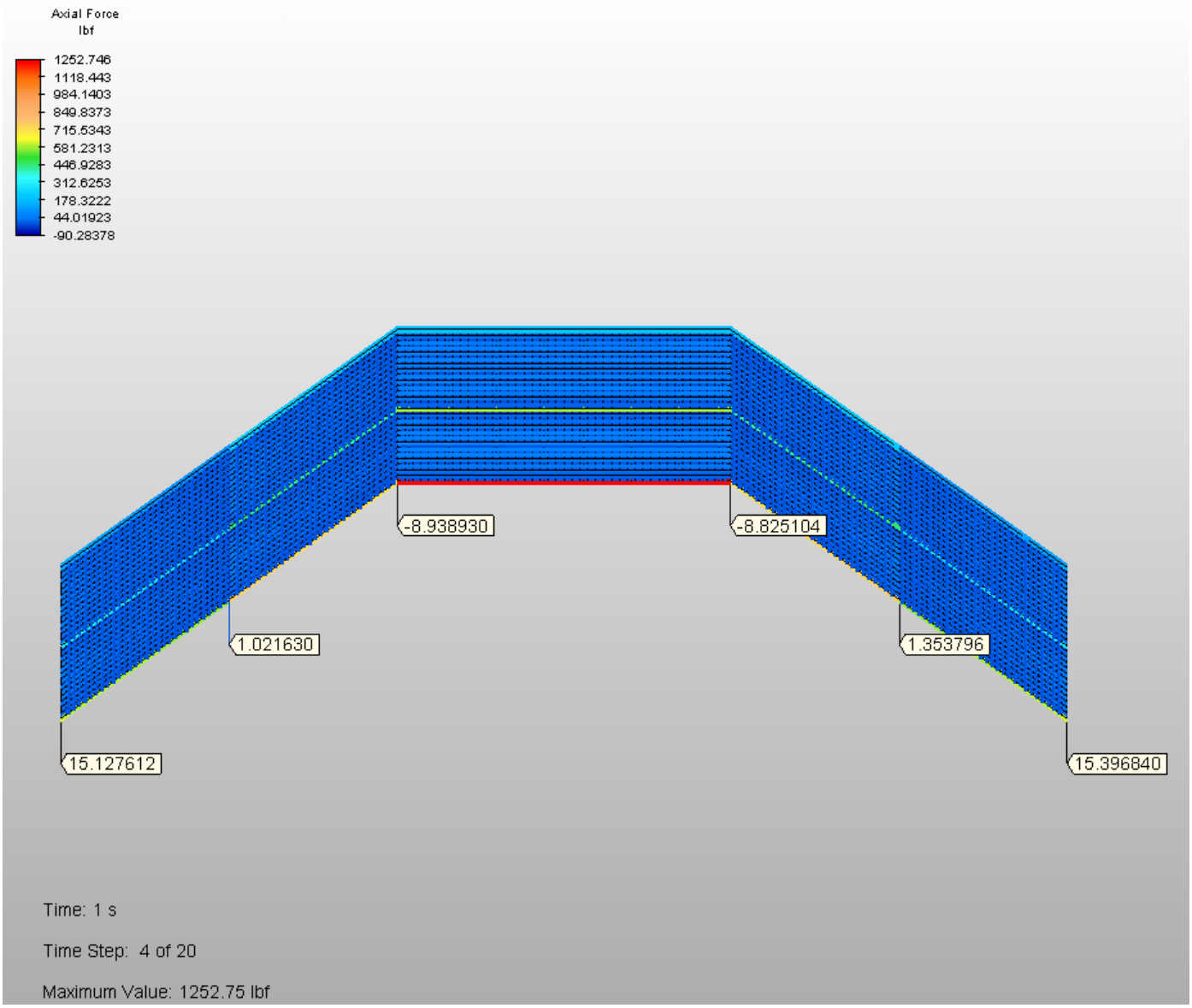
RICE ENGINEERING Template: REI-MC-5201	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Bowman Field**	Job No:	R16-05--324	
			Engineer: CCL	Sheet No: 3	
			Date: 6/15/16	Rev:	
			Chk By:	Date:	

Deflection + Y	Detail Ref.	Sheet No: 4



RICE ENGINEERING Template: REI-MC-5201	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Bowman Field**	Job No:	R16-05--324	
			Engineer: CCL	Sheet No: 4	
			Date: 6/15/16	Rev:	
			Chk By:	Date:	

