ADVANCED
ENGINEERING GROUP, P.C.

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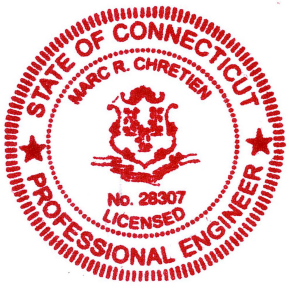
Structural Design Calculations



Site No.: **CT3461 - Bristol Middle Street**
Client: **Centerline Communications**
Date: **July 18, 2017**

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Synopsis:

The proposed AT&T equipment installation will consist of six (6) 8' antennas (2 per sector), fifteen (15) remote radio heads (RRHs) (5 per sector), and three (3) surge arrestors mounted to the existing steel-framed catwalk assembly located approximately 120' AGL on the 127' radial brick masonry smoke stack.

Material Properties:

Unit weight of brick, $\gamma_{brick} := 125 \cdot pcf$

Modulus of rupture of brick, $F_r := 300 \cdot psi$

Allowable tensile stress in bending, $F_t := 7.5 \cdot psi$ (Unreinforced brick, type N mortar)

Ultimate masonry strength, $f'_m := 2400 \cdot psi$

Chimney Properties:

The existing stack is a 127' tall radial brick masonry structure. Based on a field investigation by Industrial Communications on 1-29-14, the stack has a 11'-6" dia. base and a 5'10" dia. top. Bottom wall thickness was 24" and top wall thickness was 9". There is currently one antenna array (3 flush-mounted and one MW dish) at 96' AGL. Based on photos taken during the field investigation, the stack appears to be in good condition with minimal mortar and brick loss.

Dimensions:

Stack Height, $H := 127 \cdot ft$

Bottom outside dimension, $D_{bo} := 11.5 \cdot ft$

Bottom inside dimension, $D_{bi} := 7.75ft$

Top inside dimension, $D_{ti} := 4.333 \cdot ft$

Top outside dimension, $D_{to} := 5.833 \cdot ft$

Approx. stack weight, $$W_{stack} := \frac{\left(D_{bo}^2 - D_{bi}^2\right) + \left(D_{to}^2 - D_{ti}^2\right)}{2} \cdot H \cdot \gamma_{brick}$$

$$W_{stack} = 694.03 \cdot kip$$

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Analysis:

Wind load:

Height, $H = 127\,ft$ AGL

Exposure Category, B (ASCE 7-10 Sec 26.7.3)

Risk category II (ASCE 7-10 Table 1.5-1)

Basic wind velocity, $V := 120$ mph (CSBC Appendix N)

Exposure coefficient, $K_z := 1.07$ (ASCE 7-10 Table 29.3-1)

Topographic multipliers, $K_1 := 0$ (ASCE 7-10 Fig. 26.8)

$K_2 := 1.0$

$K_3 := 1.0$

Topographic factor, $K_{zt} := \left(1 + K_1 \cdot K_2 \cdot K_3\right)^2$ (ASCE 7-10 Sec 26.8.2)

$K_{zt} = 1$

Velocity wind pressure, $q_z := .00256 \cdot V^2 \cdot K_z \cdot K_{zt} \cdot psf$ (ASCE 7-10 Sec 29.3.1)

$q_z = 39.44 \cdot psf$

Gust effect factor, $G := .85$ (ASCE 7-10 Sec 29.3)

Force coeff., $C_{f\_f} := 1.4$ Flat (ASCE 7-10 Fig. 29.5-1)

$C_{f\_r} := .70$ Round

Wind Load factor, $LF := .6$ (for use with allowable stress design) (ASCE 7-10 Sect 2.4)

Wind load pressure on stack, $WL_{stack} := q_z \cdot G \cdot C_{f\_r}$

$WL_{stack} = 23.47 \cdot psf$

Wind load pressure on antennas/RRHs, $WL_{ant} := q_z \cdot G \cdot C_{f\_f} \cdot LF$ (ASCE 7-10 Sec. 29.5-1)

