January 10, 2019

To: Plan Commission

From: Township High School District 113

Subject: New Digital Scoreboard

Deerfield High school proposes to install a new digital scoreboard on Adams Field. The current bulb scoreboard is 25+ years old, is in poor condition, is technically obsolete and repairing or replacing parts is no longer a viable option. The current scoreboard is 10’ x 30’ with only light bulb style displays for the quarter, game time, scores and time outs.

The new scoreboard will enhance the spectator experience for all high school and sports contests held on Adams Field. Not only will the new scoreboard show the game score and time clock but can also show instant replays and highlights, it can also show team and players through profile screens, pictures, videos, statistics, animations, and all other relevant game information.

The digital media driving the board will enable graphics to encourage spectator involvement during the games and help to celebrate the success of all boys’ and girls’ teams (Soccer, Lacrosse, Field Hockey, Track & Field, and Football, Band, Warrior Dance Team) in addition to the many service projects done by the sports teams.

Additionally, students interested in sports broadcasting and similar media fields at DHS will have additional educational opportunities enabled by the technology associated with the new board. The Booster Club, that partners with the school, will have a greater opportunity to generate significant annual advertising revenue from new sponsors and to increase revenue from existing sponsors. The additional revenue will enhance the DHS Booster Club's ability to continue its primary mission to fund a wide variety of projects which foster spirit, sportsmanship, seadship, and tradition for all 31 athletic teams.

The entire DHS community could benefit from the use of the digital scoreboard for events other than sporting events played on Adams Field. To name a few; potential community movie nights and fundraisers, community fundraisers (such as Walk for Life and School Chest 5k), watch parties for state events, Special Olympics or and even allow for watch parties for some DHS away games are just a few ideas. We are estimating 5-6 events a year.
Images on the following pages provide a visual of sightlines and components of the Scoreboard.

A scaled version of the scoreboard can be seen below. The board is from Formetco Co. and is 19’ 11.5” high x 36’ 9” wide (20’ x 37’) TRUE pixel 16mm digital scoreboard. The top of the scoreboard will stand 34.124’ in overall height. There is also a 4’ non-illuminated truss for the school name and mascot. The scoreboard will be mounted on a steel monopole structure.

The board will be operated using a computer system and wireless controllers from the press box. The computer system will be using ProPresenter Software with multi-sport scoring, custom zoning and advertising platforms, along with social media, rss feed and HUDL integration features.

A scaled version of the board can be seen below. Notice that this board displays the truss, scoring section of the board, video display and an advertising column. The board will have multiple views during games featuring full screen to split templates as you see below.
Sound and Lighting

The digital scoreboard will not include sound. We will continue to use the sound system that is currently mounted on the press box. As far as lighting is concerned, the board comes with a scoreboard mounted photo cell for optimized brightness control. During the day, the board will operate at appx 50-60% of its max brightness capability, while at night operating between 5-10% of max brightness. The additional purpose of the photo cell is to ensure the board always operates at a proper setting for ambient lighting which will reduce the potential for distractions to residential areas or any traffic. The new location of the digital board is an additional 150 yards further than the current board, so even visibility from a distance by residents will be minimal if at all. In addition, during the Fall and Spring seasons, the tennis courts are wrapped with windscreens up to 10’ which will also provide even less visibility from the south. See photos below.

From South Warrior Way Drive and Waukegan looking North
Back of existing board is visible from 1 resident fence line
From Warrior Way Drive, further East while looking North, the Scoreboard is no longer visible, obstructed view by the building.

From Waukegan Road traveling North
Scoreboard is no longer visible, obstructed view by the building.
From Waukegan Road traveling North
Scoreboard is viewable for 1.2 seconds traveling at speed limit

From North side of track looking South
Only 1-2 residents could have partial visibility to the scoreboard dependent on trees and leaves. When the tennis windscreens are up, there will be even less visibility
January 8, 2019

Robert Ruiz  
Athletic Director  
Deerfield High School  
1959 Waukegan Road  
Deerfield, Illinois 60015  

RE: New Scoreboard Site Plan Review

Dear Mr. Ruiz:

The Fire Prevention Bureau has completed the preliminary site plan review for the new scoreboard located inside the athletic stadium using the International Building and Fire Codes 2012 Editions and adopted local ordinances. The fire department recommends approval of the proposed site plan. The new scoreboard will have no impact on emergency vehicle access.

This letter does not preclude the possibility that corrections or additions may have to be made during the actual construction phase. If you have any questions, or would like to set up a meeting, please do not hesitate to contact us.

Have a safe day,

[Signature]

Brian McCarthy  
Fire Marshal

Cc: Village of Deerfield
FTX-16mm SPECS

WEIGHT = 9337 LBS

TOTAL POWER = 19813 W (FULL BRIGHT WHITE)

POWER = 55.0A/LEG @ 208V (3PH)

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>FORMETCO P/N</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>WEIGHT</th>
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</table>

DIMENSIONS ARE IN INCHES

TOLERANCES

FRACTIONAL

1/16"

ANGULAR BEND

2°

PROPRIETARY AND CONFIDENTIAL

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### MAKE 20 TOTAL ASSEMBLIES

![Diagram of Formed I-Beam Clamp, Double Width](image)

<table>
<thead>
<tr>
<th>Item No.</th>
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<td>Formed I-Beam Clamp, Double Width</td>
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<td>U-Strut Clamp Nut Plate</td>
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<td>3</td>
<td>Screw1/2x3x2.25Serr-Dacro</td>
<td>Screw1/2-13x2.25&quot; Serrated Flg DACRO Coated</td>
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### MAKE 24 TOTAL ASSEMBLIES

![Diagram of Formed I-Beam Clamp, Single Width](image)

