# STRUCTURAL ANALYSIS REPORT

Prepared for: Sac Wireless / AT&T

## New Antenna Installation on Existing Structure

Site No.: MNL06635F_R01 / MNL06634F_R02 / MNL06635F_R03 / MNL06636F_R01
FA Number: 13931784
Pace Number: MRUMW017659 / MRUMW017662 / MRUMW017666 / MRUMW017671
PTN Number: 3511A09R84 / 3511A09R63 / 3511A09R83 / 3511A09R82
Site Name.: CRAN_RUMW_MOAMN_008/ CRAN_RUMW_MOAMN_009/
CRAN_RUMW_MOAMN_010/ CRAN_RUMW_MOAMN_011
Hyatt Regency Bloomington-Minneapolis
3200 E 81st Street
Bloomington, MN 55425

December 28, 2017

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota
**Abraham J Rokach**
**License # 52005**

**Abraham J. Rokach, P.E.**

FULLERTON
ENGINEERING · DESIGN

**Fullerton Engineering Consultants, Inc.**
1100 E. Woodfield Road, Suite 500
Schaumburg, IL 60173
Tel: 847.908.8400
www.fullertonengineering.com
Project Number: 2017.0301.0009

## Summary

The structural analysis was performed by Fullerton Engineering Consultants, as requested by the client, to determine the conformance of existing structure with the 2015 Minnesota Building Code (2012 International Building Code) and the industry standard, TIA-222-G (Structural Standard for Steel Antenna Supporting Structures and Antennas). The analysis considers the structural properties, existing antennas and proposed antennas and the required loading criteria.

## Scope

- Determine adequacy of the existing structure to support the proposed antenna and cabinet installation.
- Determine adequacy of the proposed mounting structures to support the proposed antenna installation.

## Conclusion

- The existing structure is **adequate** to support the proposed antenna and cabinet installation.
- The proposed mounting structures are **adequate** to support the proposed antenna installation.

## Analysis Data

The following is based on information provided by the client, field investigation, and other determination by Fullerton Engineering Consultants or third parties.

**References:** Site walk photos dated 09/19/2017.
Building Drawings by Elness Swenson Graham Architects dated 10/15/2014.

# Appurtenance Loading Schedule

| ELEV. (FT.=AGL) | APPURTENANCE |
|---|---|
| | **Proposed** |
| 201'-0" | (4) KMW EPBQ-654L8H8 Antennas<br>(4) Alcatel-Lucent B25 RRH4x30<br>(4) Alcatel-Lucent RRH2x40-07L-AT<br><br>New antennas and RRH Units will be installed on new mounting structures attached to existing screen wall. |
| | **Cabinets** |
| Roof Level | (1) Commscope RBC36-24 Cabinet<br><br>New cabinet will be installed on new steel beams on existing roof. |

# Assumptions

This analysis is based on the theoretical capacity of the members and is not a condition assessment of the structure. The analysis is based solely on the information supplied, and the results, in turn, are only as accurate as data extracted from this information. Fullerton has been instructed by the client to assume the information supplied is accurate, and Fullerton has made no independent determination of its accuracy. The exception to the previous statement is if Fullerton has been contracted by the client to provide an independent structural mapping report of the structure and related appurtenances, in which case Fullerton has made an independent determination of the accuracy of the information resulting from the mapping report.

- The structural member sizes and geometry are considered accurate as supplied. The material grade is as per data supplied and/or as assumed and stated in the materials section.
- The existing structure is assumed to have been properly maintained. The existing structure is assumed to be in good condition with no structural defects and with no deterioration to its member capacities.
- The antenna configuration is as supplied and/or stated in the analysis section. It is assumed to be complete and accurate. All antennas, mounts, remote radios, cables and cable supports are assumed to be properly installed and supported as per the manufacturer's requirements.
- The antennas, mounts, remote radios, cables and cable supports stated in the appurtenance loading schedule represent Fullerton's understanding of the overall antenna configuration. If the actual configuration is different than above, then this analysis is invalid. Please refer to this report for the projected wind areas used in the calculations for antennas and mounts. If variations or discrepancies are identified, please inform Fullerton.
- Some assumptions are made regarding antenna and mount sizes and their projected areas based on a best interpretation of the data supplied and a best knowledge of antenna type and industry practice.
- All welds and connections are assumed to develop at least the member capacity, unless determined otherwise and explicitly stated in this report.
- All prior structural modifications, if any, are assumed to be as per date supplied/ available, to be properly installed and to be fully effective.

# Scope and Limitations

The engineering services rendered by Fullerton Engineering Consultants, Inc. (Fullerton) in connection with this structural analysis are limited to an analysis of the structure, size and capacity of its members. Fullerton does not analyze the fabrication, including welding and connection capacities, except as included in this report.

The information and conclusions contained in this report were determined by application of the current engineering standards and analysis procedures and formulae, and Fullerton assumes no obligation to revise any of the information or conclusions contained in this report in the event such engineering and analysis procedures and formulae are hereafter modified or revised.

Fullerton makes no warranties, expressed or implied in connection with this report and disclaims any liability arising from original design, material, fabrication and erection deficiencies or the "as-built" condition of this structure. Fullerton will not be responsible whatsoever for or on account of consequential or incidental damages sustained by any person, firm, or organization as a result of any data or conclusions contained in this report.

Installation procedures and loading are not within the scope of this report and should be performed and evaluated by a competent contractor.