$WL_{ant} = 28.16 \cdot psf$

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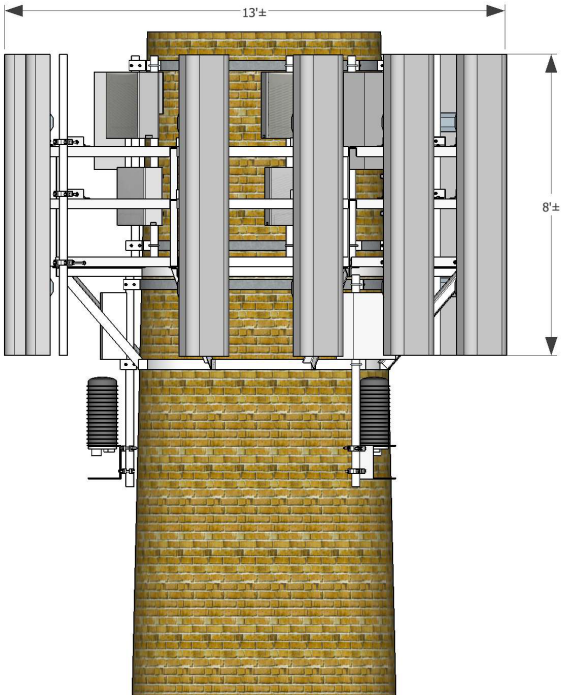
The proposed AT&T installation will be conservatively analyzed as a 13'x8' flat appurtenance. The existing three flush-mounted antennas will be analyzed assuming that two antennas project entirely beyond the profile of the smokestack (the 3rd will be assumed to be within the profile of the stack and not contribute to wind loading).



Equipment Loads:

Existing/proposed Inventory:

Proposed Antenna Properties:

Width, $w_{pant} := 14.4 \cdot in$

Depth, $t_{pant} := 7.3 \cdot in$

Length, $l_{pant} := 92.8 \cdot in$

Weight, $W_{pant} := 53 \cdot lb$

Proposed RRUS 11 Properties:

Width, $w_{11} := 19.7 \cdot in$

Depth, $t_{11} := 7.2 \cdot in$

Length, $l_{11} := 17 \cdot in$

Weight, $W_{11} := 51 \cdot lb$

Proposed RRUS 32 Properties:

Width, $w_{32} := 13.3 \cdot in$

Depth, $t_{32} := 9.5 \cdot in$

Length, $l_{32} := 29.9 \cdot in$

Weight, $W_{32} := 77 \cdot lb$

Proposed RRH Ericsson RRUS-12:

Width, $w_{12} := 18.5in$

Depth, $t_{12} := 7.5in$

Height, $l_{12} := 20.4in$

Weight, $W_{12} := 50lb$

Existing Antenna Properties:

Width, $w_{ant} := 12 \cdot in$

Depth, $t_{ant} := 6 \cdot in$

Length, $l_{ant} := 72 \cdot in$

Weight, $W_{ant} := 46 \cdot lb$

Proposed Surge Properties:

Diameter, $w_{ss} := 9.7 \cdot in$

Length, $l_{ss} := 24 \cdot in$

Weight, $W_{ss} := 20 \cdot lb$

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Weight of proposed AT&T equipment, $P_{att} := 6 \cdot (W_{pant}) + 6 \cdot W_{11} + 6 \cdot W_{12} + 3 \cdot W_{32} + 3 \cdot W_{ss}$

$P_{att} = 1215\,lb$

Approximate weight of steel catwalk, $P_{cw} := 2000 \cdot lb$

Proposed AT&T equipment and catwalk assembly:

Width, $w_{esf\_12} := 13ft$

Height, $h_{esf\_12} := 8 \cdot ft$

Weight, $W_{esf\_12} := P_{att} + P_{cw}$

$W_{esf\_12} = 3215\,lb$

Existing flush-mount antennas:

Width, $w_{fm} := w_{ant} = 1\,ft$

Height, $h_{fm} := l_{ant} = 6\,ft$

Weight, $W_{fm} := 3 \cdot W_{ant} = 138\,lb$

Approx. weight of mounting brackets, cable ladders, and cables, $W_{appurt} := 3500 \cdot lb$

