

Structural Calculations For:

Genesis RTU Renovation

Lee's Summit, MO

<u>Section</u>	<u>Description</u>	<u>No. Pages</u>
A	New Unit Check.....	4
B	Replacement Unit Check.....	3
C	Supplemental Steel Details.....	1

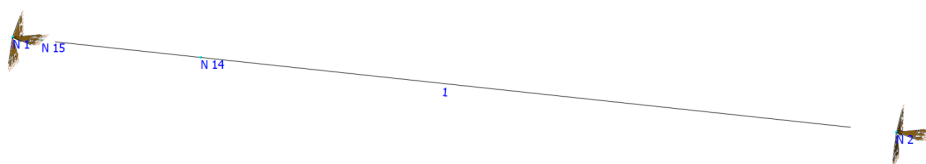
BSE WAS ASKED TO ASSESS THE EXISTING ROOF FRAMING FOR A NEW UNIT AS WELL AS A REPLACEMENT UNIT WITH A NEW CURB. BSE CONDUCTED A REVIEW SHOWN IN THE FOLLOWING CALCULATIONS AND DETERMINED THAT BOTH THE NEW 900 LB RTU 13 AND THE REPLACEMENT UNIT RTU 12 AND 250 LB NEW CUR ARE ACCEPTABLE TO BE PLACED ON THE EXISTING ROOF FRAMING.

NO REINFORCEMENT TO THE EXISTING JOISTS IS REQUIRED AS THE CAPACITIES OF THE EXISTING JOISTS EXCEED THE REQUIRED CAPACITY TO SUPPORT THE TWO ROOF TOP UNITS. PROVIDE SUPPLEMENTAL STEEL FRAMING AS REQUIRED PER SECTION C OF THIS CALCULATION BOOK.



RTU 13

NEW 900 LB UNIT ON
EXISTING 18KCS5 JOISTS



LOADS APPLIED TO JOIST :

ROOF DEAD LOAD = 12 psf

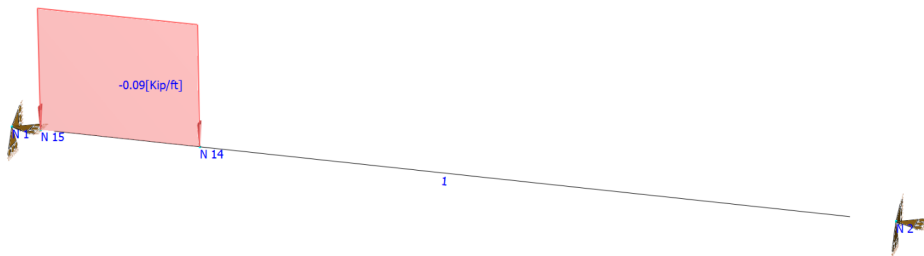
ROOF LIVE LOAD = 20 psf

ROOF SNOW LOAD = 5 psf

900 LB UNIT / 2 JOISTS / 5 FT LONG = 90 LB/FT

Loads

-  Shear force
-  Bending moments
-  Distributed user loads - Members



Analysis result

Nodal displacements envelope

Note.- Ic is the controlling load condition

Nodal displacements envelope for :

D1=DL+RTU

D2=DL+RTU+LL

D3=DL+RTU+0.75LL

Node		Translation						Rotation					
		X Ic		Y Ic		Z Ic		Rx Ic		Ry Ic		Rz Ic	
		[in]		[in]		[in]		[Rad]		[Rad]		[Rad]	
1	Max	0.000	D1	0.000	D1	0.000	D1	0.01403	D2	0.00000	D1	0.00000	D1
	Min	0.000	D1	0.000	D1	0.000	D1	0.00647	D1	0.00000	D1	0.00000	D1
2	Max	0.000	D1	0.000	D1	0.000	D1	-0.00604	D1	0.00000	D1	0.00000	D1
	Min	0.000	D1	0.000	D1	0.000	D1	-0.01412	D2	0.00000	D1	0.00000	D1
14	Max	0.000	D1	-0.416	D1	0.000	D1	0.01063	D2	0.00000	D1	0.00000	D1
	Min	0.000	D1	-0.918	D2	0.000	D1	0.00464	D1	0.00000	D1	0.00000	D1
15	Max	0.000	D1	-0.072	D1	0.000	D1	0.01393	D2	0.00000	D1	0.00000	D1
	Min	0.000	D1	-0.155	D2	0.000	D1	0.00642	D1	0.00000	D1	0.00000	D1