# Structural Calculations

| | | |
|---|---|---|
| **Site No.:** MNL06635F_R01 / MNL06635F_R02 / MNL06635F_R03 / MNL06636F_R01<br>**Prepared By:** THC<br>**Checked By:** AJR | **Fullerton Engineering Consultants, Inc.**<br>1100 E. Woodfield Road, Suite 500<br>Schaumburg, IL 60173<br>(847) 908-8400 | **Date:** 12/28/2017 |

## Analysis and Design Criteria

Type of structure: Rooftop

| | | |
|---|---|---|
| *Elevation of antenna centerline above ground* | $z := 201ft$ | |
| *Structure height above grade* | $h := 205ft$ | |
| *Ultimate Design 3-Second Gust Wind Speed* | $V_{ult} := 115mph$ | *IBC 2012: Section 1609* |
| *Equivalent Nominal Wind Speed* | $V_{asd} := V_{ult}\sqrt{0.6} = 89.08 \cdot mph$ | *IBC 2012: Section 1609.3.1* |
| *Basic Wind Speed: 3-second gust* | $V := 90$ mph GOVERNS | *ANSI/TIA-222-G: ANNEX B* |
| *Structure Class* | II | *ANSI/TIA-222-G: Section 2.6.6.2* |
| *Exposure Category* | C | *ANSI/TIA-222-G: Section 2.6.6.2* |
| *Topographic Category* | 1 | *ANSI/TIA-222-G: Section 2.6.6.2* |
| *Gust Effect Factor* | $G_h := 1$ | *ANSI/TIA-222-G, Section 2.6.9* |
| *Height of crest above surrounding terrain* | $H := 5ft$ | |
| *Importance Factor for Wind* | $I_{wind} = 1$ | *ANSI/TIA-222-G: Table 2-3* |
| *Wind Direction Probability Factor* | $K_d = 0.95$ | *ANSI/TIA-222-G: Table 2-2* |
| *Velocity Pressure Coefficient* | $K_z = 1.47$ | *ANSI/TIA-222-G: Section 2.6.5.2* |
| *Topographic Factor* | $K_{zt} = 1$ | *ANSI/TIA-222-G: Section 2.6.6.4* |
| $q_z := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot I_{wind} \cdot V^2 \cdot psf$ | $q_z = 28.88 \cdot psf$ | *Velocity Pressure*<br>*ANSI/TIA-222-G: Section 2.6.9.6.* |

| | | |
|---|---|---|
| **Site No.:** MNL06635F_R01 / MNL06635F_R02 / MNL06635F_R03 / MNL06636F_R01<br>**Prepared By:** THC<br>**Checked By:** AJR | **Fullerton Engineering Consultants, Inc.**<br>1100 E. Woodfield Road, Suite 500<br>Schaumburg, IL 60173<br>(847) 908-8400 | **Date:** 12/28/2017 |

## Wind Load Calculations

### New KMW EPBQ-654L8H8-L2 Antenna

| ***Height*** | ***Width/Diameter*** | ***Depth/Diameter*** | ***Weight*** | ***Shape*** |
|---|---|---|---|---|
| $height := 96in$ | $width := 21in$ | $depth := 6.3in$ | $weight := 104.5lbf$ | (•) Flat ( ) Round |

### Wind Load acting on front face of appurtenance

$$C_{A.r}(h, w) := \left| \begin{array}{l} Aspect \leftarrow \frac{h}{w} \\ C \leftarrow \left(I_{wind} \cdot K_{zt} K_z\right)^{0.5} \cdot V \cdot w \cdot \frac{1}{ft} \\ p \leftarrow \left| \begin{array}{l} \text{if } C < 32 \\ \quad \left| \begin{array}{l} .7 \quad \text{if } Aspect \leq 2.5 \\ .7 + .1 \cdot \frac{Aspect - 2.5}{7 - 2.5} \quad \text{if } 2.5 \leq Aspect \leq 7 \\ .8 \quad \text{if } Aspect = 7 \\ .8 + .4 \cdot \frac{Aspect - 7}{25 - 7} \quad \text{if } 7 \leq Aspect \leq 25 \\ 1.2 \quad \text{if } Aspect \geq 25 \end{array} \right. \\ \text{if } 32 \leq C \leq 64 \\ \quad \left| \begin{array}{l} \frac{3.76}{C^{.485}} \quad \text{if } Aspect \leq 2.5 \\ \frac{3.76}{C^{.485}} + \left(\frac{3.37}{C^{.415}} - \frac{3.76}{C^{.485}}\right) \cdot \frac{Aspect - 2.5}{7 - 2.5} \quad \text{if } 2.5 \leq Aspect \leq 7 \\ \frac{3.37}{C^{.415}} \quad \text{if } Aspect = 7 \\ \frac{3.37}{C^{.415}} + \left(\frac{38.4}{C} - \frac{3.37}{C^{.415}}\right) \cdot \frac{Aspect - 7}{25 - 7} \quad \text{if } 7 \leq Aspect \leq 25 \\ \frac{38.4}{C} \quad \text{if } Aspect \geq 25 \end{array} \right. \end{array} \right. \end{array} \right.$$

*Function to determine Force Coefficient for Round Appurtenance per ANSI/TIA-222-G Table 2-8*

| | | |
|---|---|---|
| **Site No.:** MNL06635F_R01 / MNL06635F_R02 / MNL06635F_R03 / MNL06636F_R01<br>**Prepared By:** THC<br>**Checked By:** AJR | **Fullerton Engineering Consultants, Inc.**<br>1100 E. Woodfield Road, Suite 500<br>Schaumburg, IL 60173<br>(847) 908-8400 | **Date:** 12/28/2017 |

$$\left|\begin{array}{l} \text{if } C > 64 \\ \quad \left|\begin{array}{l} .5 \text{ if } Aspect \le 2.5 \\ .5 + .1\cdot\dfrac{Aspect - 2.5}{7 - 2.5} \text{ if } 2.5 \le Aspect \le 7 \\ .6 \text{ if } Aspect \ge 7 \end{array}\right. \\ p \end{array}\right.$$