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<td>FTXPART-MTG-SingleClip1/2Gray</td>
<td>Formed I-Beam Clamp, Single Width</td>
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<td>3</td>
<td>Screw1/2x3x2.25Serr-Dacro</td>
<td>Screw1/2-13x2.25&quot; Serrated Flg DACRO Coated</td>
<td>8</td>
</tr>
</tbody>
</table>

### Formed I-Beam Clamp

- **Double Width**: 3-1/2"x1/2" Flat Bar
- **Paint**: Gray
- **QTY Required**: 40

- **Single Width**: 1-3/4"x1/2" Flat Bar
- **Paint**: Gray
- **QTY Required**: 48

### UNISTRUT Clamp Bolt Plate

- **Single Width**: 1.375"x9" Flat
- **Material**: 12GA Galvanneal
- **Paint**: Gray
- **QTY Required**: 128

### UNC-3L-1000-G-3D

- **Material**: Steel
- **Quantity**: 1000
- **Thread**: UNC-3L-1000
- **Head Style**: Hex
- **QTY Required**: 3

---

**Notes:**
- Dimensions are in inches.
- Tolerances: Fractional 1/64" angular bend 2°.
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<td>DESCRIPTION</td>
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**Detail I**

Scale 1:5

**Dimensions are in inches. Tolerances are in 1/64". Angular bend is 2°.**

**Proprietary and Confidential.**

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DETAIL J
SCALE 1 : 5

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**Details:**
- Scale 1:5
- Dimensions are in inches
- Tolerances: Fractional 1/16", Angular Bend 2°

**Notes:**
- Do not scale drawing
- Material Finish N/A
- Weight: N/A
- Material Finish: N/A

**Revised:**
- 10/5/2018 11:32:34 AM
- 12/3/2018 12:03:25 PM

**Dimensions:**
- 16"x99" 16 TILE WIDE X 6 TILE TALL
- 16"x99" 16'x9'
ITEM NO. | QTY. | DESCRIPTION | LENGTH | TOTAL LENGTH
--- | --- | --- | --- | ---
1 | 2 | 19'11 3/8" | 113'4 3/4"
2 | 2 | 20' | 113'4 3/4"
3 | 2 | 16'9" | 113'4 3/4"

2"X6-3/8" ANGLE TRIM SPLICE
QTY 6 REQUIRED
20 GA BLK/BLK STEEL SHEET
W/ DOUBLE SIDED TAPE APPLIED
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<td>4'6 7/16&quot;</td>
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<td>1 SQ x .125 Wall</td>
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<td>17</td>
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<td>UNISTRUT, 1 5/8&quot; SQUARE</td>
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</tr>
</tbody>
</table>

**TOTAL LINEAR FEET**

3X1.5X14GA TUBE = 137'9"  
1X1X.125 TUBE = 54'  
1 5/8" SQ UNISTRUT = 24'4"
0

1

2

3

4

5

6

7

8

9

10

11

12

13

14

DETAIL D
SCALE 1 : 2

3" x 1.5" x 1/8" CUT DETAIL

ASTM A36 Steel

BLACK PAINT

DO NOT SCALE DRAWING

WEIGHT:

UNLESS OTHERWISE SPECIFIED

TOLERANCES
FRAC TIONAL 1/16"

ANGULAR BEND
2°

PROPRIETARY AND CONFIDENTIAL

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POWER CABINET AND BREAKER REQUIREMENTS AND AMPERAGE AND WATTAGE RATINGS SHOWN ARE PER DIGITAL DISPLAY UNLESS OTHERWISE INDICATED.

POWER CABINET AND BREAKERS BY FORMETCO

POWER REQUIREMENTS PER EACH DIGITAL DISPLAY
FULL BRIGHT, WHITE IMAGE IS 19813 WATTS (MAXIMUM)
OPERATING AVERAGE POWER IS 4161 WATTS

TYPICAL SPECIFICATION:
(1) TYPE 3R ENCLOSURE BOX RATED 125A, MIN 30 CKT, 3 PH
(12) 120/240V 20 AMP 2 POLE CIRCUIT BREAKERS
(1) 120/240 20 AMP 1 POLE CIRCUIT BREAKER
(1) LOAD CENTER EQUIP GROUND BAR
POWER CABINET AND BREAKERS BY FORMETCO
POWER REQUIREMENTS PER EACH DIGITAL DISPLAY
FULL BRIGHT, WHITE IMAGE IS 19813 WATTS (MAXIMUM)
OPERATING AVERAGE POWER IS 4161 WATTS

DUE TO THE INRUSH CURRENT CREATED BY THE DISPLAY ON STARTUP THE OVER CURRENT PROTECTION DEVICE(S) HAVE TO BE OVERSIZED

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NOTES:

1. ALL CEMENT MORTAR TO BE USED FOR ALL WORK PER
2. ALL PLUMBING DRAINAGE TO BE PERFORMED AT THE PLANT TO
3. ALL STRUCTURES ARE TO BE PROVIDED WITH A 10-100 LBS. PER
4. ALL VERTICAL RIGID FLEXIBLE PIPE TO BE PROVIDED WITH A 10-100 LBS. PER
5. ALL EPOXY SEALANT TO BE PROVIDED WITH A 10-100 LBS. PER
6. ALL DRILLING TO BE PERFORMED WITH A 10-100 LBS. PER
7. ALL GRADE CONTROL TO BE PROVIDED WITH A 10-100 LBS. PER
8. ALL PIPE TO BE PROVIDED WITH A 10-100 LBS. PER
9. ALL AIR CONTROL TO BE PROVIDED WITH A 10-100 LBS. PER
10. ALL ELECTRICAL WORK TO BE PERFORMED AT THE PLANT TO
11. ALL WIRING TO BE PROVIDED WITH A 10-100 LBS. PER
12. ALL CONCRETE TO BE PROVIDED WITH A 10-100 LBS. PER
13. ALL STRUCTURAL STEEL TO BE PROVIDED WITH A 10-100 LBS. PER
14. ALL BRICKWORK TO BE PROVIDED WITH A 10-100 LBS. PER
15. ALL ROOFING TO BE PROVIDED WITH A 10-100 LBS. PER
16. ALL GUTTERING TO BE PROVIDED WITH A 10-100 LBS. PER
17. ALL HVAC TO BE PROVIDED WITH A 10-100 LBS. PER
18. ALL PIPING TO BE PROVIDED WITH A 10-100 LBS. PER
19. ALL MECHANICAL TO BE PROVIDED WITH A 10-100 LBS. PER
20. ALL UTILITY WORK TO BE PERFORMED AT THE PLANT TO