Envelope for nodal reactions

Note.- Ic is the controlling load condition



Direction of positive forces and moments

Envelope of nodal reactions for :

D1=DL+RTU

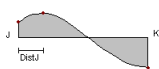
D2=DL+RTU+LL

D3=DL+RTU+0.75LL

Node		Forces						Moments					
		Fx Ic		Fy Ic		Fz Ic		Mx Ic		My Ic		Mz Ic	
		[Kip]		[Kip]		[Kip]		[Kip*ft]		[Kip*ft]		[Kip*ft]	
1	Max	0.000	D1	2.108	D2	0.000	D1	0.00000	D1	0.00000	D1	0.00000	D1
	Min	0.000	D1	1.244	D1	0.000	D1	0.00000	D1	0.00000	D1	0.00000	D1
2	Max	0.000	D1	2.257	D2	0.000	D1	0.00000	D1	0.00000	D1	0.00000	D1
	Min	0.000	D1	0.907	D1	0.000	D1	0.00000	D1	0.00000	D1	0.00000	D1

MAXIMUM
SHEAR

Points of interest in members



Considered points

CONDITION : **D1=DL+RTU**

Station	Dist to J [ft]	Axial [Kip]	Shear V2 [Kip]	Plane 1-2		Plane 1-3	
				M33 [Kip*ft]	Shear V3 [Kip]	M22 [Kip*ft]	Torsion [Kip*ft]
MEMBER 1							
0%	0.000	0.000	1.244	0.000	0.000	0.000	0.000
48%	12.825	0.000	-0.014	6.534	0.000	0.000	0.000
100%	27.000	0.000	-0.907	0.000	0.000	0.000	0.000

CONDITION : **D2=DL+RTU+LL**

Station	Dist to J [ft]	Axial [Kip]	Shear V2 [Kip]	Plane 1-2		Plane 1-3	
				M33 [Kip*ft]	Shear V3 [Kip]	M22 [Kip*ft]	Torsion [Kip*ft]
MEMBER 1							
0%	0.000	0.000	2.108	0.000	0.000	0.000	MAXIMUM MOMENT
50%	13.500	0.000	0.011	15.159	0.000	0.000	
100%	27.000	0.000	-2.257	0.000	0.000	0.000	

MAXIMUM
MOMENT

CONDITION : **D3=DL+RTU+0.75LL**

Station	Dist to J [ft]	Axial [Kip]	Shear V2 [Kip]	Plane 1-2		Plane 1-3	
				M33 [Kip*ft]	Shear V3 [Kip]	M22 [Kip*ft]	Torsion [Kip*ft]
MEMBER 1							
0%	0.000	0.000	1.892	0.000	0.000	0.000	0.000
50%	13.500	0.000	-0.006	12.997	0.000	0.000	0.000
100%	27.000	0.000	-1.920	0.000	0.000	0.000	0.000

PER VULCRAFT JOIST DESIGN MANUAL 18KCS5
MOMENT CAPACITY = 88.5 kip-ft > 15.159 kip-ft - OK
SHEAR CAPACITY = 6.2 kips > 2.257 kips - OK

RTU 12

LOADS APPLIED TO JOIST :

ROOF DEAD LOAD = 12 psf
ROOF LIVE LOAD = 20 psf
ROOF SNOW LOAD = 5 psf

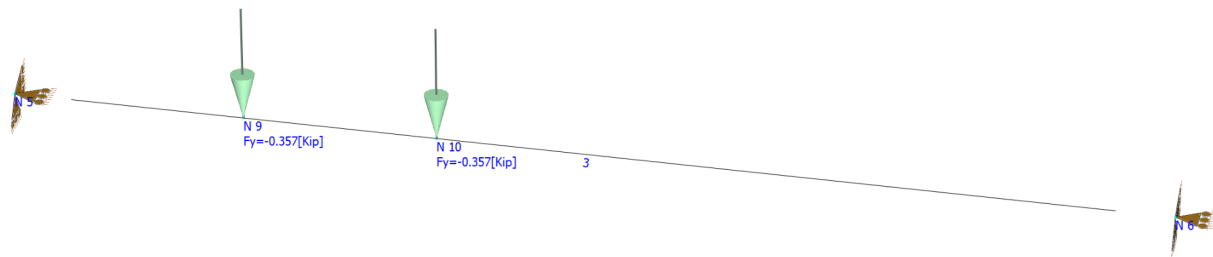
EXISTING UNIT = 2196 LBS
NEW UNIT = 1892 LBS