$C_{A.r}(height, width) = 0.55$

$$C_{A.f}(h, w) := \left|\begin{array}{l} Aspect \leftarrow \dfrac{h}{w} \\ p \leftarrow \left|\begin{array}{l} 1.2 \text{ if } Aspect \le 2.5 \\ 1.2 + .2\cdot\dfrac{Aspect - 2.5}{7 - 2.5} \text{ if } 2.5 \le Aspect \le 7 \\ 1.4 \text{ if } Aspect = 7 \\ 1.4 + .6\cdot\dfrac{Aspect - 7}{25 - 7} \text{ if } 7 \le Aspect \le 25 \\ 2.0 \text{ if } Aspect \ge 25 \end{array}\right. \\ p \end{array}\right.$$

*Function to determine Force Coefficient for Flat Appurtenance per ANSI/TIA-222-G Table 2-8*

$C_{A.f}(height, width) = 1.29$

$$C_A := \left|\begin{array}{l} C_{A.f}(height, width) \text{ if } Shape \\ C_{A.r}(height, width) \text{ otherwise} \end{array}\right.$$

$C_A = 1.29$

$A_F := height \cdot width$ $\quad A_F = 14\,ft^2$ $\quad EPA_F := C_A \cdot A_F = 18.09\,ft^2$

$F_F := EPA_F \cdot q_z \cdot G_h$ $\quad \boxed{F_F = 522.39\cdot lbf}$ *Wind force applied at front of appurtenance*

**Wind Load acting on side face of appurtenance**

$C_{A.r}(height, depth) = 0.65$ *Force Coefficient for Round Appurtenances*

$C_{A.f}(height, depth) = 1.67$ *Force Coefficient for Flat Appurtenances*

$$C_A := \left|\begin{array}{l} C_{A.f}(height, depth) \text{ if } Shape \\ C_{A.r}(height, depth) \text{ otherwise} \end{array}\right.$$

$C_A = 1.67$

$A_S := height \cdot depth$ $\quad A_S = 4.2\,ft^2$ $\quad EPA_S := C_A \cdot A_S = 7.03\,ft^2$

$F_S := EPA_S \cdot q_z \cdot G_h$ $\quad \boxed{F_S = 203.12\cdot lbf}$ *Wind force applied at side of appurtenance*

| | | |
|---|---|---|
| **Site No.:** MNL06635F_R01 / MNL06635F_R02 / MNL06635F_R03 / MNL06636F_R01<br>**Prepared By:** THC<br>**Checked By:** AJR | **Fullerton Engineering Consultants, Inc.**<br>1100 E. Woodfield Road, Suite 500<br>Schaumburg, IL 60173<br>(847) 908-8400 | **Date:** 12/28/2017 |

**Summary of Lateral Forces:**

| | | |
|---|---|---|
| $DL_1 := weight$ | $\frac{DL_1}{2} = 52.25\ lbf$ | *Dead Load* |
| $F_{F1} := F_F$ | $\frac{F_{F1}}{2} = 261.19\ lbf$ | *Wind Load on Front Face of Antenna* |
| $F_{S1} := F_S$ | $\frac{F_{S1}}{2} = 101.56\ lbf$ | *Wind Load on Side Face of Antenna* |

**New Alcatel Lucent B25 RRH4x30**

| ***Height*** | ***Width/Diameter*** | ***Depth/Diameter*** | ***Weight*** | ***Shape*** |
|---|---|---|---|---|
| $height := 21.2in$ | $width := 12in$ | $depth := 7.2in$ | $weight := 53lbf$ | (•) Flat ( ) Round |

| | | |
|---|---|---|
| $DL_2 := weight$ | $\frac{DL_2}{2} = 26.5\ lbf$ | *Dead Load* |
| $F_{F2} := F_F$ | $\frac{F_{F2}}{2} = 30.61\ lbf$ | *Wind Load on Front Face of Antenna* |
| $F_{S2} := F_S$ | $\frac{F_{S2}}{2} = 18.67\ lbf$ | *Wind Load on Side Face of Antenna* |

**New Alcatel Lucent RRH2x40-07L-AT**

| ***Height*** | ***Width/Diameter*** | ***Depth/Diameter*** | ***Weight*** | ***Shape*** |
|---|---|---|---|---|
| $height := 24.8in$ | $width := 11.5in$ | $depth := 5.7in$ | $weight := 55.9lbf$ | (•) Flat ( ) Round |

| | | |
|---|---|---|
| $DL_3 := weight$ | $\frac{DL_3}{2} = 27.95\ lbf$ | *Dead Load* |
| $F_{F3} := F_F$ | $\frac{F_{F3}}{2} = 34.32\ lbf$ | *Wind Load on Front Face of Antenna* |
| $F_{S3} := F_S$ | $\frac{F_{S3}}{2} = 18.18\ lbf$ | *Wind Load on Side Face of Antenna* |

