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STRUCTURAL CALCULATIONS FOR

RETAIL TENANT IMPROVEMENT

Bath & Body Works – SOUTH HILL MALL (Remote Storage)

Space No. 235

3500 S. Meridian Street

Puyallup, WA 98373

REV	Issue Date	Issue	Revised/Added Pages
	4/20/2023		Initial Calc Submittal

Proj 20221012

MICHAEL E. HAAS
STATE OF WASHINGTON
19110324
REGISTERED
PROFESSIONAL ENGINEER

expires 6/18/24
date 4/26/23

GF Project # 20221012.0

Building Code: 2018 International Building Code

GENERAL STANDARD JOIST ANALYSIS

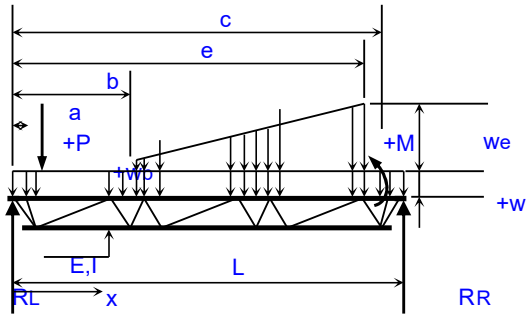
For Steel Joists Considered as Simple-Span Beams
Subjected to Non-Standard Loads

Job Name:	BBW SOUTH HILL - REMOTE STORAGE	Subject:	AHU 1		
Job Number:	20221012.0	Originator:	AD	Checker:	MH

Input Data:

Joist Data:

Designation =	K-series	
Span, L =	50.0000	ft. **TO BE V.I.F.**
Modulus, E =	29000000	psi
Inertia, Ix =	731.45	in.^4



Original Design or Capacity Loads:

Full Uniform:

w = 366 lbs./ft. **32LH07 @ 7'-6", TO BE V.I.F.**

Nomenclature

Distributed:

	Start b (ft.)	Wb (lbs./ft.)	End e (ft.)	We (lbs/ft.)
#1:				
#2:				
#3:				
#4:				
#5:				
#6:				
#7:				
#8:				

Point Loads:

	a (ft.)	P (lbs.)
#1:		
#2:		
#3:		
#4:		
#5:		
#6:		
#7:		
#8:		
#9:		
#10:		
#11:		
#12:		
#13:		
#14:		
#15:		

Moments:

	c (ft.)	M (ft-lbs)
#1:		
#2:		
#3:		
#4:		

New Design Loads:

Full Uniform:

w = 277.5 lbs./ft.

Distributed:

	Start b (ft.)	Wb (lbs./ft.)	End e (ft.)	We (lbs/ft.)
#1:				
#2:				
#3:				
#4:				
#5:				
#6:				
#7:				
#8:				

Point Loads:

	a (ft.)	P (lbs.)
#1:	10.00	41.75
#2:	11.60	41.75
#3:		
#4:		
#5:		
#6:		
#7:		
#8:		
#9:		
#10:		
#11:		
#12:		
#13:		
#14:		
#15:		

Moments:

	c (ft.)	M (ft-lbs)
#1:		
#2:		
#3:		
#4:		

Results of Joist Analysis:

Original Design or Capacity Loads:

End Reactions:

RL = 9150.0 lbs. RR = 9150.0 lbs.

Minimum Design Web Member Shear:

Vw(min) = 2287.5 lbs. (25% of maximum end reaction for K-series and LH-series joists per SJI Spec's.)

Maximum Moments:

+Mx(max) = 114375.0 ft-lbs @ x = 25.00 ft.
-Mx(max) = 0.0 ft-lbs @ x = 0.00 ft.

***Maximum Deflections:**

-Δ(max) = -2.790 in. @ x = 25.00 ft.
+Δ(max) = 0.000 in. @ x = 0.00 ft.
Δ(ratio) = L/215

**Note: deflections shown above include a 15% increase above the values calculated using traditional "simple-beam" flexure in order to more closely match actual test results obtained by SJI.*

New Design Loads:

End Reactions:

RL = 7003.0 lbs. RR = 6955.5 lbs.

Maximum Moments:

+Mx(max) = 87170.2 ft-lbs @ x = 24.94 ft.
-Mx(max) = 0.0 ft-lbs @ x = 0.00 ft.

