SMBH
STRUCTURAL ENGINEERING

October 28, 2020

Eyemart Express
Attn: Thomas Wentz
13800 Senlac Dr. Suite 200
Farmers Branch, TX 75234

Re: Eyemart Express
1041 NE Sam Walton Dr,
Lee's Summit, MO 64086
Our Job #: 320-001.009

Thomas,

We have finished our review of the existing roof framing, and we have determined that the existing framing will have sufficient capacity to safely support the new rooftop mechanical units and the code required loads, provided the attached details are followed. Joist reinforcement per detail C is required under units #1 and #3. Joist reinforcement per detail D is required under unit #2. This review was based upon the following information:

- Mechanical drawing H1.0 by Point One Design, Ltd., received on 10/22/2020.
- Site survey by Precision Architectural As-Builts, dated 07/02/2020.
- Three new rooftop units will replace one existing rooftop unit:
    1. Unit #1 weighs 750 lbs.
    2. Unit #2 weighs 1150 lbs and will replace an existing 730 lb unit.
    3. Unit #3 weighs 850.
- Existing roof framing consists of 1'-8" deep open-web steel joists:
    1. At unit #1, joists span approximately 30'-1" and are spaced 5'-0" on center.
    2. At units #2 and #3, joists span approximately 30'-6" and are spaced 5'-0" on center.

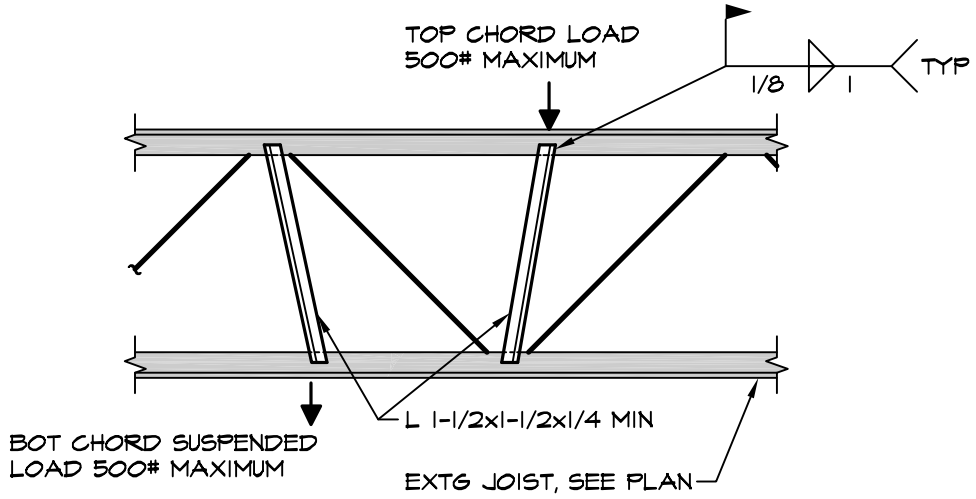
Please let us know if any of this information is incorrect or if there are changes in the final design, so that we may review the existing framing for the final load condition. If you have any further questions or comments, please do not hesitate to contact us.

Sincerely,

Stephen J. Metz, P.E.

Scott DeGan

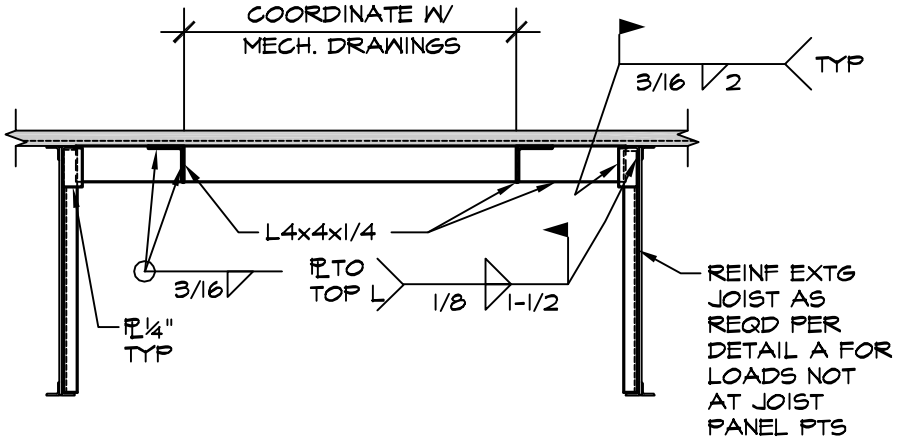
SMBH, Inc.
sdegan@smbhinc.com



NOTES:
CONCENTRATED MECH UNIT LOADS, FOLDING PARTITIONS, SUSPENDED LOADS, ETC, SHOULD BE LOCATED AT JOIST PANEL POINTS WHERE POSSIBLE. WHEN PANEL POINT IS NOT ACCESSIBLE, SUPPORT LOAD AS SHOWN. ALL WELDING TO JOIST IS TO BE DONE WITH CARE AS NOT TO IMPAIR THE STRENGTH OF THE JOIST.