**Site No.:** MNL06635F_R01 / MNL06635F_R02 / MNL06635F_R03 / MNL06636F_R01
**Prepared By:** THC
**Checked By:** AJR

**Fullerton Engineering Consultants, Inc.**
1100 E. Woodfield Road, Suite 500
Schaumburg, IL 60173
(847) 908-8400

**Date:** 12/28/2017

## New Pipe

$H_{pipe} := 9 \cdot ft$

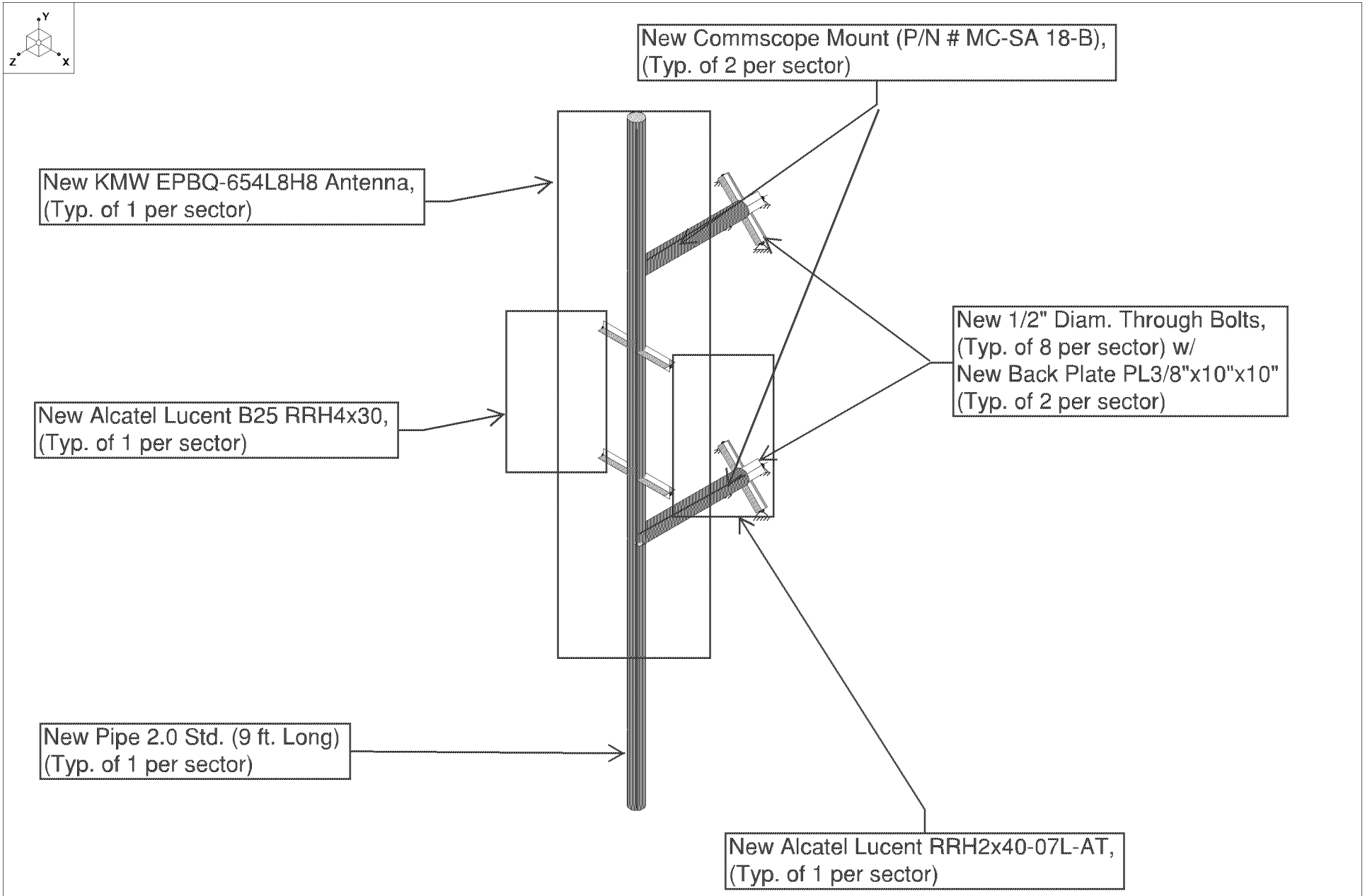
$Pipe := 2$

$DL_{p1} := LW_{pipe} \cdot H_{pipe}$

$DL_{p1} = 32.94\ lbf$ *Self Weight of pipe*

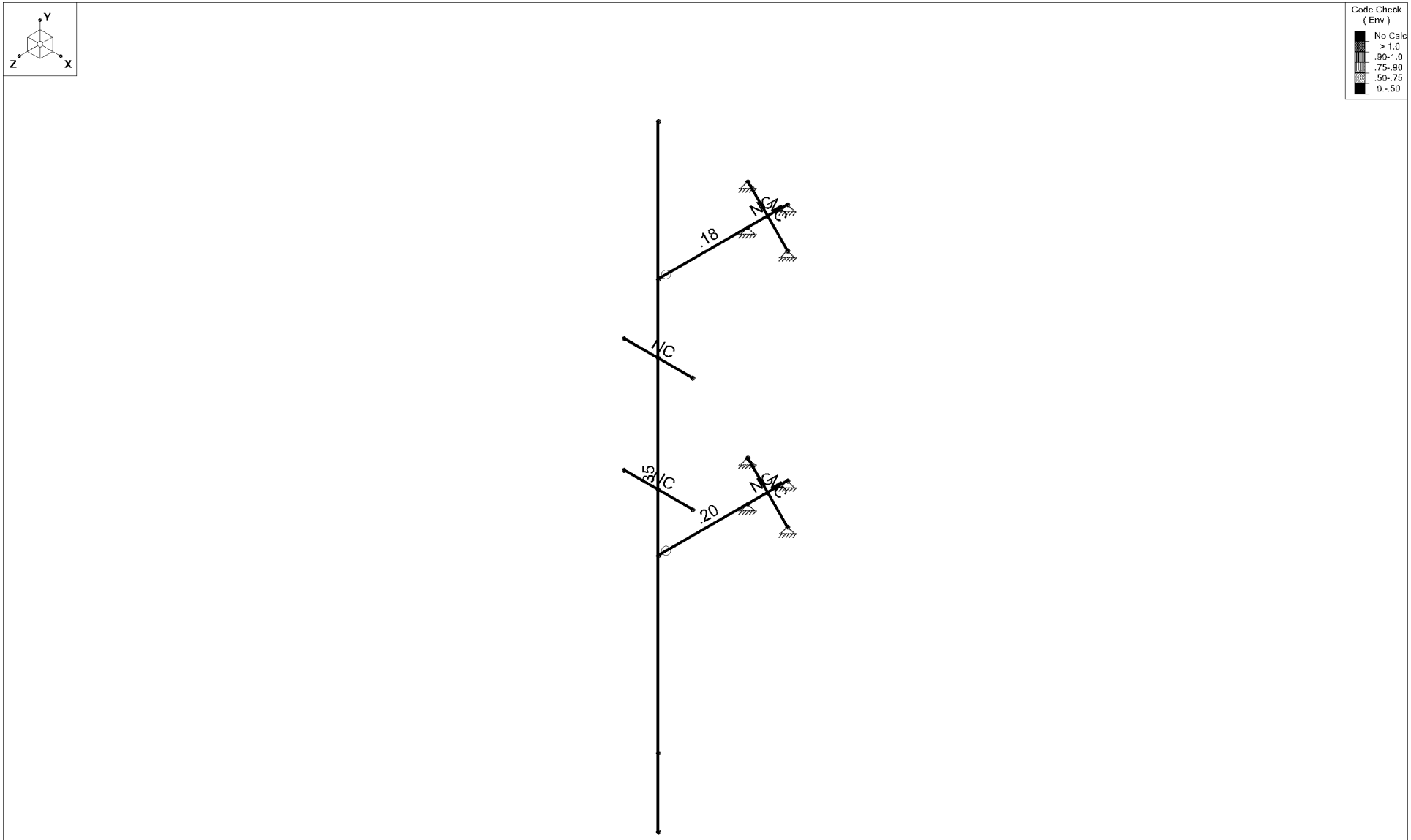
$F_{p1} := F_p = 61.86\ lbf$

$\frac{F_{p1}}{H_{pipe}} = 6.87 \cdot plf$ *Wind Load*



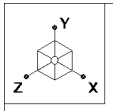

Envelope Only Solution

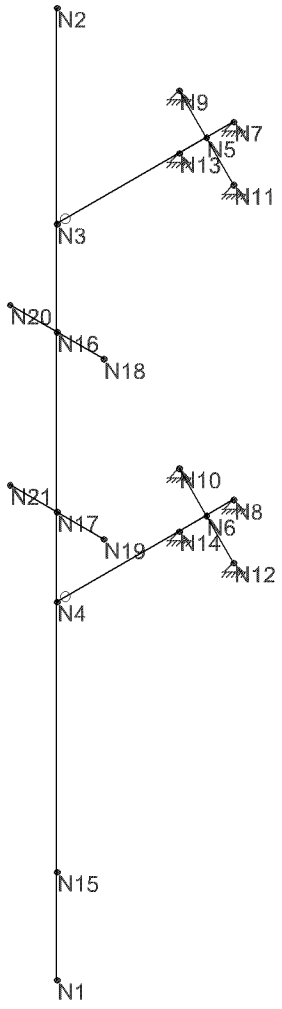
| | | |
|---|---|---|
| Fullerton Engineering Consultants, ... | Mount Analysis | SK - 1 |
