
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

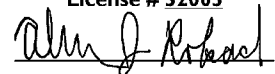
3200 E 81st Street

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 (4) Alcatel-Lucent B25 RRH4x30 (4) Alcatel-Lucent RRH2x40-07L-AT 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 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 data 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

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

Analysis and Design Criteria

Type of structure

Rooftop 

Elevation of antenna centerline above ground

$z := 201\text{ft}$

Structure height above grade

$h := 205\text{ft}$

Ultimate Design 3-Second Gust Wind Speed

$V_{ult} := 115\text{mph}$

IBC 2012: Section 1609

Equivalent Nominal Wind Speed

$V_{asd} := V_{ult} \sqrt{0.6} = 89.08\text{ mph}$

IBC 2012: Section 1609.3.1

Basic Wind Speed: 3-second gust

$V := 90\text{ mph}$ **GOVERNS**

ANSI/TIA-222-G: ANNEX B

Structure Class



ANSI/TIA-222-G: Section 2.6.6.2

Exposure Category



ANSI/TIA-222-G: Section 2.6.6.2

Topographic Category



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

$H := 5\text{ft}$



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

$q_z := 0.00256 K_z K_{zt} K_d I_{wind} V^2 \cdot \text{psf}$

$q_z = 28.88\text{ psf}$

Velocity Pressure
ANSI/TIA-222-G: Section 2.6.9.6.

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

Wind Load Calculations

New KMW EPBQ-654L8H8-L2 Antenna

Height

height := 96in

Width/Diameter

width := 21in

Depth/Diameter

depth := 6.3in

Weight

weight := 104.5lbf

Shape

☒ Flat
☐ Round



Wind Load acting on front face of appurtenance

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

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

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

if $C > 64$

.5 if Aspect ≤ 2.5

.5 + .1 $\frac{\text{Aspect} - 2.5}{7 - 2.5}$ if $2.5 \leq \text{Aspect} \leq 7$

.6 if Aspect ≥ 7

p

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

$$C_{A,f}(h, w) := \text{Aspect} \leftarrow \frac{h}{w}$$

$p \leftarrow$ 1.2 if Aspect ≤ 2.5

1.2 + .2 $\frac{\text{Aspect} - 2.5}{7 - 2.5}$ if $2.5 \leq \text{Aspect} \leq 7$

1.4 if Aspect = 7

1.4 + .6 $\frac{\text{Aspect} - 7}{25 - 7}$ if $7 \leq \text{Aspect} \leq 25$

2.0 if Aspect ≥ 25

p

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

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

$$C_A := \begin{cases} C_{A,f}(\text{height}, \text{width}) & \text{if Shape} \\ C_{A,r}(\text{height}, \text{width}) & \text{otherwise} \end{cases}$$

$$C_A = 1.29$$

$$A_F := \text{height} \cdot \text{width}$$

$$A_F = 14 \text{ ft}^2$$

$$EPA_F := C_A \cdot A_F = 18.09 \text{ ft}^2$$

$$F_F := EPA_F q_z G_h$$

$$F_F = 522.39 \text{ lbf}$$

Wind force applied at front of
appurtenance

Wind Load acting on side face of appurtenance

$$C_{A,r}(\text{height}, \text{depth}) = 0.65$$

Force Coefficient for Round Appurtenances

$$C_{A,f}(\text{height}, \text{depth}) = 1.67$$

Force Coefficient for Flat Appurtenances

$$C_A := \begin{cases} C_{A,f}(\text{height}, \text{depth}) & \text{if Shape} \\ C_{A,r}(\text{height}, \text{depth}) & \text{otherwise} \end{cases}$$

$$C_A = 1.67$$

$$A_S := \text{height} \cdot \text{depth}$$

$$A_S = 4.2 \text{ ft}^2$$

$$EPA_S := C_A \cdot A_S = 7.03 \text{ ft}^2$$

$$F_S := EPA_S q_z G_h$$

$$F_S = 203.12 \text{ lbf}$$

Wind force applied at side of
appurtenance



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

Summary of Lateral Forces:

$$DL_1 := \text{weight}$$

$$\frac{DL_1}{2} = 52.25 \text{ lbf}$$

Dead Load

$$F_{F1} := F_F$$

$$\frac{F_{F1}}{2} = 261.19 \text{ lbf}$$

Wind Load on Front Face of
Antenna

$$F_{S1} := F_S$$

$$\frac{F_{S1}}{2} = 101.56 \text{ lbf}$$

Wind Load on Side Face of
Antenna

New Alcatel Lucent B25 RRH4x30

Height

$$\text{height} := 21.2 \text{ in}$$

Width/Diameter

$$\text{width} := 12 \text{ in}$$

Depth/Diameter

$$\text{depth} := 7.2 \text{ in}$$

Weight

$$\text{weight} := 53 \text{ lbf}$$

Shape



$$DL_2 := \text{weight}$$

$$\frac{DL_2}{2} = 26.5 \text{ lbf}$$

Dead Load

$$F_{F2} := F_F$$

$$\frac{F_{F2}}{2} = 30.61 \text{ lbf}$$

Wind Load on Front Face of
Antenna

$$F_{S2} := F_S$$

$$\frac{F_{S2}}{2} = 18.67 \text{ lbf}$$

Wind Load on Side Face of
Antenna

New Alcatel Lucent RRH2x40-07L-AT

Height

$$\text{height} := 24.8 \text{ in}$$

Width/Diameter

$$\text{width} := 11.5 \text{ in}$$

Depth/Diameter

$$\text{depth} := 5.7 \text{ in}$$

Weight

$$\text{weight} := 55.9 \text{ lbf}$$

Shape



$$DL_3 := \text{weight}$$

$$\frac{DL_3}{2} = 27.95 \text{ lbf}$$

Dead Load

$$F_{F3} := F_F$$

$$\frac{F_{F3}}{2} = 34.32 \text{ lbf}$$

Wind Load on Front Face of
Antenna

$$F_{S3} := F_S$$

$$\frac{F_{S3}}{2} = 18.18 \text{ lbf}$$

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

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

$$Pipe := 2$$



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

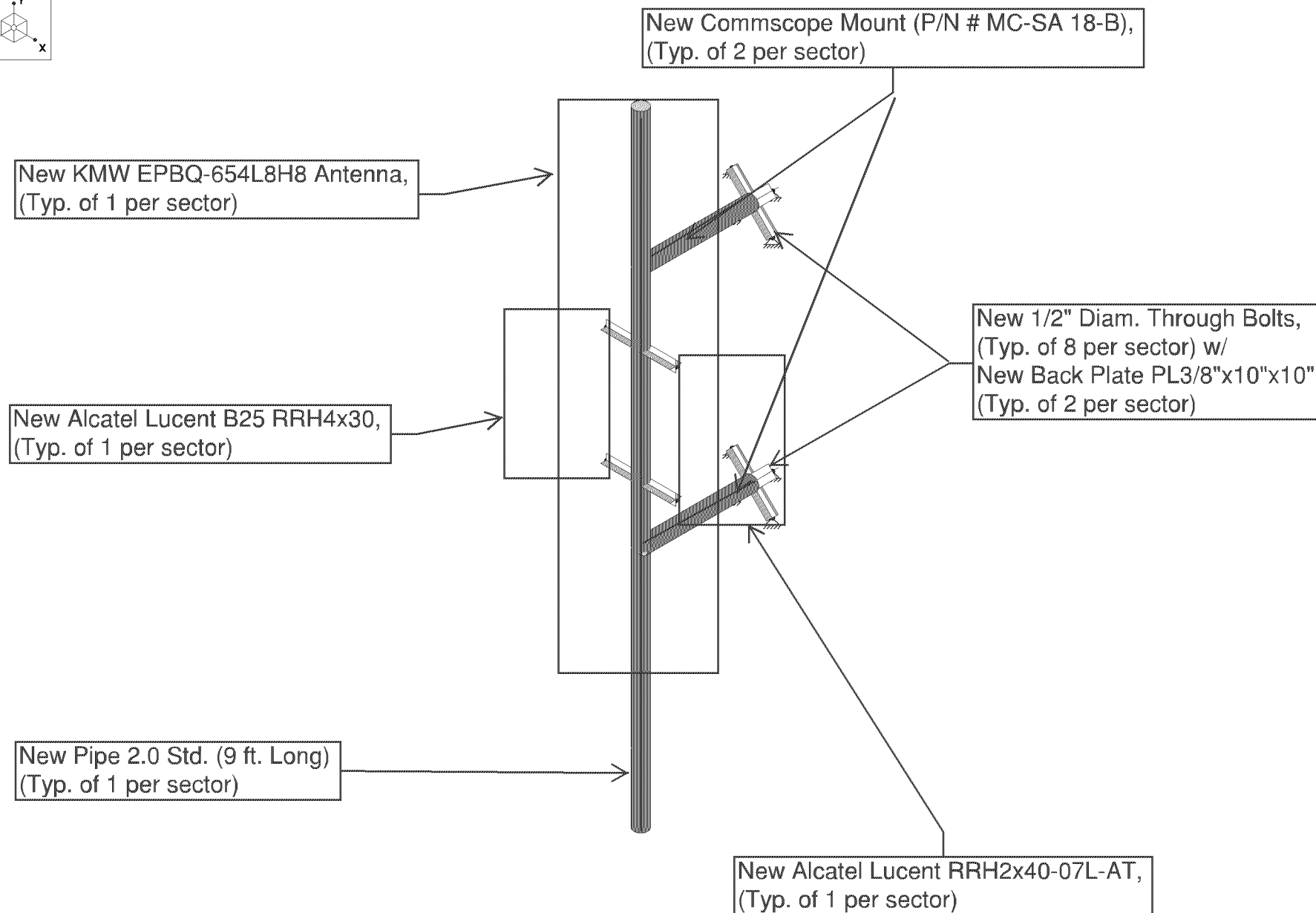
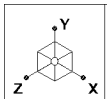
$$DL_{p1} = 32.94 \cdot lbf$$