DETAIL A

NO SCALE: TYP SUPPORT OF CONCENTRATED LOADS NOT AT JOIST PANEL POINT

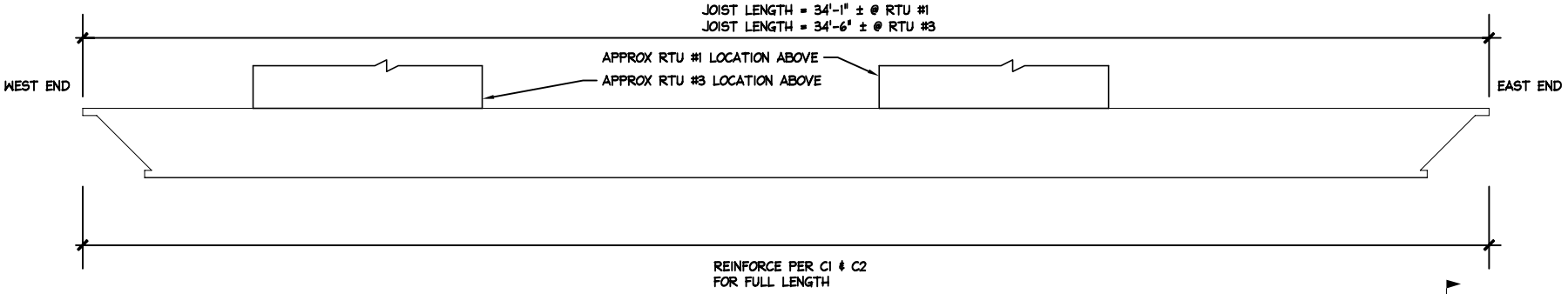


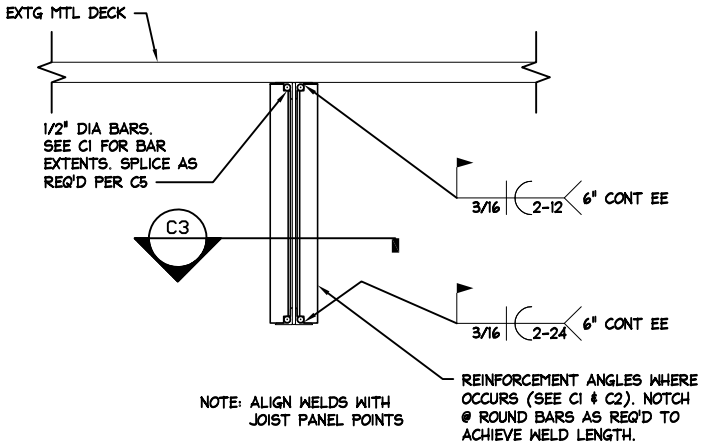
NOTES:

1. PROVIDE L4x4x1/4 FRAMES UNDER ALL UNIT CURBS AND AROUND ALL OPENINGS THROUGH THE ROOF DECK.
2. SEE MECHANICAL DRAWING FOR LOCATIONS, SIZES, AND QUANTITIES OF ROOF OPENINGS.
3. ALL WELDING TO JOIST TO BE DONE WITH CARE SO AS NOT TO IMPAIR THE STRENGTH OF THE JOIST.

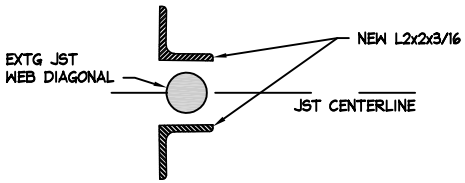
DETAIL B

NO SCALE:





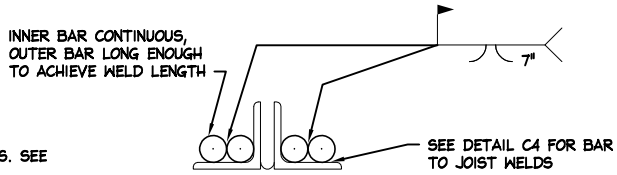
C4 JOIST REINFORCING
N.T.S.



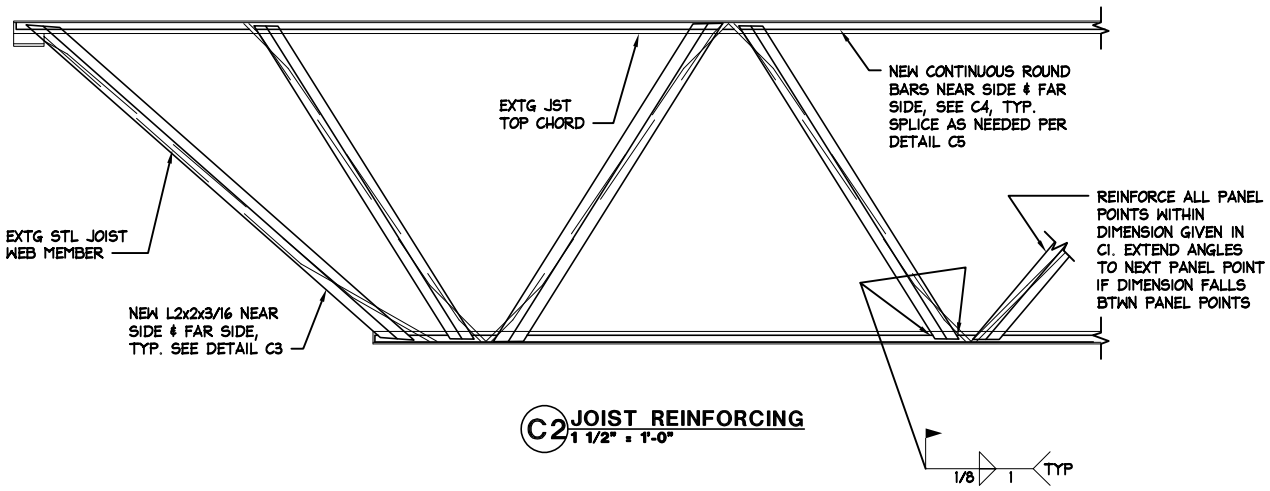
C3 JOIST REINFORCING
3" = 1'-0"