| THC | | Dec 28, 2017 at 2:21 PM |
| MNL06635F_R01 / MNL06635F_R... | | MNL06635F - Risa Calculations.r3d |




Member Code Checks Displayed (Enveloped)
Envelope Only Solution

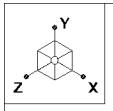
| | | |
|---|---|---|
| Fullerton Engineering Consultants, ... | Mount Analysis | SK - 2 |
| THC | | Dec 28, 2017 at 2:48 PM |
| MNL06635F_R01 / MNL06635F_R... | | MNL06635F - Risa Calculations.r3d |

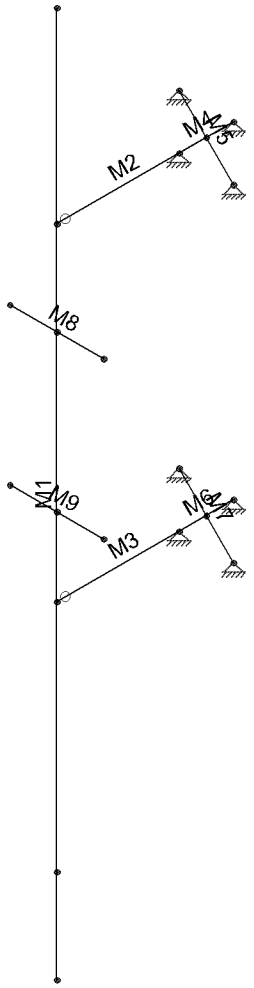



Envelope Only Solution

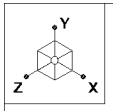
| | | |
|---|---|---|
| Fullerton Engineering Consultants, ... | Mount Analysis | SK - 3 |
| THC | | Dec 28, 2017 at 2:48 PM |
| MNL06635F_R01 / MNL06635F_R... | | MNL06635F - Risa Calculations.r3d |