Self Weight of pipe

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

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

Wind Load



Envelope Only Solution

Fullerton Engineering Consultants, ...

THC

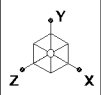
MNL06635F_R01 / MNL06635F_R...

Mount Analysis

SK - 1

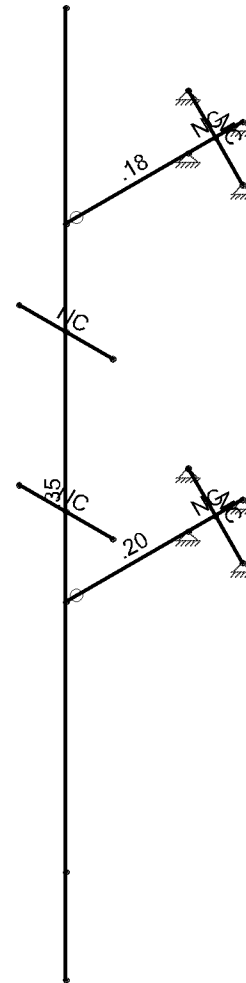
Dec 28, 2017 at 2:21 PM

MNL06635F - Risa Calculations.r3d



Code Check
(Env)

No Calc
> 1.0
.90-1.0
.75-.90
.50-.75
0-.50



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Fullerton Engineering Consultants, ...

THC

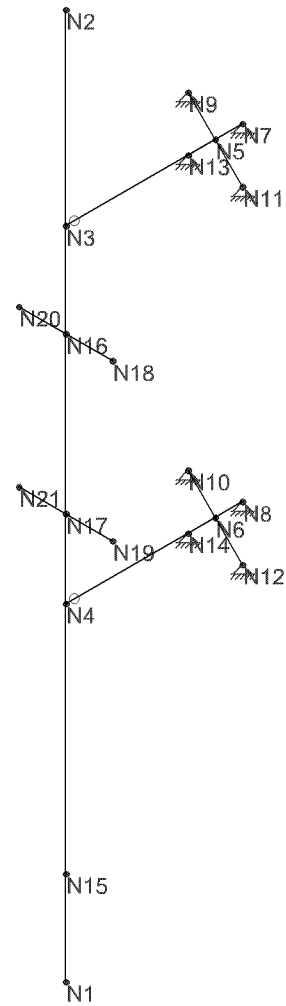
MNL06635F_R01 / MNL06635F_R...

Mount Analysis

SK - 2

Dec 28, 2017 at 2:48 PM

MNL06635F - Risa Calculations.r3d



Envelope Only Solution

Fullerton Engineering Consultants, ...