TYPICAL GUSSET DETAIL:

LENGTH & WIDTH OF GUSSET TO BE

GENERAL NOTES:

1. ALL MATERIALS TO BE PROVIDED WITH A 10-100 LBS. PER
2. ALL WORK TO BE PERFORMED AT THE PLANT TO
3. ALL STRUCTURES TO BE PROVIDED WITH A 10-100 LBS. PER
4. ALL PIPE TO BE PROVIDED WITH A 10-100 LBS. PER
5. ALL AIR CONTROL TO BE PROVIDED WITH A 10-100 LBS. PER
6. ALL GRADE CONTROL TO BE PROVIDED WITH A 10-100 LBS. PER
7. ALL VERTICAL RIGID FLEXIBLE PIPE TO BE PROVIDED WITH A 10-100 LBS. PER
8. ALL WATER CONTROL TO BE PROVIDED WITH A 10-100 LBS. PER
9. ALL ELECTRICAL WORK TO BE PERFORMED AT THE PLANT TO
10. ALL WIRING TO BE PROVIDED WITH A 10-100 LBS. PER
11. ALL CONCRETE TO BE PROVIDED WITH A 10-100 LBS. PER
12. ALL STRUCTURAL STEEL TO BE PROVIDED WITH A 10-100 LBS. PER
13. ALL BRICKWORK TO BE PROVIDED WITH A 10-100 LBS. PER
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15. ALL GUTTERING TO BE PROVIDED WITH A 10-100 LBS. PER
16. ALL HVAC TO BE PROVIDED WITH A 10-100 LBS. PER
17. ALL PIPING TO BE PROVIDED WITH A 10-100 LBS. PER
18. ALL MECHANICAL TO BE PROVIDED WITH A 10-100 LBS. PER
19. ALL UTILITY WORK TO BE PERFORMED AT THE PLANT TO
20. ALL DRILLING TO BE PERFORMED WITH A 10-100 LBS. PER
25.125' x 36.75' Centermount Single Face

34.125' overall height

2015 IBC (115 mph - Exp. C - Risk Category II)

(1) 9,200 lb. digital face (21.01' x 36.75')

Drawing Number SS-6424

Project Number SS-6424

Location: Deerfield, IL

Client:

Selective Structures, LLC
811 East Avenue
Athens, TN 37303

Revised: Job Number Date

Effective Engineering Solutions, Ltd.
61 White Water Court
New Lenox, IL 60451
815-485-1470

20-Dec-18
Conversion Factors and Constants:

\[
\text{psf} := \frac{\text{lbf}}{\text{ft}^2}, \quad \text{pcf} := \frac{\text{lbf}}{\text{ft}^3}, \quad \text{plf} := \frac{\text{lbf}}{\text{ft}}, \quad \text{ksi} := 1000\text{psi}, \quad k := 1000\text{lbf} \\
\text{klf} := 1000\text{plf}, \quad f_y := 36\text{ksi}, \quad ksf := 1000\text{psf}, \quad kcf := 1000\frac{\text{lbf}}{\text{ft}^3}
\]

**IBC 2015 and ASCE 7-10 Provisions**

**Site:** Deerfield, IL

**Model:** 25.125' x 36.76' Centemount Single Face @ 34.125' overall height above grade

Design wind load is based on the 2015 International Building Code and ASCE 7-10, using 115 mph, Exposure C, and Risk Category II.

**Design wind speed:** \( V := 115 \)

Velocity pressure coefficient at a height of 34.125' above grade level (Exp. C.): \( K_z := 1.004 \)
(based on table 6-3)

**Topographic factor:** \( K_t := 1.0 \)  
(based on Section 6.5.8.1)

**Wind directionality factor:** \( K_d := 0.85 \)  
(based on Table 6-4)

**Velocity pressure:** \( q_z := 0.00256 - K_z K_t K_d V^2 \) \( q_z = 28.993 \)  
(based on Sec. 6.5.10)

**Force coefficient:** \( C_f := 1.80 \)  
(based on Figure 6-20)

**Gust effect factor:** \( G_b := 0.85 \)  
(based on Section 6.5.8.1)

**Load combination factor:** \( C_{lf} := 0.6 \)  
(based on Table 6-4)

**Design pressure:** \( p_{lf} := q_z C_f G_b C_{lf} \) \( p_{lf} = 26.524 \)

**Use a design windload of 27 psf.**

\( W_{lf} := 27\text{psf} \)
A. Upright Design Review

Top effective height: \( teh := 2.18 \text{ft} \)
Center effective height: \( ceh := 3.35 \text{ft} \)
Bottom effective height: \( beh := 2.18 \text{ft} \)
Top truss effective height: \( tteh := 4.0 \text{ft} \)
Top load: \( Pt := teh \cdot 9.22 \text{ft} \cdot \text{Wll} \)
Center load: \( Pc := ceh \cdot 9.22 \text{ft} \cdot \text{Wll} \)
Bottom load: \( Pb := beh \cdot 9.22 \text{ft} \cdot \text{Wll} \)
Top truss load: \( Ptt := tteh \cdot 9.22 \text{ft} \cdot \text{Wll} \)
Top load distance: \( tld := 11.25 \text{ft} \)
Center load distance: \( cld := 13.65 \text{ft} \)
Bottom load distance: \( bld := 0.0 \text{ft} \)
Top truss load distance: \( ttd := 13.75 \text{ft} \)
Digital face deadload:
\[
{udfdl} := \left( \frac{21.125 \text{ft} \cdot 9.22 \text{ft} \cdot 12.52 \text{lbf}}{\pi^2} \right)
\]
\[{udfdl} = 2.439 \text{k} \]