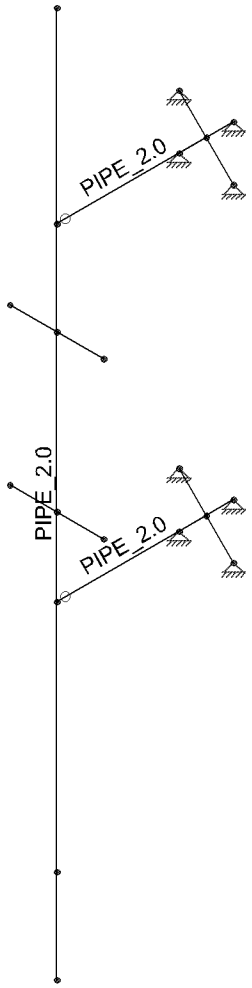



Envelope Only Solution

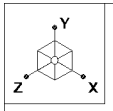
| | | |
|---|---|---|
| Fullerton Engineering Consultants, ... | Mount Analysis | SK - 4 |
| THC | | Dec 28, 2017 at 2:49 PM |
| MNL06635F_R01 / MNL06635F_R... | | MNL06635F - Risa Calculations.r3d |

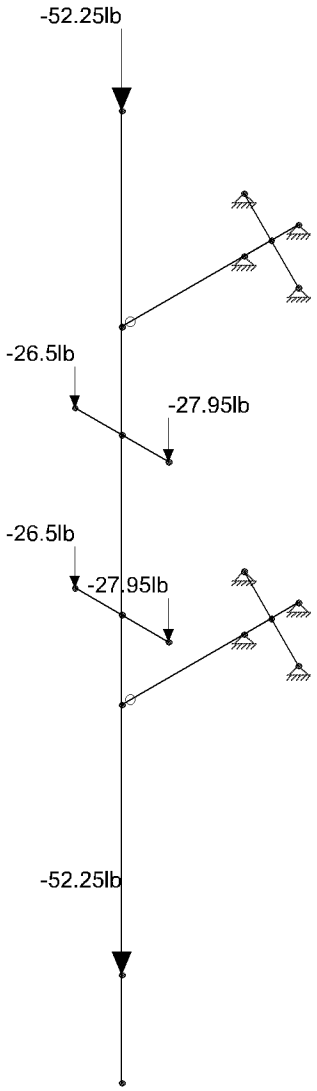



Envelope Only Solution

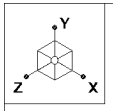
| | | |
|---|---|---|
| Fullerton Engineering Consultants, ... | Mount Analysis | SK - 5 |
| THC | | Dec 28, 2017 at 2:49 PM |
| MNL06635F_R01 / MNL06635F_R... | | MNL06635F - Risa Calculations.r3d |