THC

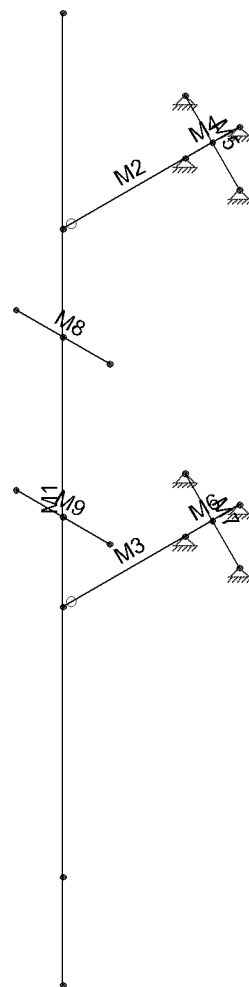
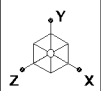
MNL06635F_R01 / MNL06635F_R...

Mount Analysis

SK - 3

Dec 28, 2017 at 2:48 PM

MNL06635F - Risa Calculations.r3d



Envelope Only Solution

Fullerton Engineering Consultants, ...

THC

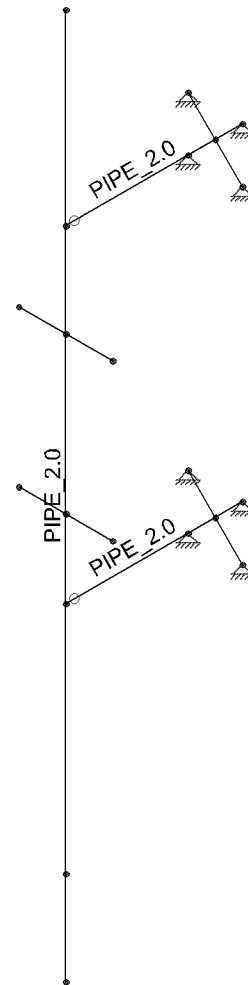
MNL06635F_R01 / MNL06635F_R...

Mount Analysis

SK - 4

Dec 28, 2017 at 2:49 PM

MNL06635F - Risa Calculations.r3d



Envelope Only Solution

Fullerton Engineering Consultants, ...

THC

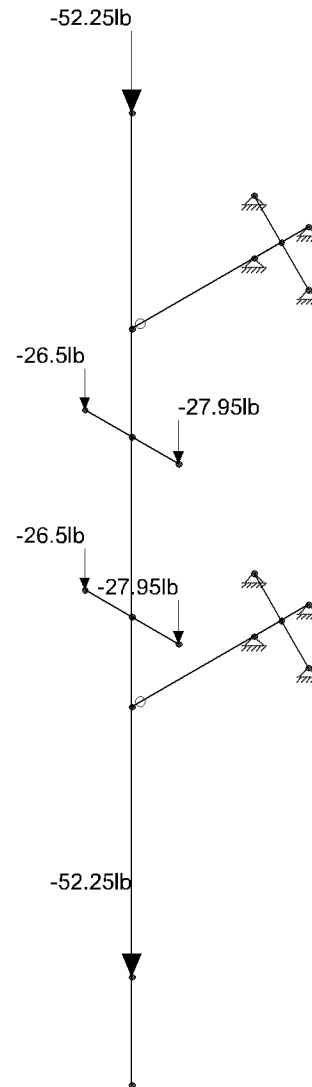
MNL06635F_R01 / MNL06635F_R...

Mount Analysis

SK - 5

Dec 28, 2017 at 2:49 PM

MNL06635F - Risa Calculations.r3d



Loads: BLC 1, DL
Envelope Only Solution

Fullerton Engineering Consultants, ...

THC

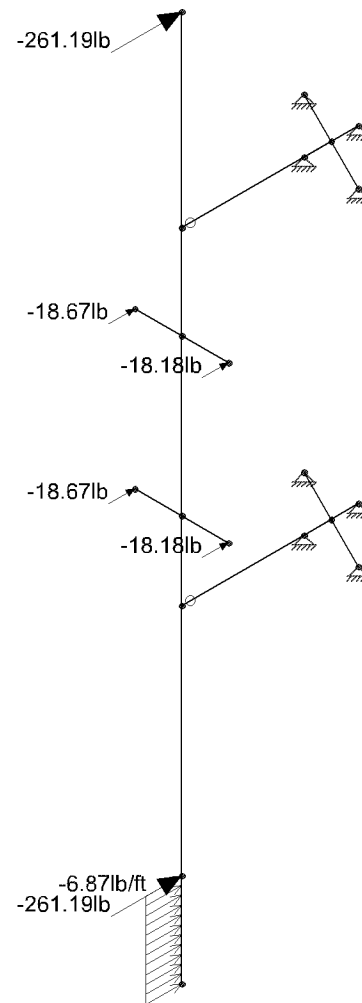
MNL06635F_R01 / MNL06635F_R...