Cable Force - Y	Detail Ref.	Sheet No: 5



$F_{cable} := 1253 \ lb$

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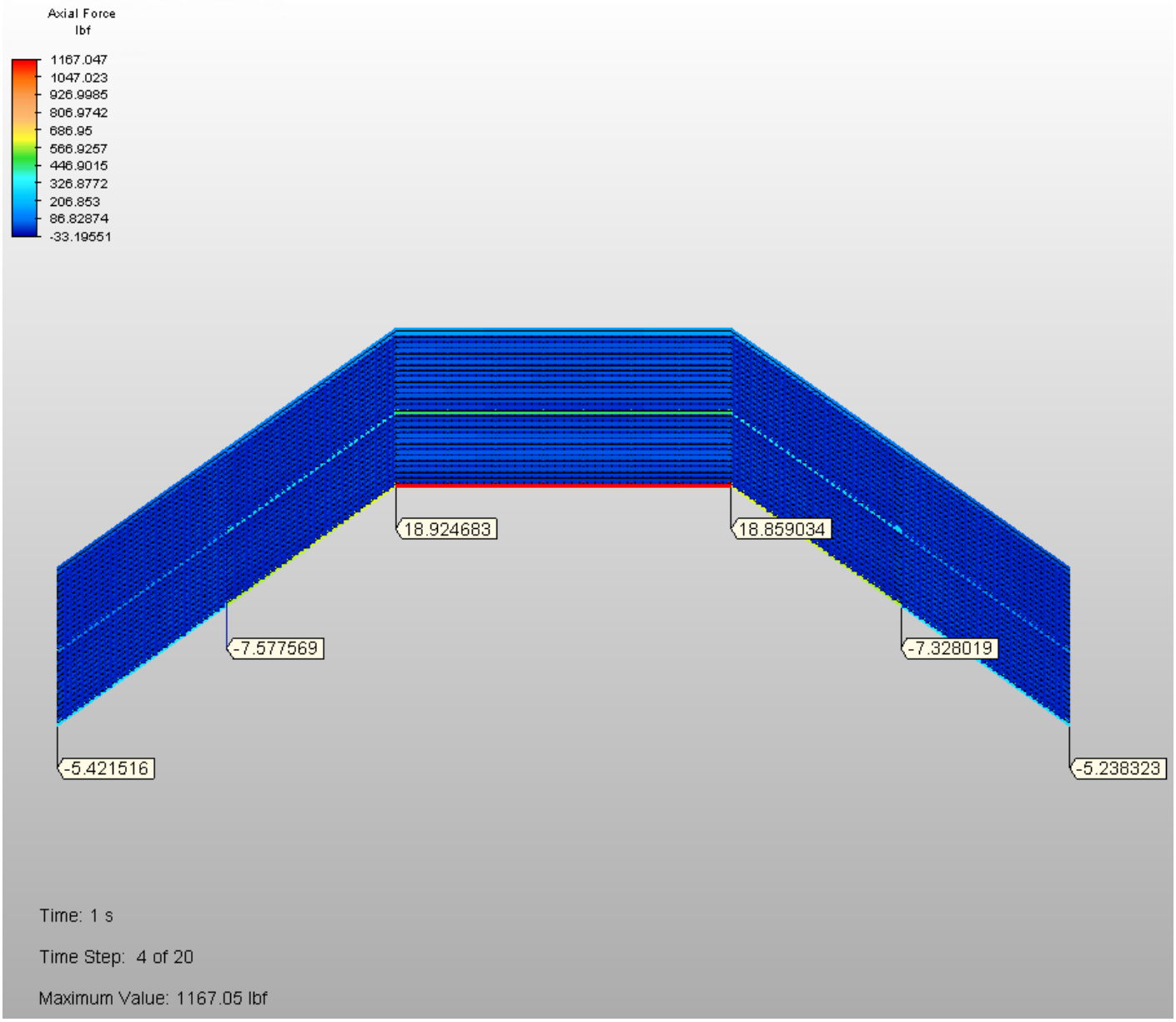
			Engineer: CCL	Sheet No: 5
			Date: 6/15/16	Rev:
			Chk By:	Date:

Cable Force + Y	Detail Ref.	Sheet No: 6



$F_{cable} := 1167 \ lb$

RICE ENGINEERING Template: REI-MC-5201	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Bowman Field**	Job No: R16-05--324	
			Engineer: CCL	Sheet No: 6
			Date: 6/15/16	Rev:
			Chk By:	Date:

Steel Cable Strength	Detail Ref.	Sheet No: 7

ASCE 19-10: Structural Applications Of Steel Cables for Buildings

Inputs:

$T_n := 1272 \cdot lbf$ *Maximum Cable Tension*

$N_f \equiv 1.0$ *Fitting Reduction Factor (Table 3-1)*

$N_d \equiv 1.0$ *Deflector Reduction Factor (Table 3-2)*

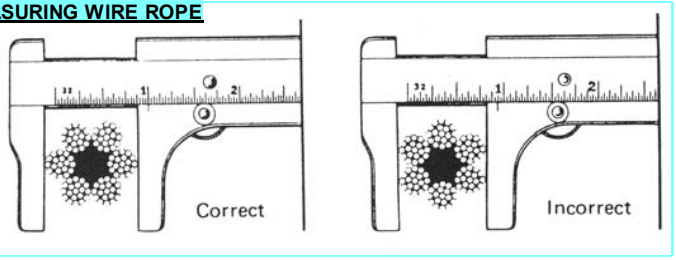
TYPE OF CABLE

cboMaterial = Galvanized Cable

cboType = 7x19

D_{r_str} = 1/4" = 0.25 in *Diameter of Cable*

MEASURING WIRE ROPE



Calculations:

All Calculations Below This Line Are Automatic

$FS \equiv 2.2$ *Factor of Safety per ASCE 19-10; 3.3.1 Design Strength*

$D_r = 0.25\ in$ *Diameter of Wire Rope*

$WT_r = 0.11\ plf$ *Weight*

$F_{br} = 7000\ lbf$ *Breaking Strength*

$A_r := 0.25 \cdot \pi \cdot D_r^2 = 0.05\ in^2$ *Area of Cable (Approx)*

$S_d := \frac{F_{br} \cdot \min(N_f, N_d)}{FS} = 3181.82 \cdot lbf$ *Allowable Tension*

$I_{cable} := \text{"}\left(\frac{T_n}{S_d}\right) = \text{"0.4 < 1.00 PASS"}$

Generic Material Properties

"Material"	"Modulus of Elasticity"	"Density"
"Steel"	29000000 ·psi	0.284 ·pci
"Dyneema"	16000000 ·psi	0.035 ·pci

Use min 1/4" (6mm) Diameter 7x19 or 1x7 Galvanized Steel Wire Rope

Min. Nominal Breaking Strength = 7,000 lb

Pretension Cable to 150lb

RICE ENGINEERING

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Luxemburg, WI 54217
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Template: REI-MC-5808

Project Description: **Bowman Field**

Job No:	R16-05--324		
Engineer:	CCL	Sheet No:	7
Date:	6/15/16	Rev:	.
Chk By:		Date:	

Pole Foundation 8.625 Sch 80	Detail Ref.	Sheet No: A1

Input Variables:

Pole:

$F := 3247$ lb *(reaction force)*

$H := 35$ ft *(height)*

$h := 35$ ft *(height to load)*

$M := 739223$ in·lb

Soils:

$S := 4000$ psf *(Soil Bearing Capacity)*

$P := 400$ psf *(Passive Soil Pressure)*

Pier Foundations:

$f_c := 2500$ psi *(concrete compressive strength)*

$d := 12.5$ ft *(initial pier depth)*

$D := 3.0$ ft *(pier diameter)*

Steel:

$F_y := 42000$ psi *(Steel yield strength)*

$I_{pole} := 105.715$ in^4

$S_{pole} := 24.514$ in^3

$Z_{pole} := 33.049$ in^3

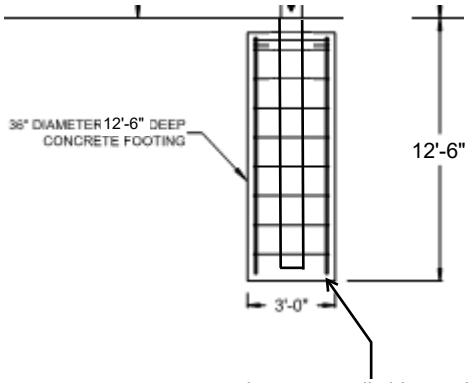
$A_{pole} := 12.756$ in^2

$D_{pole} := 8.625$ in

$t_{pole} := 0.50$ in

$E := 29 \cdot 10^6$ psi

$\Omega := 1.67$



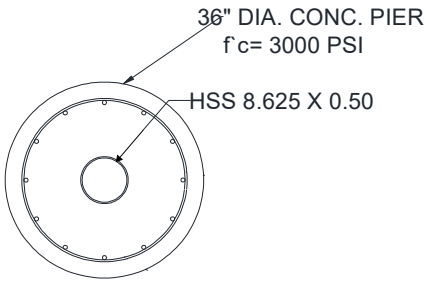
3" Clear Cover all sides and bottom. 2" Cover on top.