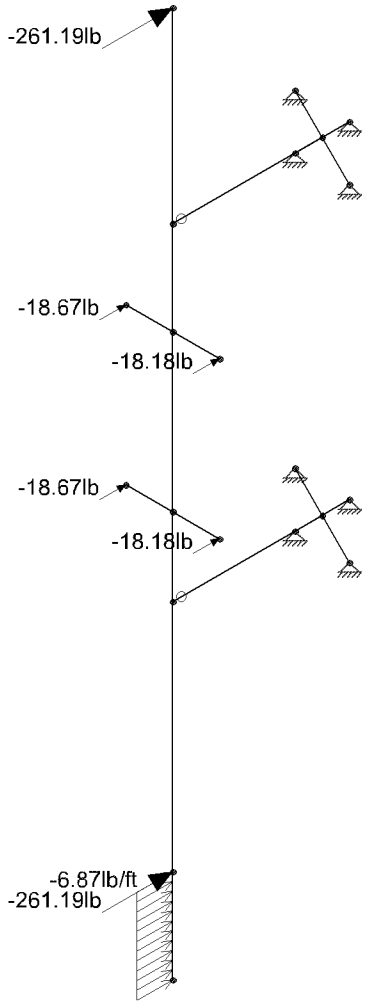



Loads: BLC 1, DL
Envelope Only Solution

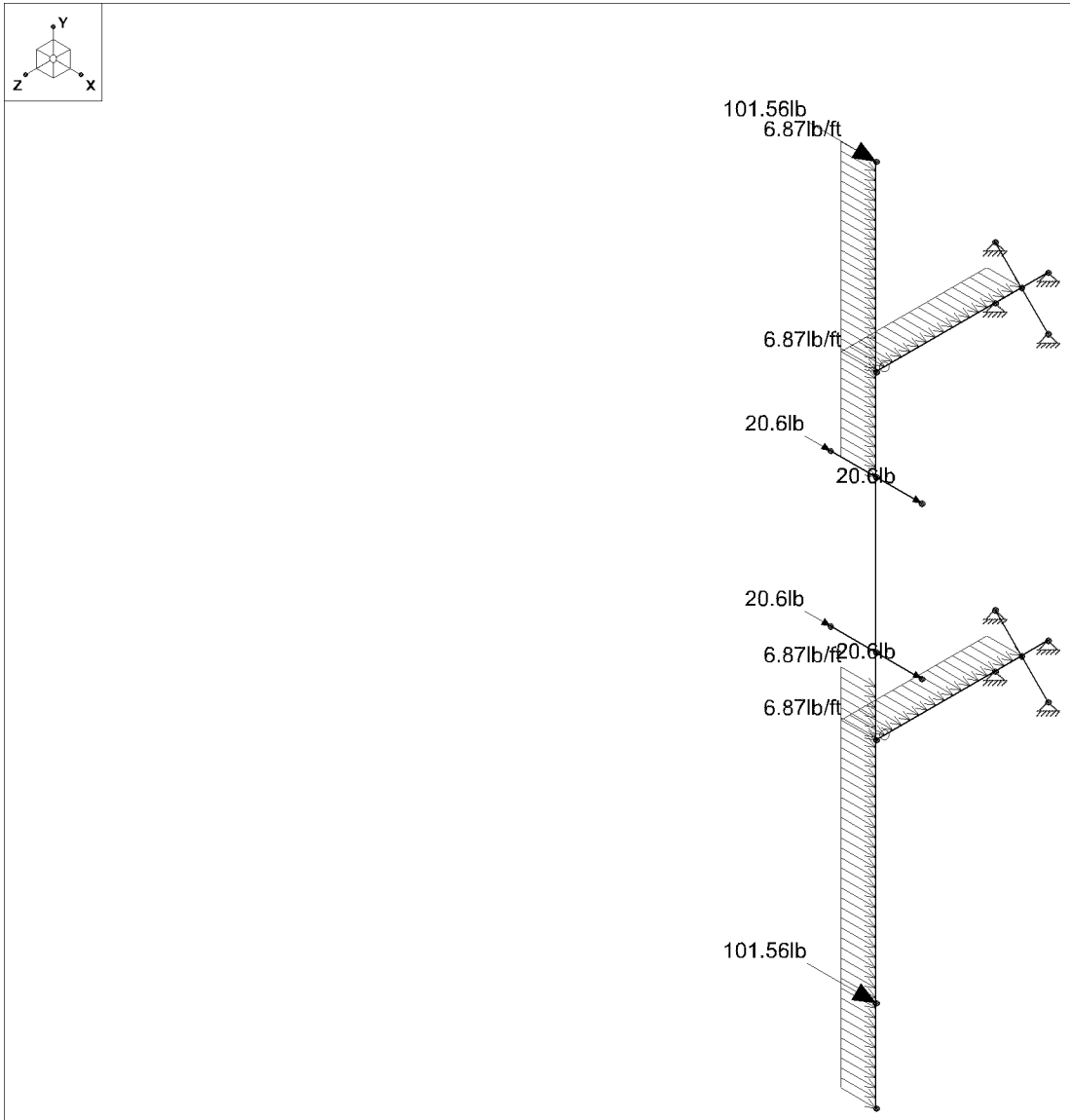
| | | |
|---|---|---|
| Fullerton Engineering Consultants, ... | Mount Analysis | SK - 6 |
| THC | | Dec 28, 2017 at 2:49 PM |
| MNL06635F_R01 / MNL06635F_R... | | MNL06635F - Risa Calculations.r3d |




Loads: BLC 2, WLz
Envelope Only Solution

| | | |
|---|---|---|
| Fullerton Engineering Consultants, ... | Mount Analysis | SK - 7 |
| THC | | Dec 28, 2017 at 2:49 PM |
| MNL06635F_R01 / MNL06635F_R... | | MNL06635F - Risa Calculations.r3d |




Loads: BLC 3, WLx
Envelope Only Solution

| | | |
|---|---|---|
| Fullerton Engineering Consultants, ... | Mount Analysis | SK - 8 |
| THC | | Dec 28, 2017 at 2:50 PM |
| MNL06635F_R01 / MNL06635F_R... | | MNL06635F - Risa Calculations.r3d |

## (Global) Model Settings

| | |
|---|---|
| Display Sections for Member Calcs | 5 |
| Max Internal Sections for Member Calcs | 97 |
| Include Shear Deformation? | Yes |
| Increase Nailing Capacity for Wind? | Yes |
| Include Warping? | Yes |
| Trans Load Btwn Intersecting Wood Wall? | Yes |
| Area Load Mesh (in^2) | 144 |
| Merge Tolerance (in) | .12 |
| P-Delta Analysis Tolerance | 0.50% |
| Include P-Delta for Walls? | Yes |
| Automatically Iterate Stiffness for Walls? | Yes |
| Max Iterations for Wall Stiffness | 3 |
| Gravity Acceleration (in/sec^2) | 386.4 |
| Wall Mesh Size (in) | 24 |
| Eigensolution Convergence Tol. (1.E-) | 4 |
| Vertical Axis | Y |
| Global Member Orientation Plane | XZ |
| Static Solver | Sparse Accelerated |
| Dynamic Solver | Accelerated Solver |

| | |
|---|---|
| Hot Rolled Steel Code | AISC 14th(360-10): LRFD |
| Adjust Stiffness? | Yes(Iterative) |
| RISAConnection Code | AISC 14th(360-10): LRFD |
| Cold Formed Steel Code | None |
| Wood Code | None |
| Wood Temperature | < 100F |
| Concrete Code | None |
| Masonry Code | None |
| Aluminum Code | None - Building |

| | |
|---|---|
| Number of Shear Regions | 4 |
| Region Spacing Increment (in) | 4 |
| Biaxial Column Method | Exact Integration |
| Parme Beta Factor (PCA) | .65 |
| Concrete Stress Block | Rectangular |
| Use Cracked Sections? | Yes |
| Use Cracked Sections Slab? | Yes |
| Bad Framing Warnings? | No |
| Unused Force Warnings? | Yes |
| Min 1 Bar Diam. Spacing? | No |
| Concrete Rebar Set | REBAR_SET_ASTMA615 |
| Min % Steel for Column | 1 |
| Max % Steel for Column | 8 |