Average diameter of stack, $D_{ave} := \frac{D_{bo} + D_{to}}{2}$

$D_{ave} = 8.67\,ft$

Wind load on stack, $WL_{chim} := H \cdot WL_{stack} \cdot D_{ave}$

$WL_{chim} = 25831.56\,lb$

Wind load on AT&T installation, $WL_{esf\_12} := h_{esf\_12} \cdot w_{esf\_12} \cdot WL_{ant}$

$WL_{esf\_12} = 2928.99\,lb$

Wind load on flush-mounted antennas, $WL_{fm} := 2h_{fm} \cdot w_{fm} \cdot WL_{ant}$

$WL_{fm} = 337.96\,lb$

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Centerline height of antenna arrays:

$h_1 := 120 \cdot ft$ (6 antennas on catwalk, AT&T)

$h_2 := 96 \cdot ft$ (3 flush-mounted antennas)

Approximate moment at base level due to wind, $M_o := \frac{WL_{chim} \cdot H}{2} + WL_{esf\_12} \cdot (h_1) + WL_{fm} \cdot (h_2)$

$M_o = 2024.23 \cdot ft \cdot kip$

Resisting moment due to self-weight of stack and equipment, $M_r := (W_{stack} + W_{appurt} + W_{esf\_12} + W_{fm}) \cdot \frac{D_{bo}}{2}$

$M_r = 4030.06 \cdot ft \cdot kip$

Factor of safety, $\frac{M_r}{M_o} = 1.99 > 1.5$ **O.K.**

Check stresses:

Section modulus of base of stack, $S := \frac{\pi \cdot D_{bo}^3}{32} - \frac{\pi \cdot D_{bi}^3}{32}$ MOI, $I := \frac{\pi \cdot (D_{bo}^4 - D_{bi}^4)}{64}$

$S = 179042.8 \cdot in^3$ $I = 14130723.49 \cdot in^4$

Area at base of chimney, $A_b := \left(\frac{\pi \cdot D_{bo}^2}{4} - \frac{\pi \cdot D_{bi}^2}{4} \right)$

$A_b = 56.7\, ft^2$

Allowable compressive stress, $F_a := (.2 \cdot f'_m)$

$F_a = 480 \cdot psi$

Allowable tensile stress, $F_t = 7.5 \cdot psi$ (Pg. 264, Ref 1)

Bending stress, $f_b := \frac{M_o}{S}$

$f_b = 135.67 \cdot psi$

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Allowable bending stress, $F_b := .33 \cdot f'_m \cdot \frac{1}{2}$

$F_b = 396 \cdot psi$

Maximum compressive stress, $f_a := \frac{W_{stack} + W_{appurt} + (W_{esf\_12} + W_{fm})}{A_b}$

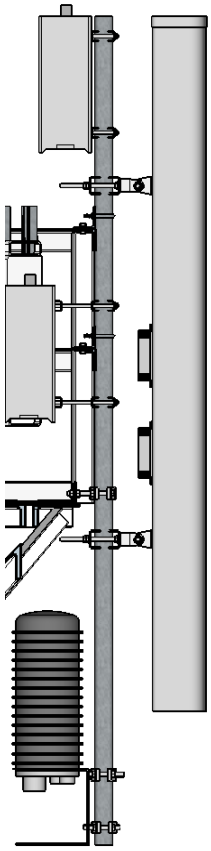
$f_a = 85.85 \cdot psi \quad < \quad F_a = 480 \cdot psi \quad o.k.$

$$UnityCheck := \begin{cases} "OK" & \text{if } \frac{f_a}{F_a} + \frac{f_b}{F_b} \le 1 \\ "NG" & \text{otherwise} \end{cases}$$

UnityCheck = "OK"

Check Catwalk Framing:

Antennnas will be mounted to the top, mid, and bottom rail of the existing catwalk handrail assembly. Attachments will be made using industry-standard rail brackets.