1892 + 250 LB CURB / 6 SUPPORT POINTS = 357 LBS

NEW 1892 LB UNIT WITH
NEW 250 LB CURB ON
EXISTING 30KCS4 JOISTS

Loads

-  Shear force
-  Bending moments
-  Concentrated - Nodes



Analysis result

Nodal displacements envelope

Note.- Ic is the controlling load condition

Nodal displacements envelope for :

D1=DL+RTU

D2=DL+RTU+LL

D3=DL+RTU+0.75LL

Node		Translation						Rotation					
		X Ic		Y Ic		Z Ic		Rx Ic		Ry Ic		Rz Ic	
		[in]		[in]		[in]		[Rad]		[Rad]		[Rad]	
5	Max	0.000	D1	0.000	D1	0.000	D1	0.05683	D2	0.00000	D1	0.00000	D1
	Min	0.000	D1	0.000	D1	0.000	D1	0.02921	D1	0.00000	D1	0.00000	D1
6	Max	0.000	D1	0.000	D1	0.000	D1	-0.02743	D1	0.00000	D1	0.00000	D1
	Min	0.000	D1	0.000	D1	0.000	D1	-0.05709	D2	0.00000	D1	0.00000	D1
9	Max	0.000	D1	-2.813	D1	0.000	D1	0.04480	D2	0.00000	D1	0.00000	D1
	Min	0.000	D1	-5.492	D2	0.000	D1	0.02267	D1	0.00000	D1	0.00000	D1
10	Max	0.000	D1	-4.271	D1	0.000	D1	0.02189	D2	0.00000	D1	0.00000	D1
	Min	0.000	D1	-8.459	D2	0.000	D1	0.01013	D1	0.00000	D1	0.00000	D1

Envelope for nodal reactions

Note.- Ic is the controlling load condition



Direction of positive forces and moments

Envelope of nodal reactions for :

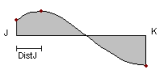
D1=DL+RTU

D2=DL+RTU+LL

D3=DL+RTU+0.75LL

Node		Forces						Moments					
		Fx Ic		Fy Ic		Fz Ic		Mx Ic		My Ic		Mz Ic	
		[Kip]		[Kip]		[Kip]		[Kip*ft]		[Kip*ft]		[Kip*ft]	
5	Max	0.000	D1	3.578	D2	0.000	D1	0.00000	D1	0.00000	D1	0.00000	D1
	Min	0.000	D1	1.864	D1	0.000	D1	0.00000	D1	0.00000	D1	0.00000	D1
6	Max	0.000	D1	3.599	D2	0.000	D1	0.00000	D1	0.00000	D1	0.00000	D1
	Min	0.000	D1	1.559	D1	0.000	D1	0.00000	D1	0.00000	D1	0.00000	D1

Points of interest in members



Considered points

CONDITION : D1=DL+RTU

Station	Dist to J [ft]	Axial [Kip]	Shear V2 [Kip]	Plane 1-2		Plane 1-3	
				M33 [Kip*ft]	Shear V3 [Kip]	M22 [Kip*ft]	Torsion [Kip*ft]
MEMBER 3							
0%	0.000	0.000	1.864	0.000	0.000	0.000	0.000
43%	18.275	0.000	-0.001	19.280	0.000	0.000	0.000
100%	43.000	0.000	-1.559	0.000	0.000	0.000	0.000

CONDITION : D2=DL+RTU+LL

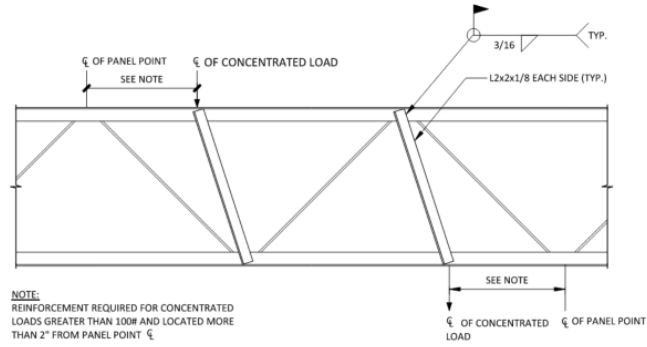
Station	Dist to J [ft]	Axial [Kip]	Plane 1-2			Plane 1-3	
			Shear V2 [Kip]	M33 [Kip*ft]	Shear V3 [Kip]	M22 [Kip*ft]	Torsion [Kip*ft]
MEMBER 3							
0%	0.000	0.000	3.578	0.000	0.000	0.000	MAXIMUM MOMENT AND SHEAR
50%	21.500	0.000	0.013	38.541	0.000	0.000	
100%	43.000	0.000	-3.599	0.000	0.000	0.000	