***Maximum Deflections:**

-Δ(max) = -2.128 in. @ x = 24.98 ft.
+Δ(max) = 0.000 in. @ x = 0.00 ft.
Δ(ratio) = L/282

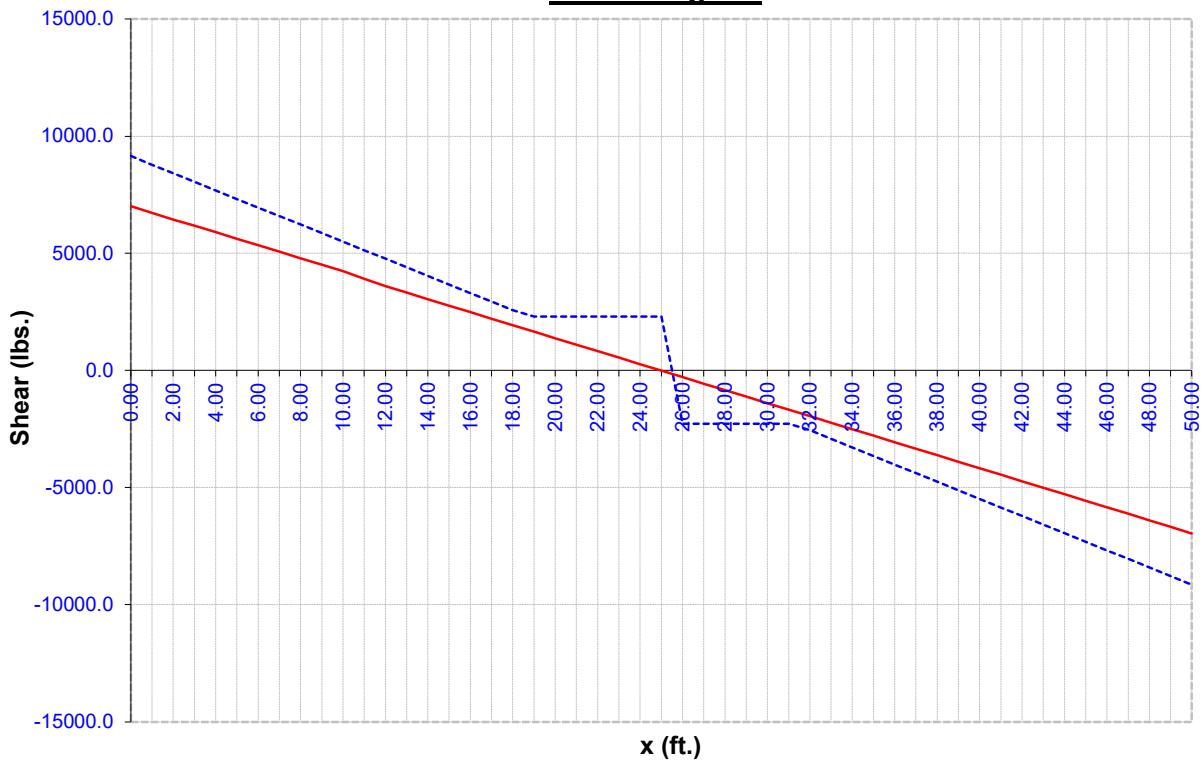
**Note: deflections shown above include a 15% increase above the values calculated using traditional "simple-beam" flexure in order to more closely match actual test results obtained by SJI.*

Maximum Stress Ratios:

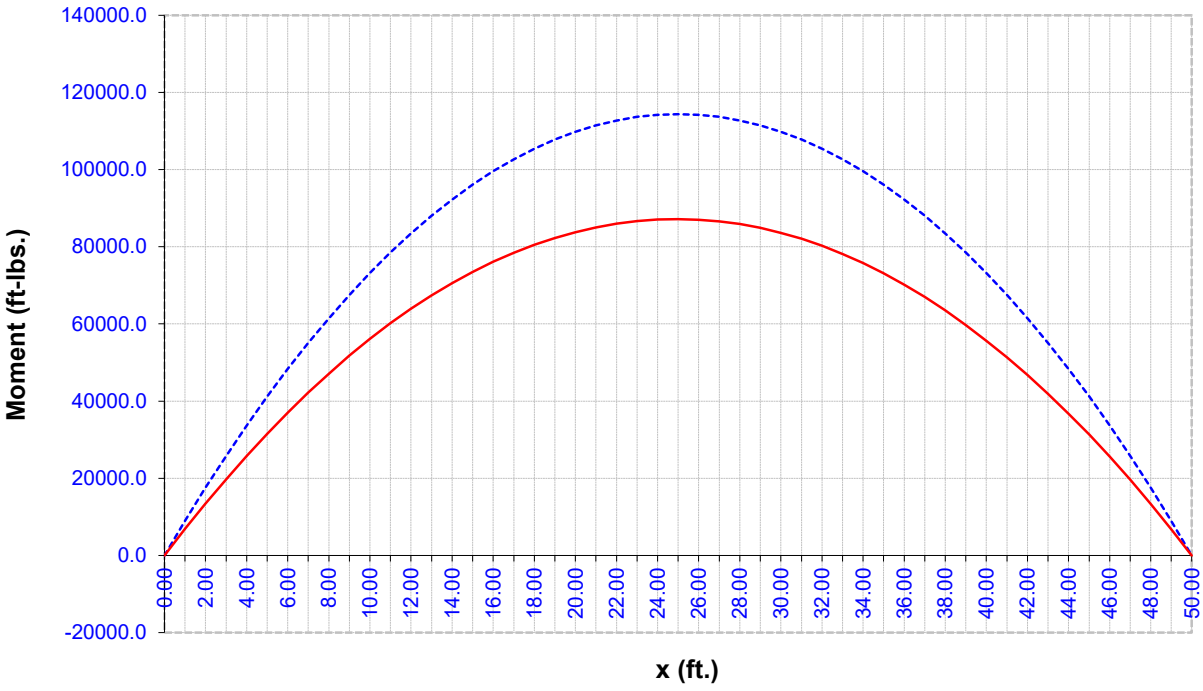
S.R. = **0.770** for Shear @ x = 10.00 ft.
S.R. = **0.767** for Moment @ x = 10.00 ft.

Comments:

Shear Diagram



Moment Diagram



= curves for original design or capacity loads

= curves for new design loads

GENERAL STANDARD JOIST ANALYSIS

For Steel Joists Considered as Simple-Span Beams
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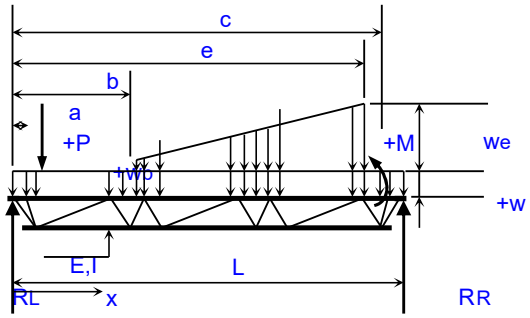


Original Design or Capacity Loads:

Full Uniform:

w = 366 lbs./ft. **32LH07 @ 7'-6", TO BE V.I.F.**

Nomenclature

	Start		End	
Distributed:	b (ft.)	wb (lbs./ft.)	e (ft.)	we (lbs/ft.)
#1:				
#2:				
#3:				
#4:				
#5:				
#6:				
#7:				
#8:				

Point Loads:	a (ft.)	P (lbs.)
#1:		
#2:		
#3:		
#4:		
#5:		
#6:		
#7:		
#8:		
#9:		
#10:		
#11:		
#12:		
#13:		
#14:		
#15:		

Moments:	c (ft.)	M (ft-lbs)
#1:		
#2:		
#3:		
#4:		

New Design Loads:

Full Uniform:

w = 277.5 lbs./ft.

	Start		End	
Distributed:	b (ft.)	wb (lbs./ft.)	e (ft.)	we (lbs/ft.)
#1:	4.9200	80.5	7.3300	80.5
#2:				
#3:				
#4:				
#5:				
#6:				
#7:				
#8:				

Point Loads:	a (ft.)	P (lbs.)
#1:		
#2:		
#3:		
#4:		
#5:		
#6:		
#7:		
#8:		
#9:		
#10:		
#11:		
#12:		
#13:		
#14:		
#15:		

Moments:	c (ft.)	M (ft-lbs)
#1:		
#2:		
#3:		
#4:		

Results of Joist Analysis:

Original Design or Capacity Loads:

End Reactions:

RL = 9150.0 lbs. RR = 9150.0 lbs.

Minimum Design Web Member Shear:

Vw(min) = 2287.5 lbs. (25% of maximum end reaction for K-series and LH-series joists per SJI Spec's.)