Wind load on antenna, $P_{ant} := \left[l_{pant} \cdot w_{pant} + (w_{11} - w_{pant}) \cdot l_{11}\right] \cdot WL_{ant}$

$P_{ant} = 278.98\,lb$

Wind load on surge, $P_{ss} := l_{ss} \cdot w_{ss} \cdot WL_{ant} = 45.53\,lb$

Wind load per bracket, $P_{brack} := \frac{P_{ant}}{2} = 139.49\,lb$

Moment on pipe, $M := .226 \cdot ft \cdot kip$

(See attached Enercalc output)

Allowable moment, $M_{allow} := 1.245 \cdot ft \cdot kip$

$$MomentCheck := \begin{cases} "OK" & \text{if } M \le M_{allow} \\ "NG" & \text{otherwise} \end{cases}$$

MomentCheck = "OK"

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Check Rails:

Top rail governs

Moment on top rail, $M_{rail} := .585 \cdot ft \cdot kip$

Allowable moment, $M_{allow} := 1.176 \cdot ft \cdot kip$

(See attached Enercalc output)

$$MomentCheck := \begin{cases} \text{"OK"} & \text{if } M_{rail} \le M_{allow} \\ \text{"NG"} & \text{otherwise} \end{cases}$$

MomentCheck = "OK"

Check Verticals

Height of verticals, $H_v := 3 \cdot ft$

Moment on vertical, $M_{vert} := .858 \cdot ft \cdot kip$

Allowable moment, $M_{allow} := 1.27 \cdot ft \cdot kip$

(See attached Enercalc output)

$$MomentCheck := \begin{cases} \text{"OK"} & \text{if } M_{vert} \le M_{allow} \\ \text{"NG"} & \text{otherwise} \end{cases}$$

MomentCheck = "OK"

Conclusion:

Based on the results of the analysis, the existing 127' radial brick masonry smoke stack and steel cat walk assembly located at the above-referenced site is structurally capable of supporting the proposed AT&T equipment. The analysis was conducted in accordance with the Connecticut State Building Code (2016) and ASCE 7-10.

References:

1. Amrhein, J.E. (1978), *Reinforced Masonry Engineering Handbook*, Masonry Institute of America, Los Angles, CA
2. American Society of Civil Engineers (2010), Minimum Design Loads for Buildings and Other Structures (7-10), American Society of Civil Engineers, New York, NY
3. Connecticut State Building Code, 2016 Edition.

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Project Title: Smoke Stack Platform
Engineer: MRC
Project Descr: AT&T NSB

Project ID: CT3461

Title Block Line 6

Printed: 18 JUL 2017, 3:19PM

Steel Beam

File = x:\ENER~P21\CT34~HXW.EC6
ENERCALC, INC. 1983-2017, Build:6.17.3.29, Ver:6.17.3.29

Lic. # : KW-06008463
Licensee : ADVANCED ENGINEERING GROUP, PC

Description : Top Rail

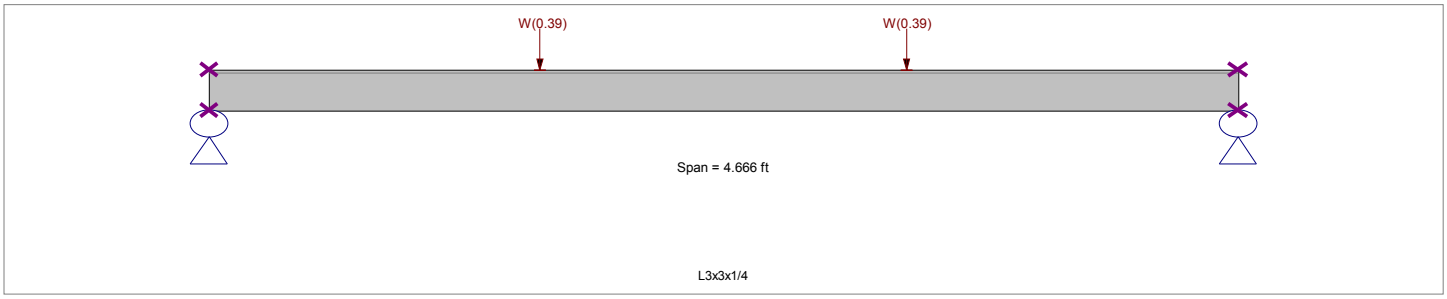
CODE REFERENCES

Calculations per AISC 360-10, IBC 2012, ASCE 7-10
Load Combination Set : IBC 2012