Calculations:

$\lambda_p := \frac{0.07 \cdot E}{F_y} = 48.33$ $\quad \lambda_r := \frac{0.31 \cdot E}{F_y} = 214.05$ therefore compact

$\lambda := \frac{D_{pole}}{t_{pole}} = 17.25$ $\quad M_n := F_y \cdot Z_{pole} \cdot \frac{1}{\Omega} = 831172.46$ in·lb

$I := \frac{M}{M_n} = 0.89$



Pier Foundation Design:

$S_c := \frac{2P \cdot d}{3}$ $\quad S_c = 3333.33$

$A_c := \frac{2.34 F}{S_c \cdot D}$ $\quad A_c = 0.76$

$d_{reqd} := \left(\frac{A_c}{2}\right) \cdot \left[1 + \sqrt{1 + 4.36 \cdot \left(\frac{h}{A_c}\right)}\right]$ $\quad d_{reqd} = 5.78$ ft

USE 8 SCH 80 Pipe
ASTM A500 Gr. B, Round, Fy = 42ksi

Use 36" Dia. Conc. Piers, *12'-6" deep f'c = 3,000 psi*

Chk rebar:

$A_{smin} := 0.005 \cdot \pi \cdot \left(\frac{D \cdot 12}{2}\right)^2$ $\quad A_{smin} = 5.09$

$A_s := 12 \cdot 0.44$ $\quad A_s = 5.28$ in^2

Use (12)- #6 Bars *w/ # 3 ties @ 12" o.c. with 36" Diameter foundations*

IBC Table 1806.2 Presumptive Load Bearing Values

Class of Materials	Vertical Foundation Pressure (psf)	Lateral Bearing Pressure (psf/f below natural grade)	Lateral Sliding Resistance	
			Coefficient of Friction	Cohesion (psf)
1. Crystline Bedrock	12000	1200	0.7	—
2. Sedimentary and foilated rock	4000	400	0.35	—
3. Sandy Gravel and/ or gravel (GW and GP)	3000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel (SW, SP, SM, SC, GM, and GC)	2000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1500	100	—	130

RICE ENGINEERING
Template:

105 School Creek Trail
Luxemburg, WI 54217
Phone: (920)845-1042
Fax: (920)845-1048
www.rice-inc.com

Project Description: **Bowman Field**

Job No:	R16-05--324		
Engineer:	CCL	Sheet No:	A1
Date:	6/15/16	Rev:	9/19/16
Chk By:		Date:	