Live load moment:
\[Mllu := Pt \cdot tld + Pc \cdot cld + Pb \cdot bld + Ptt \cdot ttd \]
\[Mllu = 31.18 \text{ft} \cdot \text{k} \]

Dead load moment:
\[Mdlu := {udfdl} \cdot 1.375 \text{ft} \]
\[Mdlu = 3.353 \text{ft} \cdot \text{k} \]

Total moment:
\[Mtu := Mllu + Mdlu \]
\[Mtu = 34.533 \text{ft} \cdot \text{k} \]

Develop moment capacity based on upright fy = 50 ksi and unbraced length of 6.0 ft.

From AISC "Allowable Moments in Beams", W10 x 22 moment capacity based on the above cited criteria is 57.75 ft-k > 34.533 ft-k, therefore - okay -

Use (4) W10 x 22 uprights @ 9.12' c/c per face w/ (2) L3 x 3 x 1/4 lateral braces.

B. Outrigger Design

Develop moment capacity based on outrigger fy = 50 ksi and unbraced length of 6.0 ft.

\[PdlD := 4.3k \quad \text{frame D distance:} \quad ddist := 6.0 \text{ft} \]

Deadload moment:
\[MdlD := PdlD \cdot ddist \]
\[MdlD = 25.8 \text{ft} \cdot \text{k} \]

Total moment:
\[Mtd := Mllu + MdlD \]
\[Mtd = 56.98 \text{ft} \cdot \text{k} \]

From AISC "Allowable Moments in Beams", W14 x 30 moment capacity based on the above cited criteria is 115.25 ft-k > 56.98 ft-k, therefore - okay -

Use W14 x 30 outriggers.
C. Torsion Pipe Design Review:

\[ P_{ll} := 25.125\text{ft}-9.16\text{ft-Wll} \quad P_{llc} := 25.125\text{ft}-9.22\text{ft-Wll} \]

\[ f_{yt} := 50\text{ksi} \]

\[ P_{ldc} := 4.2k \quad P_{ldd} := 4.23k \]

Frame C distance:

\[ C_{dist} := 3.3\text{ft} \]

Frame D distance:

\[ D_{dist} := 12.5\text{ft} \]

Pipe weight\(^2\) per foot:

\[ t_{pd} := 0.07 \frac{k}{f} \]

\[ M_{lt} := P_{llc}D_{dist} + P_{ll}C_{dist} \]

\[ M_{lt} = 1.184 \times 10^3 \text{ in-k} \]

\[ M_{lt} := P_{ldc}C_{dist} + P_{ld}D_{dist} + t_{pd} \left( \frac{13f}{2} \right)^2 \]

\[ M_{lt} = 871.8\text{in-k} \]

\[ M_{tp} := P_{ll}4.0\text{ft} + P_{llc}4.0\text{ft} \]

\[ M_{tp} = 598.49\text{in-k} \]

\[ f_{lt} := \frac{M_{lt}}{S_{tp}} \]

\[ f_{lt} = 12.643\text{ksi} \]

\[ f_{lt} := \frac{(M_{lt}-10n)}{2t_{fp}} \]

\[ f_{lt} = 3.195\text{ksi} \]

Interaction equation:

\[ l_{nt} := \sqrt{\left( \frac{f_{lt}^2 + f_{lt}^2}{0.66f_{tp}} \right) + \frac{f_{lp}^2}{(0.4f_{tp})^2}} \]

\[ l_{nt} = 0.501 < 1.0, \text{ therefore, okay} \]

Fig. 29.4-1 Case B

\[ P_{llB} := 25.125\text{ft}-36.75\text{ft-Wll} \]

\[ x_{bar} := 0.736.75\text{ft} = 18.375\text{ft} \]

\[ M_{ltB} := P_{llB}4.0\text{ft} \]

\[ M_{tpB} := P_{llB}x_{bar} \]

\[ f_{lpB} := \frac{M_{ltB}}{S_{tp}} \]

\[ f_{lpB} = 12.775\text{ksi} \]

Interaction equation:

\[ l_{ntB} := \sqrt{\left( \frac{f_{lpB}^2 + f_{lpB}^2}{0.66f_{tp}} \right) + \frac{f_{lpB}^2}{(0.4f_{tp})^2}} \]

\[ l_{ntB} = 0.823 < 1.0, \text{ therefore, okay} \]

Fig. 29.4-1 Case C

\[ C_{fs} := 2.25 \quad p_{lls} := q_{z}C_{fs}G_{h-Lcf} \]

\[ p_{lls} = 33.154 \quad W_{lls} := 33.154\text{psf} \]

\[ C_{fs} := 1.8 \quad p_{lls} := q_{z}C_{fs}G_{h-Lcf} \]

\[ p_{lls} = 26.524 \quad W_{lls} := 26.524\text{psf} \]
Plls := 25.125ft-25.125ft-Wlls  Plls = 20.929 k  xbars := 5.81ft
Pllss := 25.125ft-11.625ft-Wllss  Pllss = 7.744k  xbars := 0.0ft
PllC := Plls + Pllss  PllC = 28.673 k
MLtC := PllC-5.81ft  MLtC = 1.999 x 10^3 in-k
Mtcp := Plls-xbars + Pllss-xbars  Mtcp = 1.459 x 10^3 in-k

\[
\text{fltpC} := \frac{\text{MLtC}}{\text{Stp}} \quad \text{fltpC} = 21.342 \text{ksi} \quad \text{fttpC} := \frac{\text{Mtcp}-10\text{in.}}{2\text{ft}} \quad \text{fttpC} = 7.789 \text{ksi}
\]