## (Global) Model Settings, Continued

| | |
|---|---|
| Seismic Code | ASCE 7-10 |
| Seismic Base Elevation (in) | Not Entered |
| Add Base Weight? | Yes |
| Ct X | .02 |
| Ct Z | .02 |
| T X (sec) | Not Entered |
| T Z (sec) | Not Entered |
| R X | 3 |
| R Z | 3 |
| Ct Exp. X | .75 |
| Ct Exp. Z | .75 |
| SD1 | 1 |
| SDS | 1 |
| S1 | 1 |
| TL (sec) | 5 |
| Risk Cat | I or II |
| Om Z | 1 |
| Om X | 1 |
| Rho Z | 1 |
| Rho X | 1 |
| | |

## Hot Rolled Steel Design Parameters

| | Label | Shape | Length[in] | Lbyy[in] | Lbzz[in] | Lcomp top[in] | Lcomp bot[in] | L-torq... | Kyy | Kzz | Cb | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M1 | PIPE_2.0 | 108 | | | | | | | | | Lateral |
| 2 | M2 | PIPE_2.0 | 19.188 | | | Lbyy | | | | | | Lateral |
| 3 | M3 | PIPE_2.0 | 19.188 | | | Lbyy | | | | | | Lateral |

## Basic Load Cases

| | BLC Description | Category | X Gravity | Y Gravity | Z Gravity | Joint | Point | Distributed | Area(Me... | Surface(... |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DL | None | | -1 | | 6 | | | | |
| 2 | WLz | None | | | | 6 | | 1 | | |
| 3 | WLx | None | | | | 6 | | 4 | | |

## Load Combinations

| | Description | S... | P... | S... | B... | Fa... | BLC | Fac... | BLC | Fac... | BLC | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.2 DL + 1.6 WLz | Yes | Y | | 1 | 1.2 | 2 | 1 | | | | | | | | | | | | | | | | |
| 2 | 1.2 DL + 1.6 WLz- | Yes | Y | | 1 | 1.2 | 2 | -1 | | | | | | | | | | | | | | | | |
| 3 | 1.2 DL + 1.6 WLx | Yes | Y | | 1 | 1.2 | 3 | 1 | | | | | | | | | | | | | | | | |
| 4 | 1.2 DL + 1.6 WLx- | Yes | Y | | 1 | 1.2 | 3 | -1 | | | | | | | | | | | | | | | | |
| 5 | 0.9 DL + 1.6 WLz | Yes | Y | | 1 | .9 | 2 | 1 | | | | | | | | | | | | | | | | |
| 6 | 0.9 DL + 1.6 WLz- | Yes | Y | | 1 | .9 | 2 | -1 | | | | | | | | | | | | | | | | |
| 7 | 0.9 DL + 1.6 WLx | Yes | Y | | 1 | .9 | 3 | 1 | | | | | | | | | | | | | | | | |
| 8 | 0.9 DL + 1.6 WLx- | Yes | Y | | 1 | .9 | 3 | -1 | | | | | | | | | | | | | | | | |

## Envelope AISC 14th(360-10): LRFD Steel Code Checks

| | Member | Shape | Code Check | Loc[in] | LC | Shear Check | Loc[in] | ... | ... | phi*P... | phi*P... | phi*M... | phi*M... | ... | Eqn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M1 | PIPE_2.0 | .349 | 65.25 | 2 | .027 | 66.375 | | 5 | 1214... | 33048 | 1925.1 | 1925.1 | ... | H1-1b |
| 2 | M2 | PIPE_2.0 | .181 | 19.188 | 3 | .081 | 19.188 | | 3 | 3202... | 33048 | 1925.1 | 1925.1 | ... | H1-1b |
| 3 | M3 | PIPE_2.0 | .200 | 19.188 | 4 | .101 | 19.188 | | 4 | 3202... | 33048 | 1925.1 | 1925.1 | ... | H1-1b |

< 1.0 => Members are adequate

| | | |
|---|---|---|
| **Site No.:** MNL06635F_R01 / MNL06635F_R02 / MNL06635F_R03 / MNL06636F_R01<br>**Prepared By:** THC<br>**Checked By:** AJR | **Fullerton Engineering Consultants, Inc.**<br>1100 E. Woodfield Road, Suite 500<br>Schaumburg, IL 60173<br>(847) 908-8400 | **Date:** 12/28/2017 |

## ***New Cabinet Installation Calculations***

*Note: New cabinet will be installed on new steel framing.*

$LL := 20psf$ — *Roof live load*

*Proposed Equipment:*

$Wt_{RBC} := 425lbf$ — *Weight of proposed Commscope RBC36-24 cabinet*

$L_{I\_beam} := 48in$ — *Lenght of proposed steel framing (I-beam)*

$D_{I\_beam} := 30in$ — *Depth of proposed steel framing (I-beam)*

$DL_{I\_beam} := 12plf$ — *Weight per linear foot of proposed I-beam*

$C := 1ft$ — *Clearance around proposed steel framing*

$Wt_{I\_beam} := L_{I\_beam} \cdot DL_{I\_beam}$ $\quad Wt_{I\_beam} = 48\,lbf$ — *Total weight of proposed I-beam*

$$q_{roof} := \frac{Wt_{RBC} + 2 \cdot Wt_{I\_beam}}{\left(L_{I\_beam} + 2C\right) \cdot \left(D_{I\_beam} + 2C\right)} \qquad q_{roof} = 19.3 \cdot psf$$

*New superimposed uniform load on existing roof structure*

*RoofCheck* = "Existing roof structure is adequate for proposed loading."