Load Case #1 Wind towards net

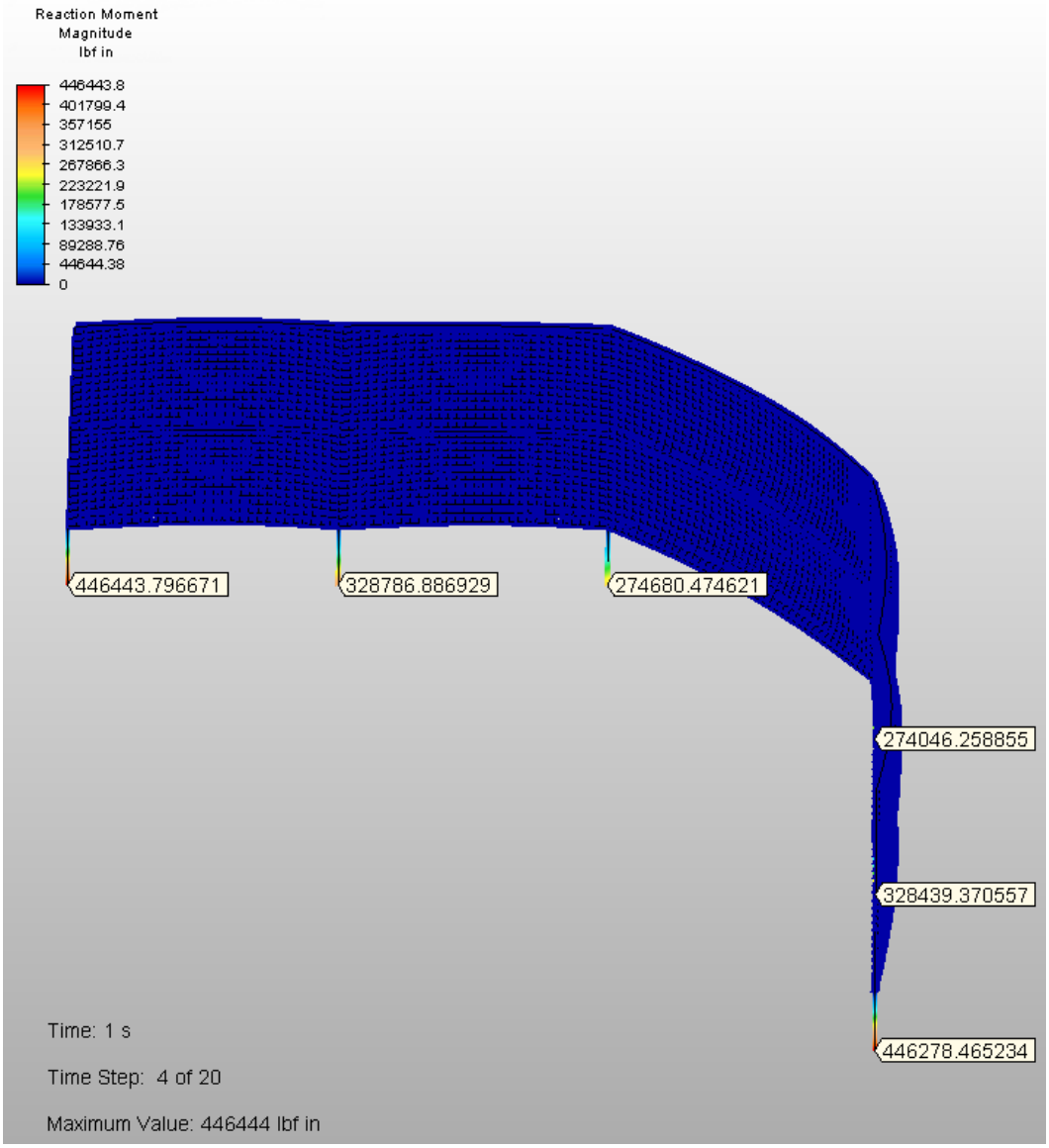
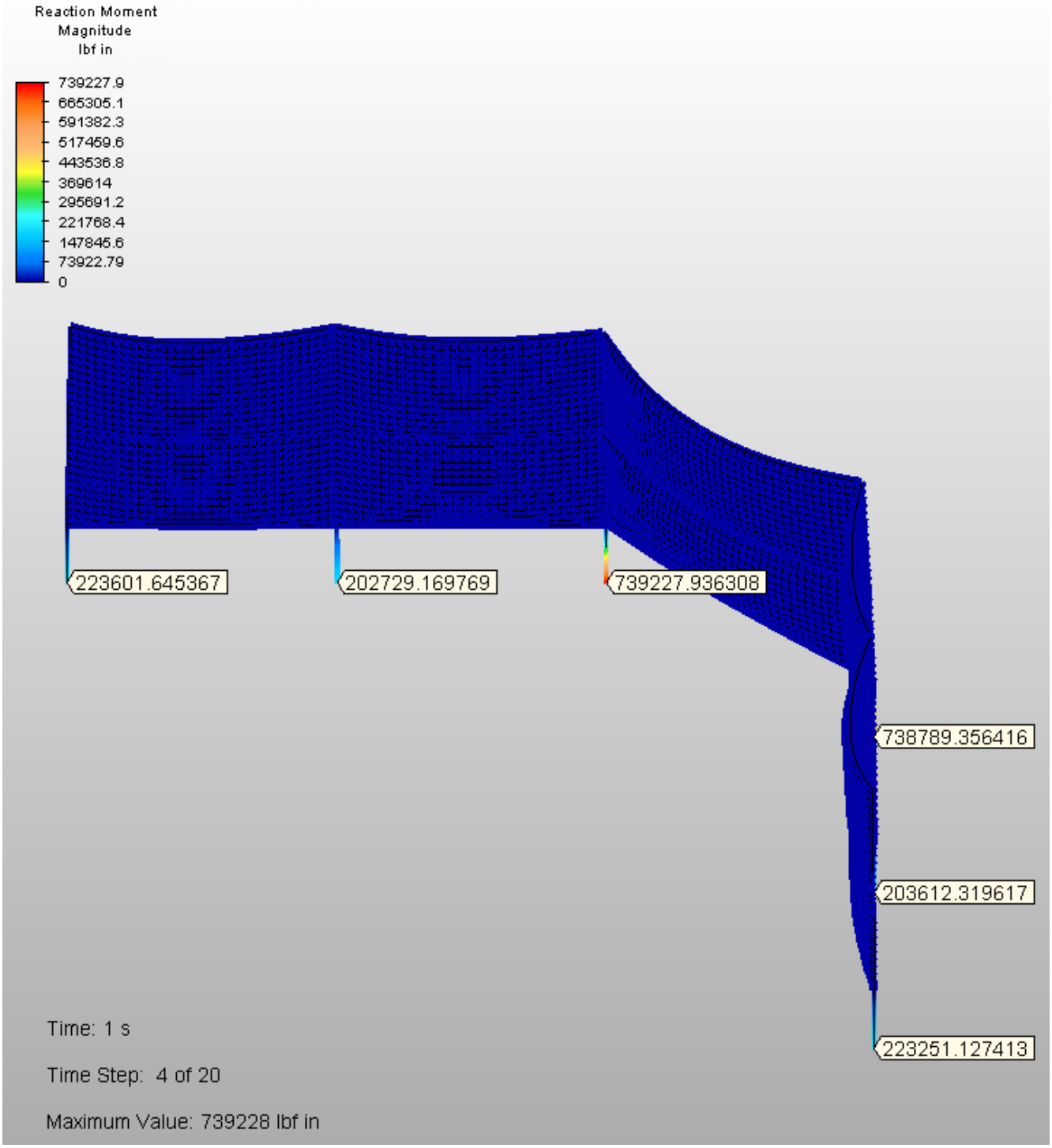