Maximum Moments:

+Mx(max) = 114375.0 ft-lbs @ x = 25.00 ft.
-Mx(max) = 0.0 ft-lbs @ x = 0.00 ft.

***Maximum Deflections:**

-Δ(max) = -2.790 in. @ x = 25.00 ft.
+Δ(max) = 0.000 in. @ x = 0.00 ft.
Δ(ratio) = L/215

**Note: deflections shown above include a 15% increase above the values calculated using traditional "simple-beam" flexure in order to more closely match actual test results obtained by SJI.*

New Design Loads:

End Reactions:

RL = 7107.7 lbs. RR = 6961.3 lbs.

Maximum Moments:

+Mx(max) = 87313.9 ft-lbs @ x = 24.91 ft.
-Mx(max) = 0.0 ft-lbs @ x = 0.00 ft.

***Maximum Deflections:**

-Δ(max) = -2.133 in. @ x = 24.97 ft.
+Δ(max) = 0.000 in. @ x = 0.00 ft.
Δ(ratio) = L/281

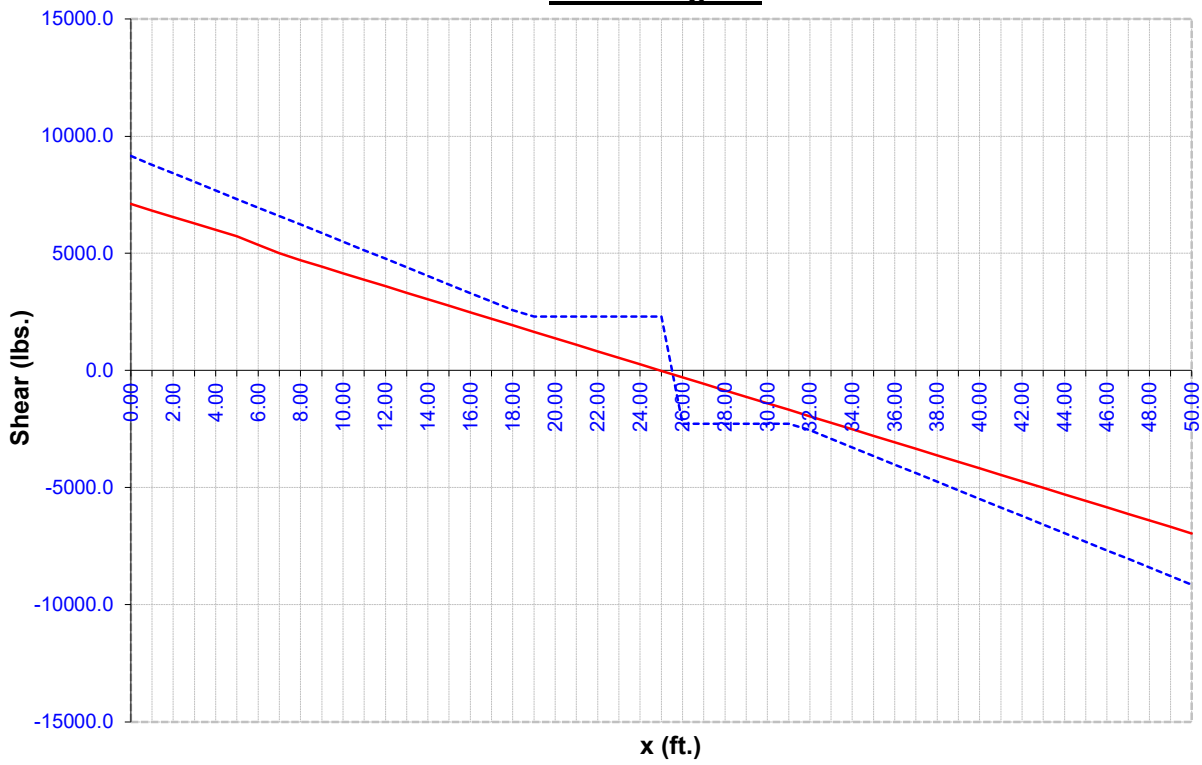
**Note: deflections shown above include a 15% increase above the values calculated using traditional "simple-beam" flexure in order to more closely match actual test results obtained by SJI.*

Maximum Stress Ratios:

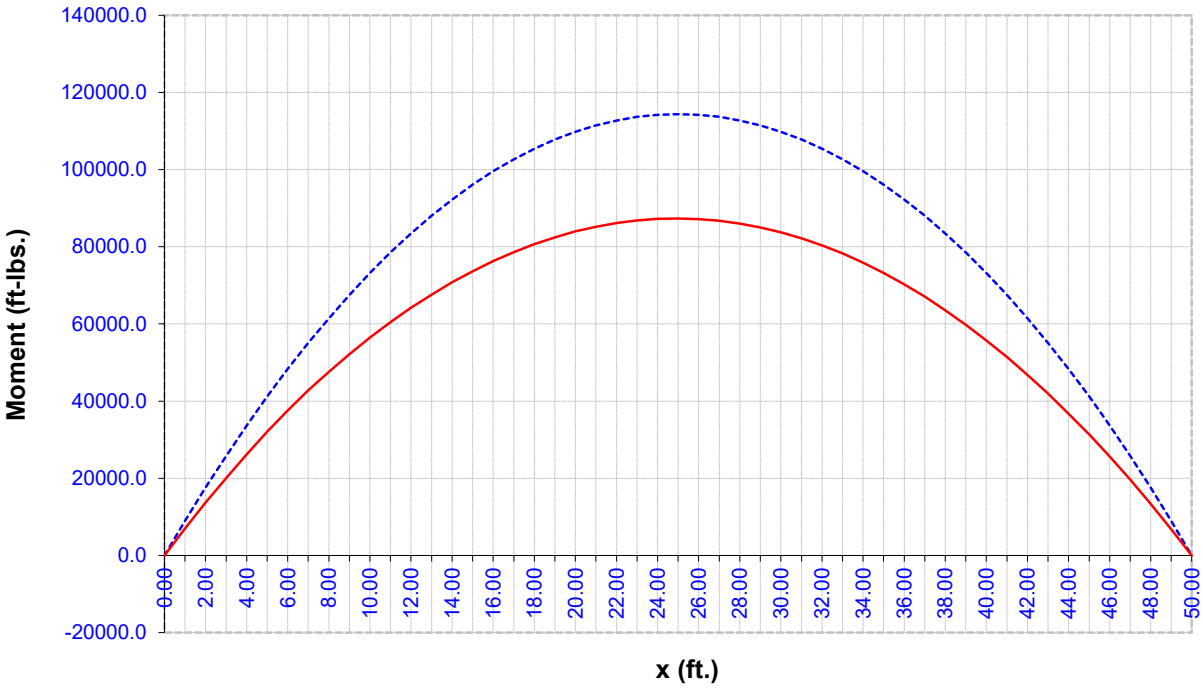
S.R. = **0.781** for Shear @ x = 5.00 ft.
S.R. = **0.779** for Moment @ x = 5.00 ft.

Comments:

Shear Diagram



Moment Diagram



= curves for original design or capacity loads

= curves for new design loads

Bath&BodyWorks
South Hill

PROJECT NUMBER 20221012.0
PROJECT LOCATION: Puyallup, WA

ASCE 7-16 WIND LOADING ON MECHANICAL EQUIPMENT

Wind Design Criteria

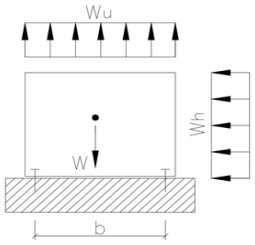
$F_v = q_h GC_r A_r$ (Eq. 29.4-3)

$q_h = 0.00256 K_h K_{zt} K_d K_e V^2$ (Equation 26.10-1)

z =	19.00	ft	K_d =	0.85	(Table 26.6-1)
K_h =	0.89	(Table 26.10-1)	K_e =	0.98	(Table 26.9-1)
K_{zt} =	1.00	(Section 26.8.2)	V =	97	mph
z_g =	433.00	(ft)			
q_z =	**17.98**	psf			

Uplift on Mechanical Unit
$F_v = q_h GC_r A_r$

GC_r =	1.5	(Eq 29.4-3)
W_r =	**26.97**	**x A_r**



Uplift on Mechanical Units

Unit(s)	Weight D (lbs)	Ar (ft^2)	A_h (ft^2)	X (ft)	Curb Length (ft)	Curb Width (ft)	F_v (lbs)	Net Uplift 0.6W-0.6D (lbs)	Curb Uplift (plf)
CU 1	161	6.88	6.65	2.38	2.75	2.50	185	15	1