Interaction equation:

\[
\text{lnpC} := \sqrt{\left(\frac{\text{fltpC}^2 + \text{fttpC}^2}{0.65-fyp}\right)^2 + \left(\frac{\text{fttpC}}{0.4-fyp}\right)^2} \quad \text{lnpC} = 0.857 \quad < 1.0, \text{therefore, okay}
\]

Use 20" diameter x 0.3125" wall fy = 50 ksi torsion pipe

E. Column Design Review

Fig. 29.4-1 Case A

\[\text{fyp} := 50 \text{ksi} \quad \text{Pllc} = 24.93 \text{k}\]
Column at grade: 36" diameter x 0.375" wall

\[\text{OAH60} := 34.125 \text{ft}\]

\[\text{pipedia60} := 3.0 \text{ft} \quad \text{pipewall60} := 0.375 \text{in}\n\]

\[\text{ML60} := \text{Pllc} \left[ \frac{\text{OAH60} - \left(\frac{25.125 \text{ft}}{2}\right)}{2} + \frac{0.67 \cdot \text{pipedia60} \cdot (\text{OAH60} - 25.125 \text{ft})^2 \cdot \text{Wll}}{\text{pipewall60}} \right]\]

\[\text{S60} := \pi \left[ \frac{\text{pipedia60}^4 - (\text{pipedia60} - 2 \cdot \text{pipewall60})^4}{32 \cdot \text{pipedia60}} \right] \quad \text{S60} = 369.94 \text{in}^3\]

\[\text{I60} := \frac{\text{S60} \cdot \text{pipedia60}^2}{2} \quad \text{I60} = 6.659 \times 10^3 \text{ in}^4\]

\[\text{Pdldf} := 19.0 \text{k} \quad \text{Mdlldfx} := \text{Pdldf} \cdot 5.5 \text{ft} \quad \text{Mdlldfx} = 1.254 \times 10^3 \text{ in-k}\]

\[\text{fl60} := \frac{\text{ML60} + \text{Mdlldfx}}{\text{S60}} \quad \text{fl60} = 20.898 \text{ ksi} \quad \text{Interaction equation:} \]

\[\text{ln60} := \frac{\text{fl60}}{28.05 \text{ksi}} \quad \text{ln60} = 0.745\]

Fig. 29.4-1 Case B

\[\text{ML60B} := \text{Pllc} \left[ \frac{\text{OAH60} - \left(\frac{25.125 \text{ft}}{2}\right)}{2} + \frac{0.67 \cdot \text{pipedia60} \cdot (\text{OAH60} - 25.125 \text{ft})^2 \cdot \text{Wll}}{\text{pipewall60}} \right]\]

\[\text{MtcpB} := \text{Pllc} \cdot 5.81 \text{ft} \quad \text{MtcpB} = 1.738 \times 10^3 \text{ in-k}\]
Effective Engr. Solutions, Ltd.  
61 White Water Court  
New Lenox, IL 60451  
815-485-1470  
Selective Structures  
Job number SS-5424

\[ f_{\text{II60B}} = \frac{(M_{\text{II60B}} + M_{\text{ldf5}})}{S_{\text{60}}} \]

\[ f_{\text{II60B}} = 20.898 \text{kai} \quad f_{\text{60B}} := \frac{1}{2} \left( \frac{p_{\text{60B}}}{h_{\text{60}}} \right) \quad f_{\text{60B}} = 2.349 \text{ ks} \]

Interaction equation:

\[ \text{Int}_{\text{60B}} := \frac{f_{\text{II60B}}}{0.66 \cdot f_{\text{yp}}} + \frac{f_{\text{60B}}^2}{(0.4 \cdot f_{\text{yp}})^2} \]

\[ \text{Int}_{\text{60B}} = 0.647 \]

Fig. 29.4-1 Case C

\[ M_{\text{II60C}} := \frac{1}{2} \left[ OAH_{\text{60}} - \frac{(17.0R)}{2} \right] + \frac{0.67 \cdot p_{\text{60B}} - (OAH_{\text{60}} - 17.0R)^2 \cdot W_{\text{II}}}{2} \]

\[ M_{\text{II60C}} = 8.912 \times 10^3 \text{ in-k} \]

\[ M_{\text{tcpC}} := \text{Pls} \cdot xbars + \text{Plss} \cdot xbarsss \]

\[ M_{\text{tcpC}} = 1.459 \times 10^3 \text{ in-k} \]

\[ f_{\text{II60C}} := \frac{(M_{\text{II60C}} + M_{\text{ldf5}})}{S_{\text{60}}} \]

\[ f_{\text{II60C}} = 27.481 \text{kai} \quad f_{\text{60C}} := \frac{1}{2} \left( \frac{p_{\text{60C}}}{h_{\text{60}}} \right) \quad f_{\text{60C}} = 1.972 \text{ ksi} \]

Interaction equation:

\[ \text{Int}_{\text{60C}} := \frac{f_{\text{II60C}}}{0.66 \cdot f_{\text{yp}}} + \frac{f_{\text{60C}}^2}{(0.4 \cdot f_{\text{yp}})^2} \]

\[ \text{Int}_{\text{60C}} = 0.842 \]

Use 36" diameter x 0.375 fy = 60 ksi column at grade

E. Footing Design:

Footing design is based on an allowable lateral soil bearing pressure = 250 psf./ft. of depth below natural grade.