Material Properties

Analysis Method: Allowable Strength Design
Beam Bracing: Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield: 36.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : W = 0.390 k @ 1.50 ft, (Pipe Mount)
Point Load : W = 0.390 k @ 3.167 ft, (Pipe Mount)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.298 : 1	Maximum Shear Stress Ratio =	0.024 : 1
Section used for this span	L3x3x1/4	Section used for this span	L3x3x1/4
Ma : Applied	0.351 k-ft	Va : Applied	0.2340 k
Mn / Omega : Allowable	1.176 k-ft	Vn/Omega : Allowable	9.701 k
Load Combination	+D+0.60W+H	Load Combination	+D+0.60W+H
Location of maximum on span	1.506 ft	Location of maximum on span	3.173 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.067 in	Ratio =	838 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.040 in	Ratio =	1397 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
+D+H												
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+L+H												
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+Lr+H												
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+S+H												
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+0.750Lr+0.750L+H												
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+0.750L+0.750S+H												
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+0.60W+H												
Dsgn. L = 4.67 ft	1	0.298	0.024	0.35		0.35	1.96	1.18	1.12	1.00	0.23	16.20 9.70
+D+0.70E+H												
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+0.750Lr+0.750L+0.450W+H												
Dsgn. L = 4.67 ft	1	0.224	0.018	0.26		0.26	1.96	1.18	1.12	1.00	0.18	16.20 9.70
+D+0.750L+0.750S+0.450W+H												
Dsgn. L = 4.67 ft	1	0.224	0.018	0.26		0.26	1.96	1.18	1.12	1.00	0.18	16.20 9.70
+D+0.750L+0.750S+0.5250E+H												
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+0.60D+0.60W+0.60H												

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Engineer: MRC
Project Descr: AT&T NSB

Project ID: CT3461

Title Block Line 6

Steel Beam

File = x:\ENER~P21\CT34~HXW.EC6
ENERCALC, INC. 1983-2017, Build:6.17.3.29, Ver:6.17.3.29

Lic. # : KW-06008463 — Licensee : ADVANCED ENGINEERING GROUP, PC

Description : Top Rail

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
Dsgn. L = 4.67 ft	1	0.298	0.024	0.35		0.35	1.96	1.18	1.12	1.00	0.23	16.20	9.70
+0.60D+0.70E+0.60H													
Dsgn. L = 4.67 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20	9.70

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.0668	2.346		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 — Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.390	0.390
Overall MINimum	0.175	0.176
+D+H		
+D+L+H		
+D+Lr+H		
+D+S+H		
+D+0.750Lr+0.750L+H		
+D+0.750L+0.750S+H		
+D+0.60W+H	0.234	0.234
+D+0.70E+H		
+D+0.750Lr+0.750L+0.450W+H	0.175	0.176
+D+0.750L+0.750S+0.450W+H	0.175	0.176
+D+0.750L+0.750S+0.5250E+H		
+0.60D+0.60W+0.60H	0.234	0.234
+0.60D+0.70E+0.60H		
D Only		
Lr Only		
L Only		
S Only		
W Only	0.390	0.390
E Only		
H Only		

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Description : Handrail Vertical