C1 JOIST REINFORCING EXTENTS
N.T.S.

NOTES:
1. RTU #1 & #3 ARE PLACED ON DIFFERENT JOISTS. SEE MECHANICAL DRAWING FOR RTU LOCATIONS.
2. REINFORCEMENT IS REQUIRED AT EACH JOIST WHICH SUPPORTS THE RTU ABOVE.
3. NOTIFY EOR IF RTU LOCATION DIFFERS FROM THE LOCATION INDICATED.
4. SEE DETAILS A & B FOR ANGLE FRAMING AT ROOF OPENINGS AND ANGLES REQUIRED AT CONCENTRATED LOADS



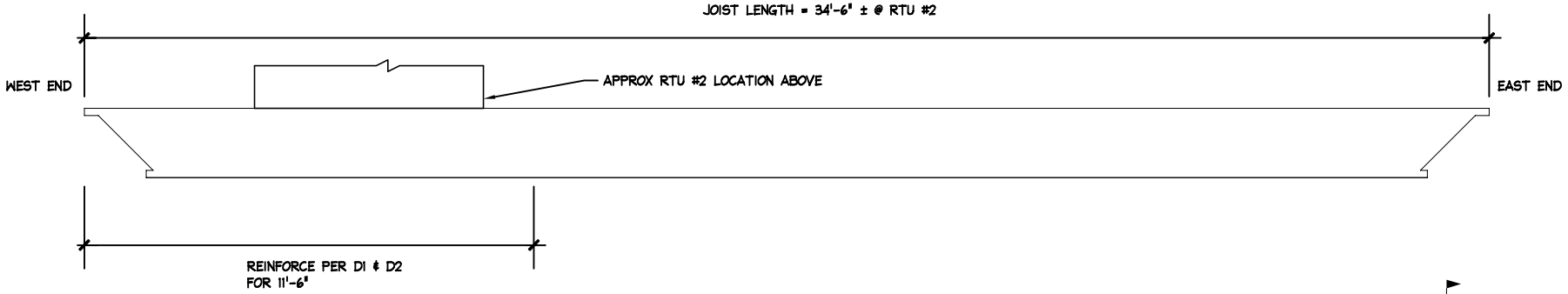
C5 BAR SPLICE DETAIL
N.T.S.



C2 JOIST REINFORCING
1 1/2" = 1'-0"

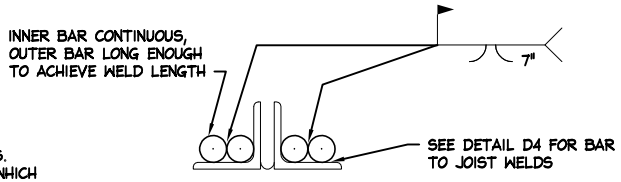
DETAIL C

NO SCALE JOIST REINFORCEMENT

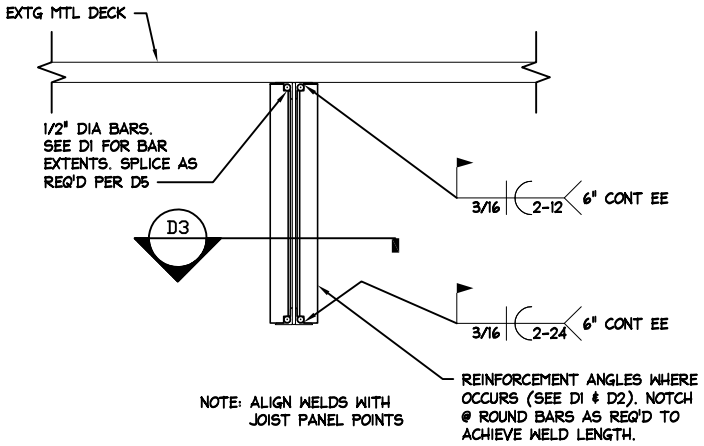


D1 JOIST REINFORCING EXTENTS
N.T.S.