\[ h_{\text{60}} := \frac{OAH_{\text{60}} - \frac{(25.125\text{ft})}{2}}{2} \]

\[ h_{\text{60}} = 21.563 \text{ ft} \]

\[ P_{\text{60}} := \frac{M_{\text{II60C}} + M_{\text{ldf5}}}{h_{\text{60}}} \]

\[ P_{\text{60}} = 29.879 \text{k} \]

\[ P_{\text{60C}} := \frac{(M_{\text{II60C}} + M_{\text{ldf5}})}{h_{\text{60}}} \]

\[ P_{\text{60C}} = 39.29 \text{k} \]

Pe60C controls:

\[ \text{pressure}_{\text{60}} := \frac{250}{\text{bsf}} \]

\[ b_{\text{60}} := 5.0\text{ ft} \]

\[ S_{\text{1}} := \frac{1}{3} \cdot 2 \cdot 12 \cdot \text{pressure}_{\text{60}} \cdot 1.33 \]

\[ S_{\text{1}} = 2.66 \text{ ksf} \]

\[ A_{\text{60}} := \frac{2.34 \cdot P_{\text{60C}}}{S_{\text{1}} \cdot h_{\text{60}}} \]

\[ A_{\text{60}} = 6.913 \text{ ft} \]

\[ d_{\text{60}} := \frac{A_{\text{60}}}{2} \left[ 1 + \frac{1 + 4.36 \cdot \frac{h_{\text{60}}}{A_{\text{60}}}}{2} \right] \]

\[ d_{\text{60}} = 16.663 \text{ ft} < 17.0' \text{ okay} \]
Use 5.0' diameter x 17'-0" depth

Design Cube Footing Alternate:

\[ b_{60c} := 11.31 \text{ft} \]

\[ S_{1c} := \frac{1}{3} \times 2 \times 12 \times \text{pressure} \times 60 \times 1.33 \]

\[ S_{1c} = 2.66 \text{ksf} \]

\[ A_{60c} := \frac{2.34 \times P_{e60c}}{S_{1c} \times b_{60c}} \]

\[ A_{60c} = 3.056 \text{ft} \]

\[ d_{60c} := \frac{A_{60c}}{2} \left[ 1 + \sqrt{1 + 4.36 \times \frac{b_{60}}{A_{60c}}} \right] \]

\[ d_{60c} = 10.14 \text{ft} < 12.0' \text{ okay} \]

Use 8.0' square cube with a 12'-0" depth
F. Upright Connection:

Outernest bolts: \( o_{buc} := 8.5 \text{in} \)

Innermost bolts: \( i_{buc} := 4.5 \text{in} \)

\[ l_{upe} := 4 \left( o_{buc}^2 + i_{buc}^2 \right) \]

\[ V_{upe} := 4.2k \]

\[ V_{upcb} := \frac{V_{upe}}{8} \]

\[ V_{upcb} = 0.525k \]

for 3/4" diameter A325 bolts:

\[ A_{upe} := 0.4418 \text{in}^2 \]

\[ f_{v_{upe}} := \frac{V_{upcb}}{A_{upe}} \]

\[ f_{v_{upe}} = 1.188 \text{ksi} \]

\[ F_{upe} := \sqrt{(44kSi)^2 - 4.39 \cdot f_{v_{upe}}^2} \]

\[ F_{upe} = 43.929 \text{ksi} \]

\[ T_{upe} := M_{tu} \cdot \frac{o_{buc}}{l_{upe}} \]

\[ T_{upe} = 9.52k \]

\[ f_{t_{upe}} := \frac{T_{upe}}{A_{upe}} \]

\[ f_{t_{upe}} = 21.548 \text{ksi} < F_{upe}, \text{okay} \]

Use (8) 3/4" diameter A325 bolts per connection

G. Column Connection:

Outernest bolts: \( o_{bcc} := 18.0 \text{in} \)

Secondmost bolts: \( s_{bcc} := 13.0 \text{in} \)

Thirdmost bolts: \( t_{bcc} := 0.0 \text{in} \)

Innermost bolts: \( i_{bcc} := 0.0 \text{in} \)

Outermost bolts: \( o_{bycc} := 18.0 \text{in} \)

Secondmost bolts: \( s_{bycc} := 13.0 \text{in} \)

\[ I_{cx} := 4 \left( 2 \cdot o_{bcc}^2 + s_{bcc}^2 + t_{bcc}^2 + i_{bcc}^2 \right) \]

\[ I_{cx} = 3.268 \times 10^3 \text{in}^2 \]

\[ I_{cy} := 4 \left( 2 \cdot o_{bycc}^2 + s_{bycc}^2 \right) \]

\[ I_{cy} = 3.268 \times 10^3 \text{in}^2 \]

for 1" diameter A490 bolts:

\[ A_{bcc} := 0.7854 \text{in}^2 \]

\[ f_{v_{bce}} := \frac{P_{llep}}{12 \cdot A_{bce}} \]

\[ f_{v_{bce}} = 2.645 \text{ksi} \]

\[ F_{t_{bce}} \left( (54kSi)^2 \right) = 3.75 \cdot f_{v_{bce}}^2 \]

\[ F_{t_{bce}} = 53.757 \text{ksi} \]

\[ M_{llec} := P_{llep} \cdot 5.0 \text{ft} + M_{ddfx} \]

\[ M_{llec} = 2.75 \times 10^3 \text{in-k} \]

\[ T_{bce} := M_{llec} \cdot \frac{o_{bcc}}{I_{cx}} \]

\[ T_{bce} = 15.146 \text{k} \]

\[ f_{t_{bce}} := \frac{T_{bce}}{A_{bce}} \]

\[ f_{t_{bce}} = 19.284 \text{ksi} < F_{t_{bce}}, \text{okay} \]
Fig. 29.4-1 Case C - based on torsion pipe calculations, Case C windload application will control

\[
f_{vccC} := \frac{(M_{tcpC} \cdot obcc)}{(leex + lcey) \cdot Abcc}
\]

\[
F_{tccC} := \sqrt{(54 \text{ksi})^2 - 3.75 \cdot f_{vccC}^2}
\]

\[
M_{ltecC} := Pl1C \cdot 8.75 \text{r} + M_{ddfx}
\]

\[
T_{ceC} := \frac{M_{ltecC} \cdot obcc}{leex}
\]

\[
f_{ceC} := \frac{T_{ceC}}{Abcc}
\]

\[
f_{vccC} = 5.117 \text{ksi}
\]

\[
F_{tccC} = 53.083 \text{ ksi}
\]

\[
M_{ltecC} = 4.265 \times 10^3 \text{ in-k}
\]

\[
T_{ceC} = 23.489 k
\]

\[
f_{ceC} = 29.908 \text{ ksi} < F_{tccC}, \text{ okay}
\]