Figure 1: Overturning Moment

Load Case #2 Wind away from net



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Pole Foundation 8.625 Sch 40	Detail Ref.	Sheet No: A2

Input Variables:

Pole:

$F := 2026$ lb *(reaction force)*

$H := 35$ ft *(height)*

$h := 35$ ft *(height to load)*

$M := 446279$ in·lb

$I_{pole} := 72.089$ in^4

$S_{pole} := 16.716$ in^3

$Z_{pole} := 22.082$ in^3

$A_{pole} := 8.345$ in^2

$D_{pole} := 8.625$ in

$t_{pole} := 0.32$ in

$E := 29 \cdot 10^6$ psi

Soils:

$S := 1500$ psf *(Soil Bearing Capacity)*

$P := 100$ psf *(Passive Soil Pressure)*

Pier Foundations:

$f_c := 2500$ psi *(concrete compressive strength)*

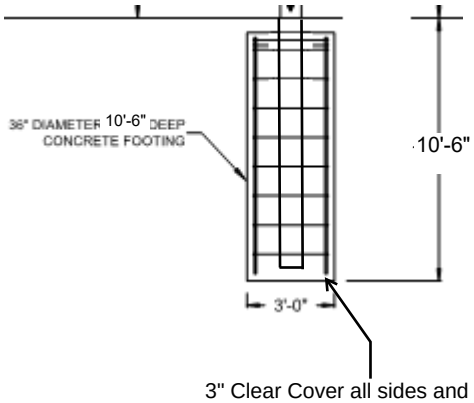
$d := 10.5$ ft *(initial pier depth)*

$D := 3.0$ ft *(pier diameter)*

Steel:

$F_y := 42000$ psi *(Steel yield strength)*

$\Omega := 1.67$



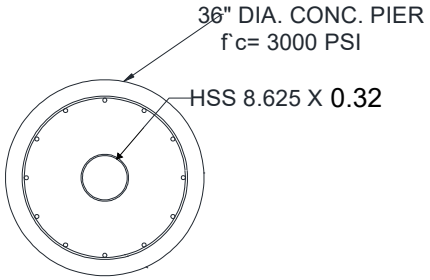
3" Clear Cover all sides and bottom. 2" Cover on top.