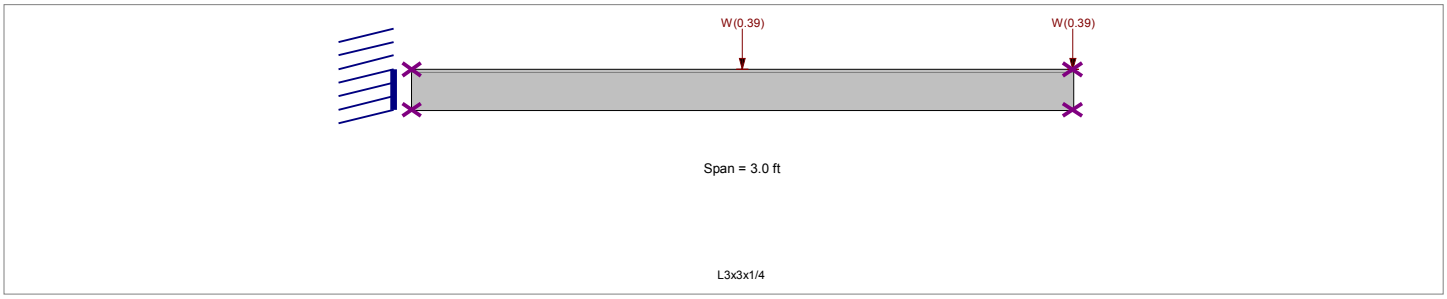
CODE REFERENCES

Calculations per AISC 360-10, IBC 2012, ASCE 7-10
Load Combination Set : IBC 2012

Material Properties

Analysis Method: Allowable Strength Design
Beam Bracing: Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield: 36.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : W = 0.390 k @ 3.0 ft, (Antenna)
Point Load : W = 0.390 k @ 1.50 ft, (Antenna)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.858 : 1	Maximum Shear Stress Ratio =	0.048 : 1
Section used for this span	L3x3x1/4	Section used for this span	L3x3x1/4
Ma : Applied	1.053 k-ft	Va : Applied	0.4680 k
Mn / Omega : Allowable	1.227 k-ft	Vn/Omega : Allowable	9.701 k
Load Combination	+D+0.60W+H	Load Combination	+D+0.60W+H
Location of maximum on span	0.000ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.223 in	Ratio =	323 >=240.
Max Upward Transient Deflection	0.000 in	Ratio =	0 <240.0
Max Downward Total Deflection	0.134 in	Ratio =	539 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
+D+H												
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+L+H												
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+Lr+H												
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+S+H												
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+0.750Lr+0.750L+H												
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+0.750L+0.750S+H												
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+0.60W+H												
Dsgn. L = 3.00 ft	1	0.858	0.048		-1.05	1.05	2.05	1.23	1.00	1.00	0.47	16.20 9.70
+D+0.70E+H												
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+D+0.750Lr+0.750L+0.450W+H												
Dsgn. L = 3.00 ft	1	0.644	0.036		-0.79	0.79	2.05	1.23	1.00	1.00	0.35	16.20 9.70
+D+0.750L+0.750S+0.450W+H												
Dsgn. L = 3.00 ft	1	0.644	0.036		-0.79	0.79	2.05	1.23	1.00	1.00	0.35	16.20 9.70
+D+0.750L+0.750S+0.5250E+H												
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20 9.70
+0.60D+0.60W+0.60H												

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Lic. # : KW-06008463
Licensee : ADVANCED ENGINEERING GROUP, PC

Description : Handrail Vertical

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
Dsgn. L = 3.00 ft	1	0.858	0.048		-1.05	1.05	2.05	1.23	1.00	1.00	0.47	16.20	9.70
+0.60D+0.70E+0.60H													
Dsgn. L = 3.00 ft	1		0.000				2.05	1.23	1.00	1.00	-0.00	16.20	9.70

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.2227	3.000		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.780	
Overall MINimum	0.351	
+D+H		
+D+L+H		
+D+Lr+H		
+D+S+H		
+D+0.750Lr+0.750L+H		
+D+0.750L+0.750S+H		
+D+0.60W+H	0.468	
+D+0.70E+H		
+D+0.750Lr+0.750L+0.450W+H	0.351	
+D+0.750L+0.750S+0.450W+H	0.351	
+D+0.750L+0.750S+0.5250E+H		
+0.60D+0.60W+0.60H	0.468	
+0.60D+0.70E+0.60H		
D Only		
Lr Only		
L Only		
S Only		
W Only	0.780	
E Only		
H Only		

ADVANCED ENGINEERING GROUP, P.C.
500 North Broadway
East Providence, RI 02914
(401) 354-2403

Project Title: Smoke Stack Platform
Engineer: MRC
Project Descr: AT&T NSB

Project ID: CT3461

Title Block Line 6

Printed: 18 JUL 2017, 3:19PM

Steel Beam

File = x:\ENER~P21\CT34~HXW.EC6
ENERCALC, INC. 1983-2017, Build:6.17.3.29, Ver:6.17.3.29