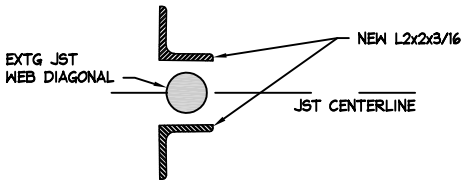
NOTES:
1. SEE MECHANICAL DRAWING FOR RTU LOCATIONS.
2. REINFORCEMENT IS REQUIRED AT EACH JOIST WHICH SUPPORTS THE RTU ABOVE.
3. NOTIFY EOR IF RTU LOCATION DIFFERS FROM THE LOCATION INDICATED.
4. SEE DETAILS A & B FOR ANGLE FRAMING AT ROOF OPENINGS AND ANGLES REQUIRED AT CONCENTRATED LOADS



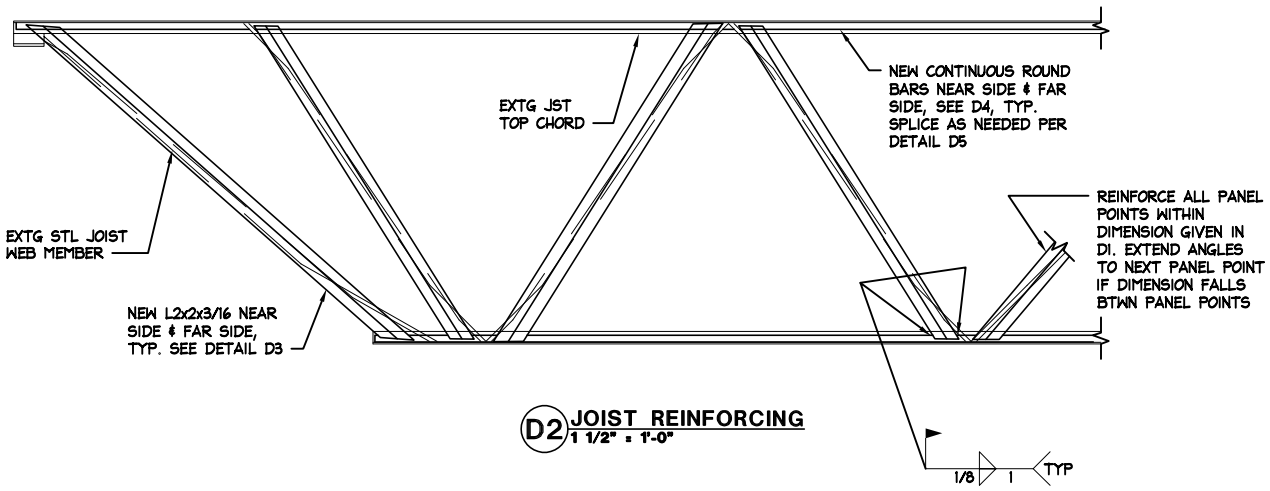
D5 BAR SPLICE DETAIL
N.T.S.



D4 JOIST REINFORCING
N.T.S.



D3 JOIST REINFORCING
3" = 1'-0"



D2 JOIST REINFORCING
1 1/2" = 1'-0"

DETAIL D

NO SCALE JOIST REINFORCEMENT

Eyemart Express

1041 NE Sam Walton Dr,
Lee's Summit, MO 64086

Structural Calculations

Submitted by SMBH, Inc.
10/28/2020

SMBH
STRUCTURAL ENGINEERING

SMBH, Inc.
1166 Dublin Road, Suite 200
Columbus, Ohio 43215
Phone: 614-481-9800
Email: sdegan@smbhinc.com
SMBH Job Number: 320-001.009

Hazards by Location

Search Information

Address: 1041 NE Sam Walton Dr, Lee's Summit, MO, USA

Coordinates: 38.9312921, -94.36108949999999

Elevation: 993 ft

Timestamp: 2020-10-27T14:31:35.432Z

Hazard Type: Snow

ASCE 7-16	ASCE 7-10	ASCE 7-05
Ground Snow Load ..... 20 lb/sqft	Ground Snow Load ..... 20 lb/sqft	Ground Snow Load ..... 20 lb/sqft

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer.

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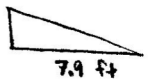
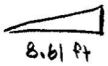
SMBH
STRUCTURAL ENGINEERING

PROJECT: EVEMART LEE'S SUMMIT, MO	NO: 320-001.009
TASK: RTU SUPPORT	PAGE: 1
	ENG: SD
CLIENT:	DATE: 10/26/20

- Uniform loads: 20 psf DL, 20 psf SNOW
- Snow drift: at West parapet 

in addition to uniform snow 

Joist under RTU #1:

750 lbs + ≈150 lb curb = 900 lbs
Reinforcement required (see spreadsheet). Full length
R = 3835 lbs @ joist girder (compare to 3482 lbs existing) ← 10.1% increase

Joist under RTU #2:

1150 lb unit replacing 730 lb unit
Reinforcing required (see spreadsheet). ≥ 5% increase from x = 0' to x = 11.04'
R = 4026 lbs @ joist girder (compare to 3823 lbs existing) ← 5.3% increase

Joist under RTU #3:

850 lbs + ≈150 lb curb = 1000 lbs
Reinforcement required (see spreadsheet). Full length
R = 3854 lbs @ joist girders (compare to 3471 lbs existing) ← 11.0% increase

Joist Girder:

Increased panel point loads from RTUs; Evaluate M + V along span:

Max 3.9% increase < 5% increase ✓ OK shear
3.8% increase < 5% ✓ OK Moment

Joist Reinforcement: Designed for worst case, see spreadsheet

GENERAL STANDARD JOIST ANALYSIS

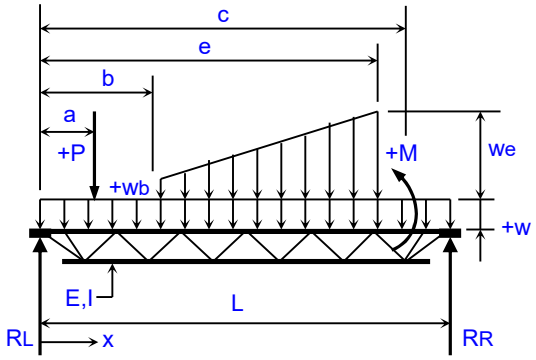
For Steel Joists Considered as Simple-Span Beams
Subjected to Non-Standard Loads

Job Name:	Eyemart - Lee's Summit, MO	Subject:	Under RTU #1		
Job Number:	320-001.009	Originator:	SD	Checker:	

Input Data:

Joist Data:

Designation =	K-series	
Span, L =	34.4167	ft.
Modulus, E =	29000000	psi
Inertia, Ix =	150.00	in.^4



Nomenclature

Original Design or Capacity Loads:

Full Uniform:

w = 200 plf

Distributed:	Start b (ft.)	Wb (plf)	End e (ft.)	We (plf)
#1:	26.5167	0	34.4167	134
#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 = 200 plf

Distributed:	Start b (ft.)	Wb (plf)	End e (ft.)	We (plf)
#1:	26.5167	0	34.4167	134
#2:				
#3:				
#4:				
#5:				
#6:				
#7:				
#8:				

Point Loads:	a (ft.)	P (lbs.)
#1:	8.8333	270
#2:	15.0000	270
#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:

R_L = 3482.2 lbs. R_R = 3930.5 lbs.

Minimum Design Web Member Shear:

$V_{w(min)}$ = 982.6179 lbs. (25% of maximum end reaction for K-series and LH-series joists per SJI Spec's.)

Maximum Moments:

+$M_{x(max)}$ = 30313.7 ft-lbs @ x = 17.41 ft.

-$M_{x(max)}$ = 0.0 ft-lbs @ x = 0.00 ft.

New Design Loads:

End Reactions:

R_L = 3835.2 lbs. R_R = 4117.4 lbs.

Maximum Moments:

+$M_{x(max)}$ = 33580.8 ft-lbs @ x = 16.48 ft.

-$M_{x(max)}$ = 0.0 ft-lbs @ x = 0.00 ft.

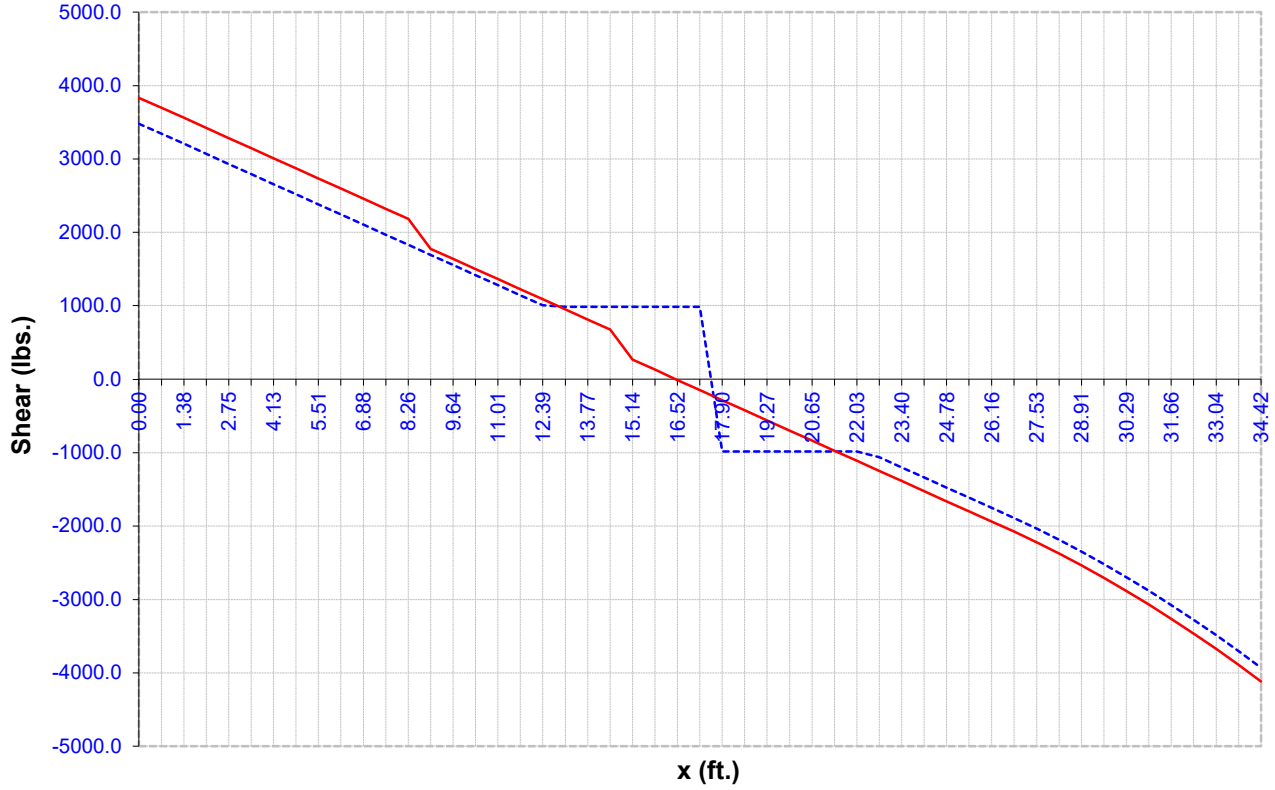
Maximum Stress Ratios:

S.R. = *1.193* for Shear @ x = 8.26 ft.

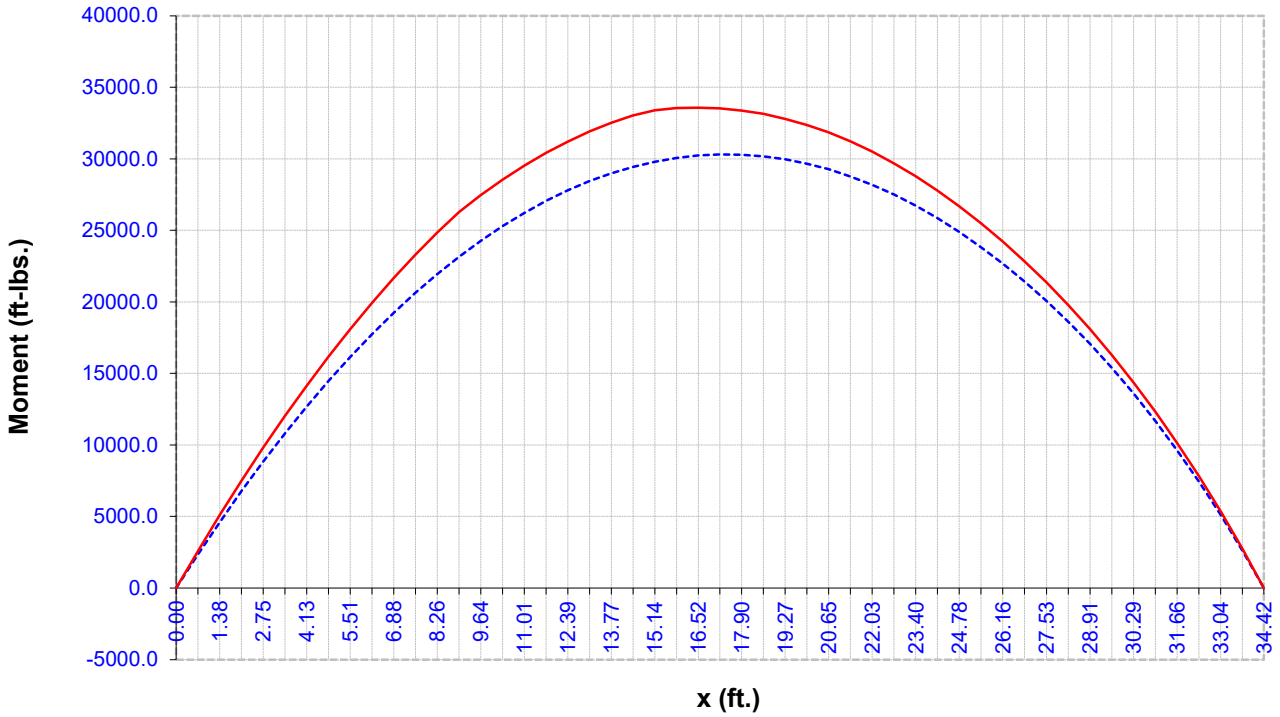
S.R. = *1.135* for Moment @ x = 8.95 ft.