Calculations:

$\lambda_p := \frac{0.07 \cdot E}{F_y} = 48.33$ $\quad \lambda_r := \frac{0.31 \cdot E}{F_y} = 214.05$ therefore compact

$\lambda := \frac{D_{pole}}{t_{pole}} = 26.95$ $\quad M_n := F_y \cdot Z_{pole} \cdot \frac{1}{\Omega} = 555355.69$ in·lb

$I := \frac{M}{M_n} = 0.8$



Pier Foundation Design:

$S_c := \frac{2P \cdot d}{3}$ $\quad S_c = 700$

$A_c := \frac{2.34F}{S_c \cdot D}$ $\quad A_c = 2.26$

$d_{reqd} := \left(\frac{A_c}{2}\right) \cdot \left[1 + \sqrt{1 + 4.36 \cdot \left(\frac{h}{A_c}\right)}\right]$ $\quad d_{reqd} = 10.48$ ft

USE 8" SCH 40 Pipe
ASTM A500 Gr. B, Round, Fy = 42ksi

Use 36" Dia. Conc. Piers, *10'-6" deep f'c = 3,000 psi*

Chk rebar:

$A_{smin} := 0.005 \cdot \pi \cdot \left(\frac{D \cdot 12}{2}\right)^2$ $\quad A_{smin} = 5.09$

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Use (12)- #6 Bars *w/ # 3 ties @ 12" o.c. with 36" Diameter foundations*

IBC Table 1806.2 Presumptive Load Bearing Values

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Engineer:	CCL	Sheet No:	A2
Date:	6/15/16	Rev:	9/19/16
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Load Case #1 Wind towards net