MAXIMUM
MOMENT
AND SHEAR

CONDITION : D3=DL+RTU+0.75LL

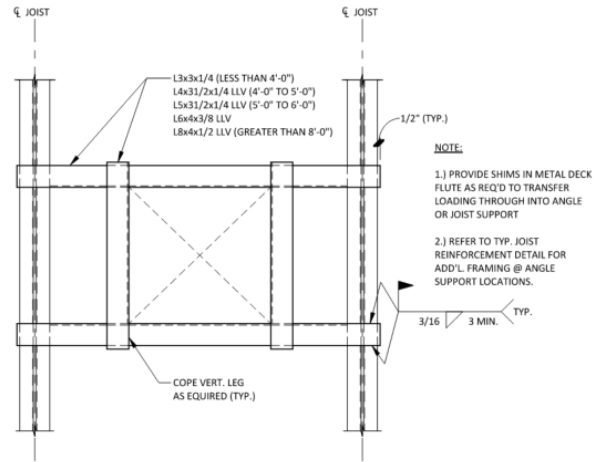
Station	Dist to J [ft]	Axial [Kip]	Shear V2 [Kip]	Plane 1-2		Plane 1-3	
				M33 [Kip*ft]	Shear V3 [Kip]	M22 [Kip*ft]	Torsion [Kip*ft]
MEMBER 3							
0%	0.000	0.000	3.150	0.000	0.000	0.000	0.000
50%	21.500	0.000	-0.041	33.643	0.000	0.000	0.000
100%	43.000	0.000	-3.089	0.000	0.000	0.000	0.000

PER VULCRAFT JOIST DESIGN MANUAL 30KCS54
MOMENT CAPACITY = 116.6 kip-ft > 38.541 kip-ft - OK
SHEAR CAPACITY = 8.5 kips > 3.599 kips - OK



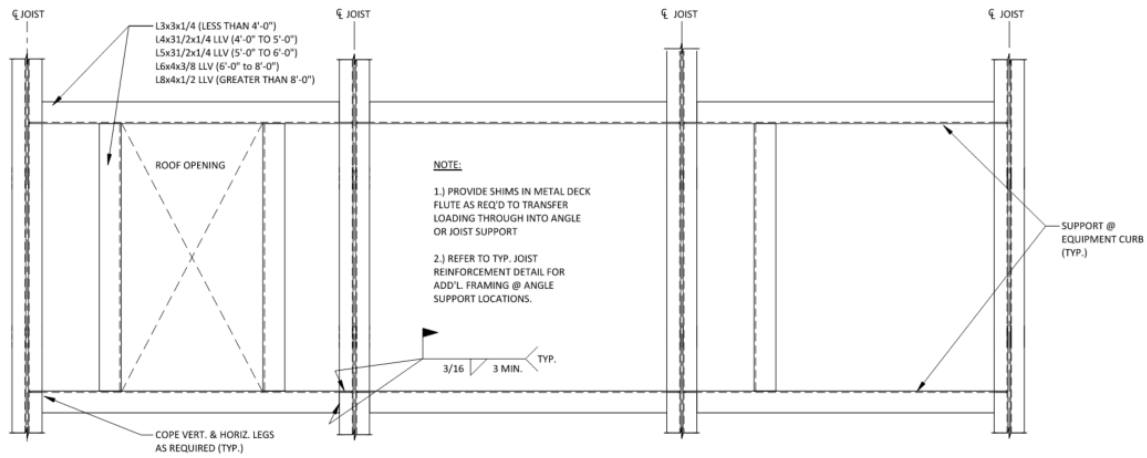
TYP. JOIST REINFORCEMENT DETAIL | 01

N.T.S. S4.1



TYP. ROOF OPENING DETAIL | 02

N.T.S. S4.1



TYP. ROOF OPENING & EQUIP. SUPPORT FRAMING DETAIL | 03

N.T.S. S4.1

FACE OF SUPPORT