Use (12) 1" diameter A490 bolts per connection
Effective Engineering Solutions, Ltd.
61 White Water Ct.
New Lenox, IL 60451
815-485-1470
815-485-0603 (FAX)

CUSTOMER  SELECTIVE
DATE  12/21/18
JOB  43-6424-PR
ENGINEER  KSW

G. COLUMN CONNECTION

1/4" A490  A = 0.7054 in²
AF = 1.025"

H = 2/3 22.5 (3.75) = 14.21 in

Weld Plate to Plate
S = \pi (2) = \pi (18)² = 1017.87 in²

f = \frac{4265}{1017.87} = 4.17 ksi
UGW = \frac{4(4.17)}{0.0722} = 0.282 lbs/in²

USE 3/8" FILLET WELD, ALL AROUND, PIPE TO PLATE

Bottom Gussets
U = 2l (l/2)² + 2(4x1) = 372.1 kN

4 = \sqrt{2(4x1)^2 + 18} = 7.65 ft
Af = \sqrt{12 + 12} = 9.20 in

UGW = \frac{4(9.20)}{0.0722} = 13.78 in²

Use 3/8" OD GUSSET, LOWER

Top Gussets
U = 2(2382) (3.75) = 107.75 kN

UGW = \frac{107.75}{0.0722} = 3.98 in²

S includes 1/8" gussets at corner

Use 1/2" x 8 fit x 7/6" OD GUSSETS, CORNER

PAGE OF
CASE C. WINDLOAD

Aspect ratio: \( \frac{B}{L} = \frac{25.75}{25.125} = 1.06 \)

0.3 \( C_t = 0.25 \)

0.05 \( C_d = 1.80 \)
Conversion Factors and Constants:

\[
\begin{align*}
\text{psf} &:= \frac{\text{lbf}}{\text{ft}^2} \\
\text{pcf} &:= \frac{\text{lbf}}{\text{ft}^3} \\
\text{plf} &:= \frac{\text{lbf}}{\text{ft}} \\
\text{ksi} &:= 1000 \text{psl} \\
\text{k} &:= 1000 \text{lbf} \\
\text{kif} &:= 1000 \text{plf} \\
\text{fy} &:= 35 \text{ksi} \\
\text{ksf} &:= 1000 \text{psf} \\
\text{kcf} &:= 1000 \frac{\text{lbf}}{\text{ft}^3}
\end{align*}
\]

**IBC 2015 and ASCE 7-10 Earthquake Provisions**

SS-6424 - 20' x 36.75' Centemount single face @ 34.125' overall height

Seismic Base Shear: \( V_{eq} = C_s \times W_{st} \) Eqn. 12.8-1

where \( C_s = \text{Seismic Response Coefficient} \)
Section 12.8.1.1

\( W_{st} = \text{Effective Seismic Weight} \)
Section 12.7.2

\( C_s = \frac{Sds}{(R/l)} \) Eqn. 12.8-2

where \( Sds = \text{Design Spectral Response Acceleration - Short Period Range} \)
Section 11.4.4

\( Req = \text{Response Modification Factor} \)
Table 12.2-1

\( I = \text{Occupancy Importance Factor} \)
Section 11.5.1

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per USGS Design Maps Summary Report:
\( Sds = 0.132-32.2 \)
\( C_s = \frac{Sds}{(Req/I)} = 1.417 \)

Effective Seismic Weight \( W_{eq} = 22.0k \)

\( V_{eq} = C_s \times W_{eq} \)
\( V_{eq} = 31.17k \)

Check column pipe at grade for shear stress:
for 36" diameter x 0.375" wall pipe
\( A_{36} = 41.97 \text{in}^2 \)
\[ f_{vp} = \frac{V_{eq}}{A_{36}} \quad f_{vp} = 0.743 \text{ ksi} \]
\[ F_{vallow} = 0.4-f_{y} \quad F_{vallow} = 14 \text{ ksi} \]

therefore, \( f_{vp} < F_{vallow} \), structure is adequate when considering earthquake design provisions of IBC 2015 and ASCE 7-10.
## Section Properties

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## Deadload per Frame Calculation

### Full length member contributions:

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### Walk angle

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### Walk grating

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<td>0.00</td>
</tr>
<tr>
<td>Trivision</td>
<td>12.5 #/ft</td>
<td>1</td>
<td>1</td>
<td>12.5</td>
<td>2434.66</td>
<td>2418.81</td>
</tr>
</tbody>
</table>

### Video board

### Totals

<table>
<thead>
<tr>
<th></th>
<th>3180.19</th>
<th>3159.49</th>
</tr>
</thead>
</table>