Lic. # : KW-06008463
Licensee : ADVANCED ENGINEERING GROUP, PC

Description : Pipe Mount

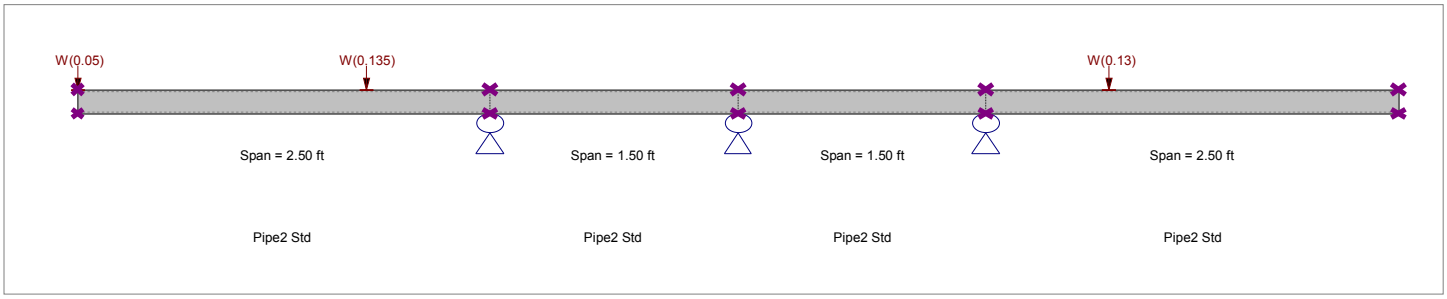
CODE REFERENCES

Calculations per AISC 360-10, IBC 2012, ASCE 7-10
Load Combination Set : IBC 2012

Material Properties

Analysis Method: Allowable Strength Design
Beam Bracing: Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield: 35.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : W = 0.1350 k @ 1.750 ft, (Antenna)
Point Load : W = 0.050 k @ 0.0 ft, (Surge)
Load(s) for Span Number 4
Point Load : W = 0.130 k @ 0.750 ft, (Antenna)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.109 : 1	Maximum Shear Stress Ratio =	0.020 : 1
Section used for this span	Pipe2 Std	Section used for this span	Pipe2 Std
Ma : Applied	0.136 k-ft	Va : Applied	0.1229 k
Mn / Omega : Allowable	1.245 k-ft	Vn/Omega : Allowable	6.287 k
Load Combination	+D+0.60W+H	Load Combination	+D+0.60W+H
Location of maximum on span	2.500 ft	Location of maximum on span	2.500 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.055 in	Ratio =	1,089 >=360
Max Upward Transient Deflection	-0.002 in	Ratio =	8,229 >=360
Max Downward Total Deflection	0.033 in	Ratio =	1815 >=180
Max Upward Total Deflection	-0.001 in	Ratio =	13715 >=180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx Mnx/Omega Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
+D+H										
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
+D+L+H										
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
+D+Lr+H										
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
+D+S+H										
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25 1.00 1.00	-0.00	10.50 6.29
+D+0.750Lr+0.750L+H										

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Engineer: MRC
Project Descr: AT&T NSB

Project ID: CT3461

Title Block Line 6

Steel Beam

File = x:\ENER~P21\CT34~HXW.EC6
ENERCALC, INC. 1983-2017, Build:6.17.3.29, Ver:6.17.3.29
Lic. # : KW-06008463
Licensee : ADVANCED ENGINEERING GROUP, PC