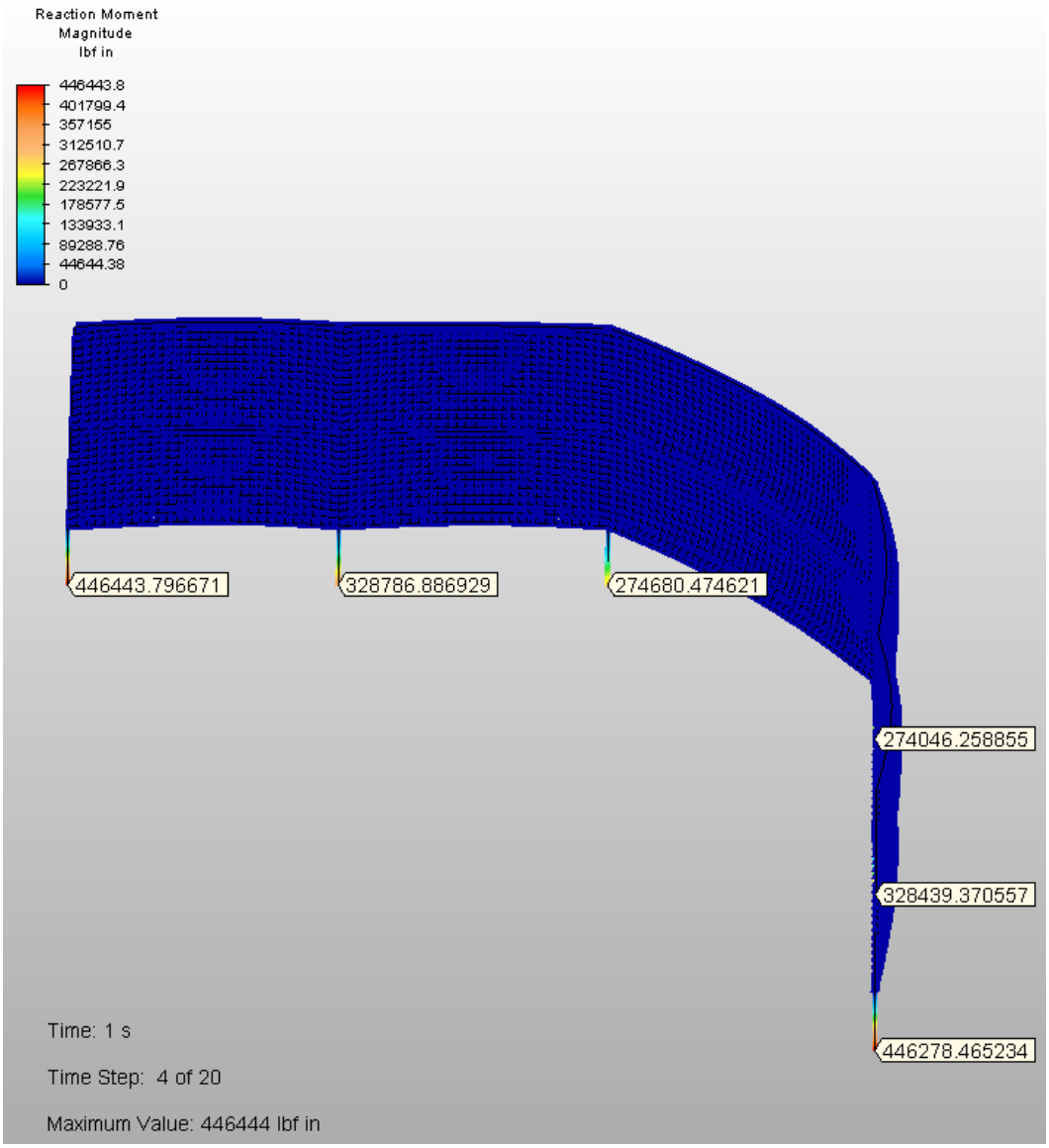
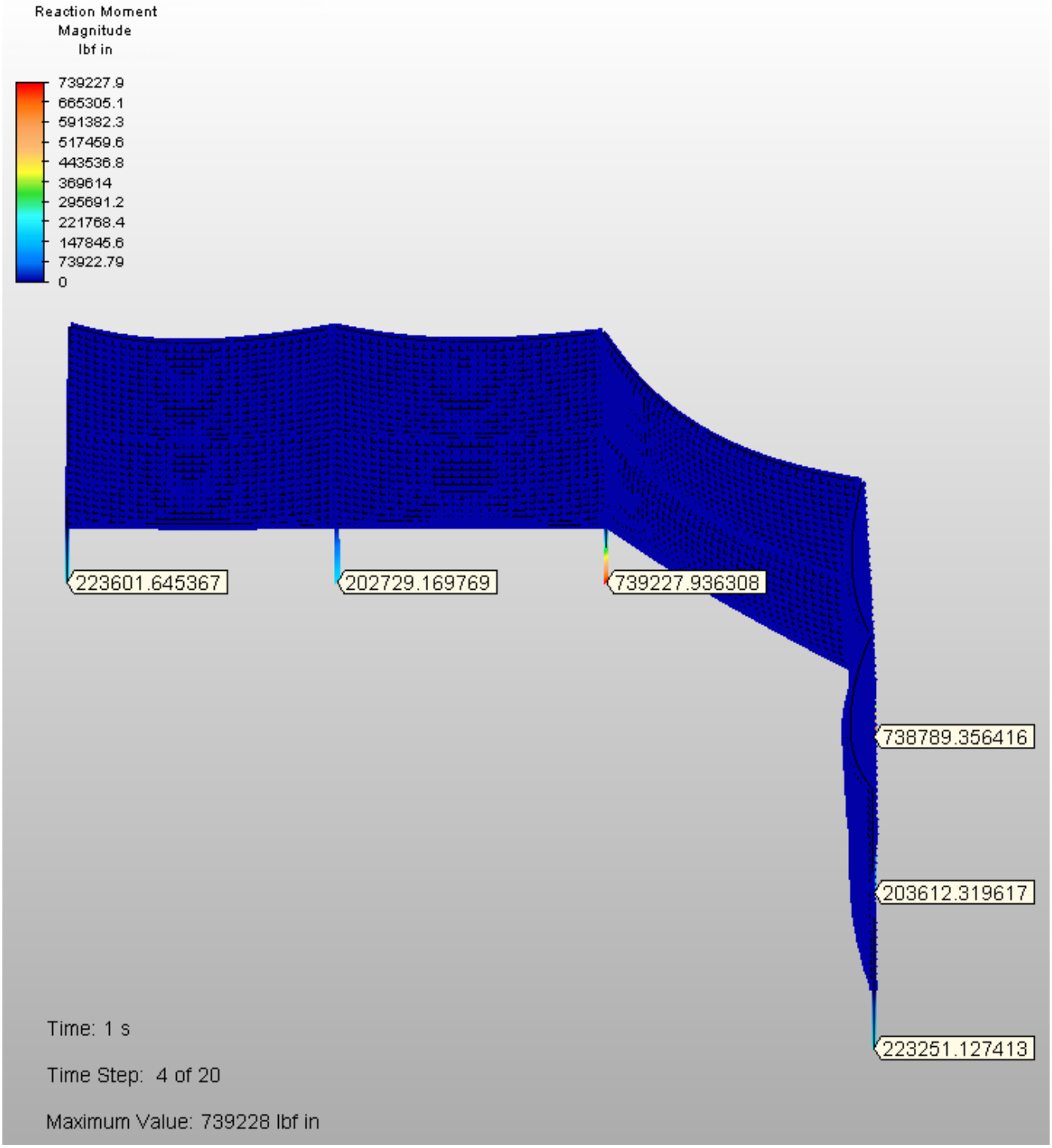


Figure 1: Overturning Moment

Load Case #2 Wind away from net



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