### Frame member contributions:

<table>
<thead>
<tr>
<th>Member</th>
<th>Size</th>
<th>Number per frame</th>
<th>Weight per foot</th>
<th>Length frame A</th>
<th>Length frame B</th>
<th>Length frame C</th>
<th>Length frame D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upright</td>
<td>W10 x 22</td>
<td>1</td>
<td>22</td>
<td>21.01</td>
<td>21.01</td>
<td>21.01</td>
<td>21.01</td>
</tr>
<tr>
<td>Outrigger</td>
<td>W14 x 30</td>
<td>1</td>
<td>30</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Conn Rigger</td>
<td>W12 x 26</td>
<td>0</td>
<td>26</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
</tr>
<tr>
<td>Front Supp.</td>
<td>W6 x 9</td>
<td>0</td>
<td>9</td>
<td>5.58</td>
<td>5.58</td>
<td>5.58</td>
<td>5.58</td>
</tr>
<tr>
<td>Rear Supp.</td>
<td>W6 x 9</td>
<td>2</td>
<td>9</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
</tr>
</tbody>
</table>

### Total frame weight

<table>
<thead>
<tr>
<th>Total Frame A</th>
<th>Total Frame B</th>
<th>Total Frame C</th>
<th>Total Frame D</th>
</tr>
</thead>
<tbody>
<tr>
<td>666.22</td>
<td>666.22</td>
<td>666.22</td>
<td>666.22</td>
</tr>
</tbody>
</table>

### Total frame weight +10%

<table>
<thead>
<tr>
<th>Total frame weight</th>
<th>Total frame weight +10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>3846.41</td>
<td>4231.05</td>
</tr>
<tr>
<td>3825.71</td>
<td>4208.28</td>
</tr>
<tr>
<td>3825.71</td>
<td>4208.28</td>
</tr>
<tr>
<td>3846.41</td>
<td>4231.05</td>
</tr>
</tbody>
</table>

### Total

| 16878.65 |
## Composite Section Properties

**Column Connection**

<table>
<thead>
<tr>
<th>Member</th>
<th>b (in.)</th>
<th>h (in.)</th>
<th>Area (in^2)</th>
<th>y bar (in.)</th>
<th>A*ybar (in^3)</th>
<th>Io (in^4)</th>
<th>d (in.)</th>
<th>Ad^2 (in.^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.1</td>
<td>0.58</td>
<td>5.86</td>
<td>0.29</td>
<td>1.70</td>
<td>0.16</td>
<td>2.45</td>
<td>35.24</td>
</tr>
<tr>
<td>2</td>
<td>0.38</td>
<td>11.18</td>
<td>4.19</td>
<td>6.17</td>
<td>25.87</td>
<td>43.67</td>
<td>3.43</td>
<td>49.24</td>
</tr>
</tbody>
</table>

\[ \Sigma = 10.05 \quad \Sigma = 27.57 \quad 43.83 \quad 84.49 \]

\[ \bar{y} = 2.74 \quad I_c = 128.32 \quad S_c = 14.23 \]

- Indicates input cell
ATC Hazards by Location

Search Information
Address: Deerfield, IL, USA
Coordinates: 42.1711265, -87.84451188999368
Timestamp: 2018-12-26 15:53:23.3772
Hazard Type: Seismic
Risk Category: II
Site Class: D
Report Title: Deerfield, IL

Map Results

MCER Horizontal Response Spectrum

Design Horizontal Response Spectrum

Text Results
Basic Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_g$</td>
<td>0.124</td>
<td>MCEs ground motion (period=0.2s)</td>
</tr>
<tr>
<td>$S_{1}$</td>
<td>0.058</td>
<td>MCEs ground motion (period=1.0s)</td>
</tr>
<tr>
<td>$S_{ms}$</td>
<td>0.198</td>
<td>Site-modified spectral acceleration value</td>
</tr>
<tr>
<td>$S_{w}$</td>
<td>0.139</td>
<td>Site-modified spectral acceleration value</td>
</tr>
<tr>
<td>$S_{0s}$</td>
<td>0.132</td>
<td>Numeric seismic design value at 3.25 SA</td>
</tr>
<tr>
<td>$S_{oi}$</td>
<td>0.093</td>
<td>Numeric seismic design value at 1.00 SA</td>
</tr>
</tbody>
</table>

Additional Information

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDC</td>
<td>B</td>
<td>Seismic design category</td>
</tr>
</tbody>
</table>

Addendum

https://hazards.atcouncil.org/

12/26/2018
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F_s$</td>
<td>1.6</td>
<td>Site amplification factor at 0.2s</td>
</tr>
<tr>
<td>$F_r$</td>
<td>2.4</td>
<td>Site amplification factor at 1.0s</td>
</tr>
<tr>
<td>PGA</td>
<td>0.002</td>
<td>MCE peak ground acceleration</td>
</tr>
<tr>
<td>$F_{max}$</td>
<td>1.6</td>
<td>Site amplification factor at PGA</td>
</tr>
<tr>
<td>PGA$_{mod}$</td>
<td>0.000</td>
<td>Site modified peak ground acceleration</td>
</tr>
<tr>
<td>$T_L$</td>
<td>12</td>
<td>Long-period transition period (s)</td>
</tr>
<tr>
<td>$S_sRT$</td>
<td>0.124</td>
<td>Probabilistic risk-targeted ground motion (0.2s)</td>
</tr>
<tr>
<td>$S_uH$</td>
<td>0.136</td>
<td>Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)</td>
</tr>
<tr>
<td>$S_d$</td>
<td>1.5</td>
<td>Factored deterministic acceleration value (0.2s)</td>
</tr>
<tr>
<td>$S_{1RT}$</td>
<td>0.024</td>
<td>Probabilistic risk-targeted ground motion (1.0s)</td>
</tr>
<tr>
<td>$S_{1UH}$</td>
<td>0.065</td>
<td>Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)</td>
</tr>
<tr>
<td>$S_D$</td>
<td>0.6</td>
<td>Factored deterministic acceleration value (1.0s)</td>
</tr>
<tr>
<td>PGA$_{ad}$</td>
<td>0.8</td>
<td>Factored deterministic acceleration value (PGA)</td>
</tr>
</tbody>
</table>

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

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