Comments:

Shear Diagram



Moment Diagram



= curves for original design or capacity loads

= curves for new design loads

GENERAL STANDARD JOIST ANALYSIS

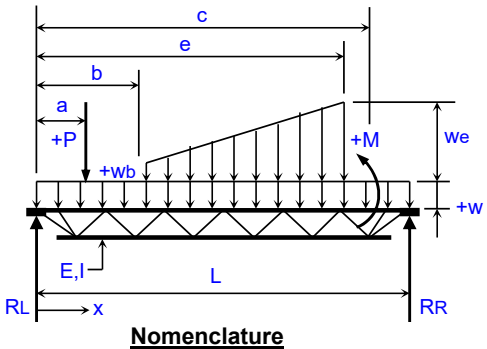
For Steel Joists Considered as Simple-Span Beams
Subjected to Non-Standard Loads

Job Name:	Eyemart - Lee's Summit, MO	Subject:	Under RTU #2		
Job Number:	320-001.009	Originator:	SD	Checker:	

Input Data:

Joist Data:

Designation =	K-series	
Span, L =	34.5000	ft.
Modulus, E =	29000000	psi
Inertia, Ix =	150.00	in.^4



Nomenclature

Original Design or Capacity Loads:

Full Uniform:

w = 200 plf

Distributed:	Start b (ft.)	Wb (plf)	End e (ft.)	We (plf)
#1:	25.8900	0	34.5000	59.5
#2:				
#3:				
#4:				
#5:				
#6:				
#7:				
#8:				

Point Loads:	a (ft.)	P (lbs.)
#1:	3.1670	219
#2:	10.3750	219
#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 = 200 plf

Distributed:	Start b (ft.)	Wb (plf)	End e (ft.)	We (plf)
#1:	25.8900	0	34.5000	59.5
#2:				
#3:				
#4:				
#5:				
#6:				
#7:				
#8:				

Point Loads:	a (ft.)	P (lbs.)
#1:	3.1670	345
#2:	10.3750	345
#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:

R_L = 3823.3 lbs. R_R = 3770.8 lbs.

Minimum Design Web Member Shear:

$V_{w(min)}$ = 955.8366 lbs. (25% of maximum end reaction for K-series and LH-series joists per SJI Spec's.)

Maximum Moments:

+$M_{x(max)}$ = 31617.1 ft-lbs @ x = 16.93 ft.

-$M_{x(max)}$ = 0.0 ft-lbs @ x = 0.00 ft.

New Design Loads:

End Reactions:

R_L = 4025.9 lbs. R_R = 3820.3 lbs.

Maximum Moments:

+$M_{x(max)}$ = 32492.4 ft-lbs @ x = 16.68 ft.

-$M_{x(max)}$ = 0.0 ft-lbs @ x = 0.00 ft.

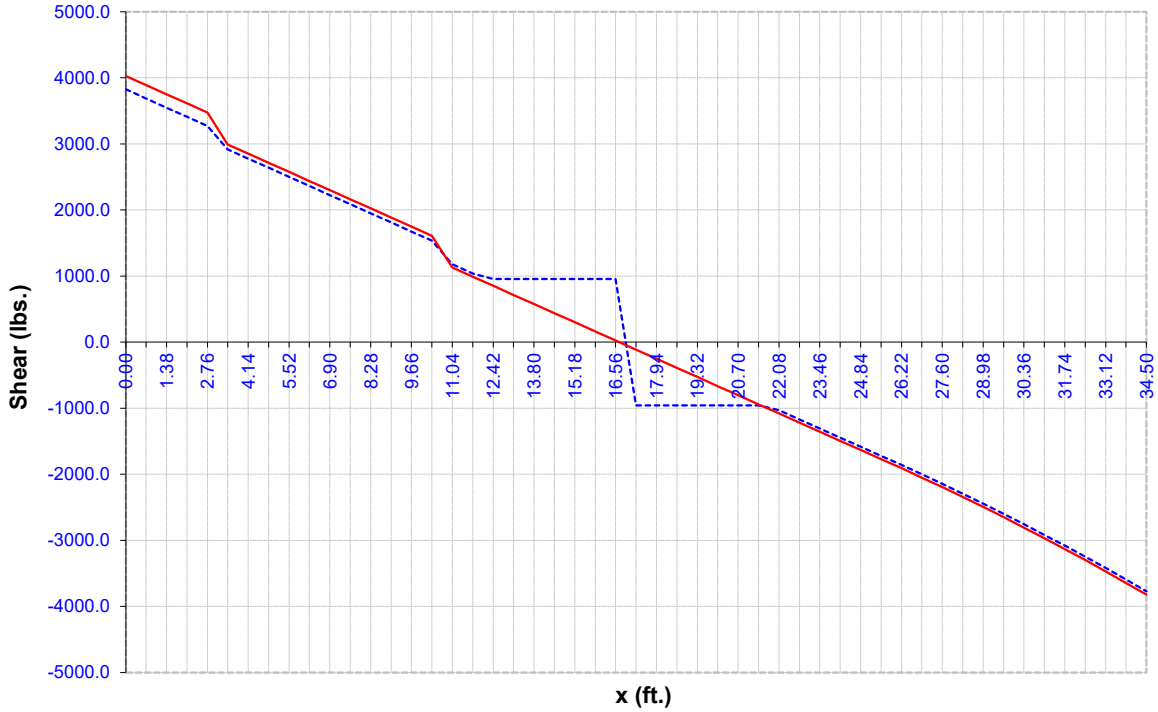
Maximum Stress Ratios:

S.R. = *1.062* for Shear @ x = 2.76 ft.