Description : Pipe Mount

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
+D+0.750L+0.750S+H												
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
+D+0.60W+H												
Dsgn. L = 2.50 ft	1	0.109	0.020		-0.14	0.14	2.08	1.25	1.00	1.00	0.12	10.50 6.29
Dsgn. L = 1.50 ft	2	0.109	0.020	0.05	-0.14	0.14	2.08	1.25	2.14	1.00	0.12	10.50 6.29
Dsgn. L = 1.50 ft	3	0.047	0.012	0.05	-0.06	0.06	2.08	1.25	2.22	1.00	0.08	10.50 6.29
Dsgn. L = 2.50 ft	4	0.047	0.012		-0.06	0.06	2.08	1.25	1.00	1.00	0.08	10.50 6.29
+D+0.70E+H												
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
+D+0.750Lr+0.750L+0.450W+H												
Dsgn. L = 2.50 ft	1	0.082	0.015		-0.10	0.10	2.08	1.25	1.00	1.00	0.09	10.50 6.29
Dsgn. L = 1.50 ft	2	0.082	0.015	0.04	-0.10	0.10	2.08	1.25	2.14	1.00	0.09	10.50 6.29
Dsgn. L = 1.50 ft	3	0.035	0.009	0.04	-0.04	0.04	2.08	1.25	2.22	1.00	0.06	10.50 6.29
Dsgn. L = 2.50 ft	4	0.035	0.009		-0.04	0.04	2.08	1.25	1.00	1.00	0.06	10.50 6.29
+D+0.750L+0.750S+0.450W+H												
Dsgn. L = 2.50 ft	1	0.082	0.015		-0.10	0.10	2.08	1.25	1.00	1.00	0.09	10.50 6.29
Dsgn. L = 1.50 ft	2	0.082	0.015	0.04	-0.10	0.10	2.08	1.25	2.14	1.00	0.09	10.50 6.29
Dsgn. L = 1.50 ft	3	0.035	0.009	0.04	-0.04	0.04	2.08	1.25	2.22	1.00	0.06	10.50 6.29
Dsgn. L = 2.50 ft	4	0.035	0.009		-0.04	0.04	2.08	1.25	1.00	1.00	0.06	10.50 6.29
+D+0.750L+0.750S+0.5250E+H												
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
+0.60D+0.60W+0.60H												
Dsgn. L = 2.50 ft	1	0.109	0.020		-0.14	0.14	2.08	1.25	1.00	1.00	0.12	10.50 6.29
Dsgn. L = 1.50 ft	2	0.109	0.020	0.05	-0.14	0.14	2.08	1.25	2.14	1.00	0.12	10.50 6.29
Dsgn. L = 1.50 ft	3	0.047	0.012	0.05	-0.06	0.06	2.08	1.25	2.22	1.00	0.08	10.50 6.29
Dsgn. L = 2.50 ft	4	0.047	0.012		-0.06	0.06	2.08	1.25	1.00	1.00	0.08	10.50 6.29
+0.60D+0.70E+0.60H												
Dsgn. L = 2.50 ft	1		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	2		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 1.50 ft	3		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29
Dsgn. L = 2.50 ft	4		0.000				2.08	1.25	1.00	1.00	-0.00	10.50 6.29

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.0551	0.000		0.0000	0.000
	2	0.0000	0.000	W Only	-0.0022	0.550
W Only	3	0.0002	0.250	W Only	-0.0005	1.120
W Only	4	0.0146	2.500		0.0000	1.120

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4	Support 5
Overall MAXimum		0.390	-0.324	0.249	
Overall MINimum		0.175	-0.146	0.112	
+D+H					
+D+L+H					
+D+Lr+H					
+D+S+H					
+D+0.750Lr+0.750L+H					
+D+0.750L+0.750S+H					
+D+0.60W+H		0.234	-0.194	0.149	
+D+0.70E+H					
+D+0.750Lr+0.750L+0.450W+H		0.175	-0.146	0.112	
+D+0.750L+0.750S+0.450W+H		0.175	-0.146	0.112	
+D+0.750L+0.750S+0.5250E+H					
+0.60D+0.60W+0.60H		0.234	-0.194	0.149	

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Project ID: CT3461

Title Block Line 6

Steel Beam

File = x:\ENER~P21\CT34~HXW.EC6
ENERCALC, INC. 1983-2017, Build:6.17.3.29, Ver:6.17.3.29

Lic. # : KW-06008463
Licensee : ADVANCED ENGINEERING GROUP, PC

Description : Pipe Mount

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4	Support 5
+0.60D+0.70E+0.60H					
D Only					
Lr Only					
L Only					
S Only					
W Only		0.390	-0.324	0.249	
E Only					
H Only					