A_r = Width x Length
A_h = Height x Length
x = Component center of gravity above point of attachment
- Uplift = Unit Weight > Uplift Load

Connection Notes:

Connect CU Curb to Framing w/ 1/8"x2"X10" Plate w/ (4) #12 screws ea. Curb
Tallow = 383 lbs (Wood Connection)
Tallow = 353.75 lbs (Cold-Formed Connection)
Tallow = 707.5 lbs per plate (Tension)

Straps have adequate capacity

Bath&BodyWorks
South Hill

PROJECT NUMBER 20221012.0
PROJECT LOCATION: Puyallup, WA

ASCE 7-16 WIND LOADING ON MECHANICAL EQUIPMENT

Wind Design Criteria

$F_h = q_h GC_r Af$ (Eq. 29.4-2)

$q_h = 0.00256\ K_h K_{zt} K_d K_e V^2$ (Equation 26.10-1)

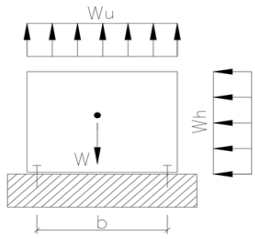
z =	19.00	ft	K_d =	0.85	(Table 26.6-1)
K_h =	0.89	(Table 26.10-1)	K_e =	0.98	(Table 26.9-1)
K_{zt} =	1.00	(Section 26.8.2)	V =	97	mph
q_z =	**17.98**	psf			

Lateral on Mechanical Unit

$F_h = q_h GC_r A_f$

GC_r = 1.9 (Eq 29.4-2)

F_h = **34.17** x A_f



Combined Lateral & Uplift on Mechanical Units

Unit(s)	Weight D (lbs)	A_h (ft^2)	X (ft)	Curb Length (ft)	Curb Width (ft)	F_v (lbs)	F_h (lbs)	M_{OT} (0.6W) (lb-ft)	M_R (0.6D) (lb-ft)	Tension (0.6W-0.6D) (lbs)	T (plf)
CU 1	161	6.646	2.38	2.75	2.5	185	15	160	120.75	16	6

A_h = Height x Length
x = Component center of gravity above point of attachment
- T = Resisting Moment > Overturning Moment, no tension loads

Connection Notes:

Connect CU Curb to Framing w/ 1/8"x2"X10" Plate w/ (4) #12 screws ea. Curb
Tallow = 383 lbs (Wood Connection)
Tallow = 353.75 lbs (Cold-Formed Connection)
Tallow = 707.5 lbs per plate (Tension)

Straps have adequate capacity

Bath&Body Works

South Hill

PROJECT NUMBER: 20221012.0
PROJECT LOCATION: Puyallup, WA

ASCE 7-16 SEISMIC LOADING ON NONSTRUCTURAL COMPONENTS

Seismic Design Criteria		
S_{DS} =	1.011	ft
h =	19.00	ft (Average Roof Height)

Component Input									
Component	Weight (lbs)	a_p	R_p	z (ft)	I_p	x (ft)	Length (ft)	Width (ft)	z/h
CU 1	161	2.50	6.00	19.00	1.00	2.38	2.75	2.50	1.00

a_p & R_p = Per ASCE 7-16 Table 13.5-1 or 13.6-1

z = Height in structure of point of attachment w/ respect to base

x = Component center of gravity above point of attachment

Component Seismic Calculations										
Fp Limit	Fp Limit	Fp Calculated (Eq. 13.3-1)		F_p Design (lbs)		± Vert Force (lbs)	M_{OT} (0.7E_h)	M_R (0.6D-0.7E_v)**	Tension	Tension
(13.3-2)	(13.3-3)	Component	Connection	Component	Connection	(Section 13.3.1.2)	(ft-lbs)	(ft-lbs)	(plf)	(lbs)
260.4	48.8	81.4	81.4	81.4	81.4	32.6	135.3	92.3	6.3	17.2

**M_R assumes worst case direction

- Tension = Resisting Moment > Overturning Moment, no tension loads

Connection Notes:

Connect CU Curb to Framing w/ 1/8"x2"X10" Plate w/ (4) #12 screws ea. Curb

Tallow = 383 lbs (Wood Connection)

Tallow = 353.75 lbs (Cold-Formed Connection)

Tallow = 707.5 lbs per plate (Tension)

Straps have adequate capacity