Mount Analysis

SK - 6

Dec 28, 2017 at 2:49 PM

MNL06635F - Risa Calculations.r3d



Loads: BLC 2, WLz
Envelope Only Solution

Fullerton Engineering Consultants, ...

THC

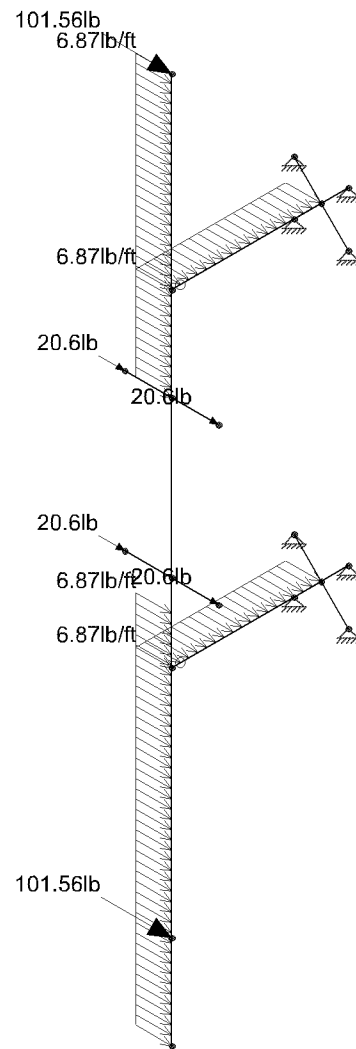
MNL06635F_R01 / MNL06635F_R...

Mount Analysis

SK - 7

Dec 28, 2017 at 2:49 PM

MNL06635F - Risa Calculations.r3d



Loads: BLC 3, WLx
Envelope Only Solution

Fullerton Engineering Consultants, ...

THC

MNL06635F_R01 / MNL06635F_R...

Mount Analysis

SK - 8

Dec 28, 2017 at 2:50 PM

MNL06635F - Risa Calculations.r3d



Company : Fullerton Engineering Consultants, Inc
 Designer : THC
 Job Number : MNL06635F_R01 / MNL06635F_R02 / MNL06635F_R03 / MNL06636F_R01
 Model Name : Mount Analysis

Dec 28, 2017
 2:50 PM
 Checked By: AJR

(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
Parame 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



Company : Fullerton Engineering Consultants, Inc
 Designer : THC
 Job Number : MNL06635F_R01 / MNL06635F_R02 / MNL06635F_R03 / MNL06636F_R01
 Model Name : Mount Analysis

Dec 28, 2017
 2:50 PM
 Checked By: AJR

(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...
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

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 Cabinet Installation Calculations

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

$LL := 20\text{psf}$

Roof live load

Proposed Equipment:

$Wt_{RBC} := 425\text{lbf}$

Weight of proposed Commscope
RBC36-24 cabinet

$L_{I_beam} := 48\text{in}$

Length of proposed steel framing
(I-beam)

$D_{I_beam} := 30\text{in}$

Depth of proposed steel framing
(I-beam)

$DL_{I_beam} := 12\text{plf}$

Weight per linear foot of proposed
I-beam

$C := 1\text{ft}$

Clearance around proposed steel
framing

$Wt_{I_beam} := L_{I_beam} \cdot DL_{I_beam}$

$Wt_{I_beam} = 48\text{lbf}$

Total weight of proposed I-beam

$q_{\text{roof}} := \frac{Wt_{RBC} + 2 \cdot Wt_{I_beam}}{(L_{I_beam} + 2C) \cdot (D_{I_beam} + 2C)}$

$q_{\text{roof}} = 19.3\text{psf}$

New superimposed uniform load
on existing roof structure

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