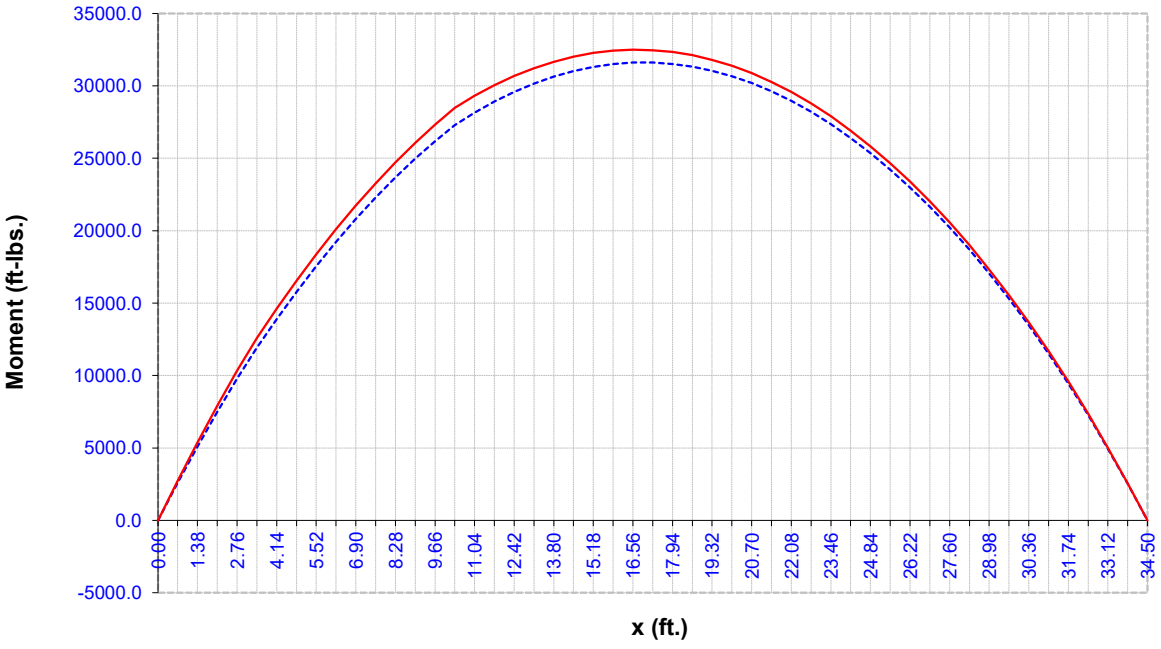
S.R. = *1.057* for Moment @ x = 2.76 ft.

Comments:

Shear Diagram



Moment Diagram



= curves for original design or capacity loads

= curves for new design loads

GENERAL STANDARD JOIST ANALYSIS

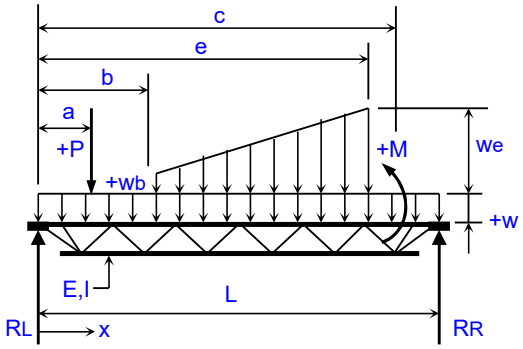
For Steel Joists Considered as Simple-Span Beams
Subjected to Non-Standard Loads

Job Name:	Eyemart - Lee's Summit, MO	Subject:	Under RTU #3		
Job Number:	320-001.009	Originator:	SD	Checker:	

Input Data:

Joist Data:

Designation =	K-series	
Span, L =	34.5000	ft.
Modulus, E =	29000000	psi
Inertia, Ix =	150.00	in.^4



Nomenclature

Original Design or Capacity Loads:

Full Uniform:

w = 200 plf

	Start		End	
Distributed:	b (ft.)	wb (plf)	e (ft.)	we (plf)
#1:	25.8900	0	34.5000	59.5
#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:		

New Design Loads:

Full Uniform:

w = 200 plf

	Start		End	
Distributed:	b (ft.)	wb (plf)	e (ft.)	we (plf)
#1:	25.8900	0	34.5000	59.5
#2:				
#3:				
#4:				
#5:				
#6:				
#7:				
#8:				

Point Loads:	a (ft.)	P (lbs.)
#1:	3.8330	239
#2:	10.0000	239
#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:

R_L = 3471.3 lbs. R_R = 3684.8 lbs.

Minimum Design Web Member Shear:

$V_{w(min)}$ = 921.2097 lbs. (25% of maximum end reaction for K-series and LH-series joists per SJI Spec's.)

Maximum Moments:

$+Mx_{(max)}$ = 30125.0 ft-lbs @ x = 17.36 ft.

$-Mx_{(max)}$ = 0.0 ft-lbs @ x = 0.00 ft.

New Design Loads:

End Reactions:

R_L = 3853.5 lbs. R_R = 3780.7 lbs.

Maximum Moments:

$+Mx_{(max)}$ = 31790.7 ft-lbs @ x = 16.88 ft.

$-Mx_{(max)}$ = 0.0 ft-lbs @ x = 0.00 ft.

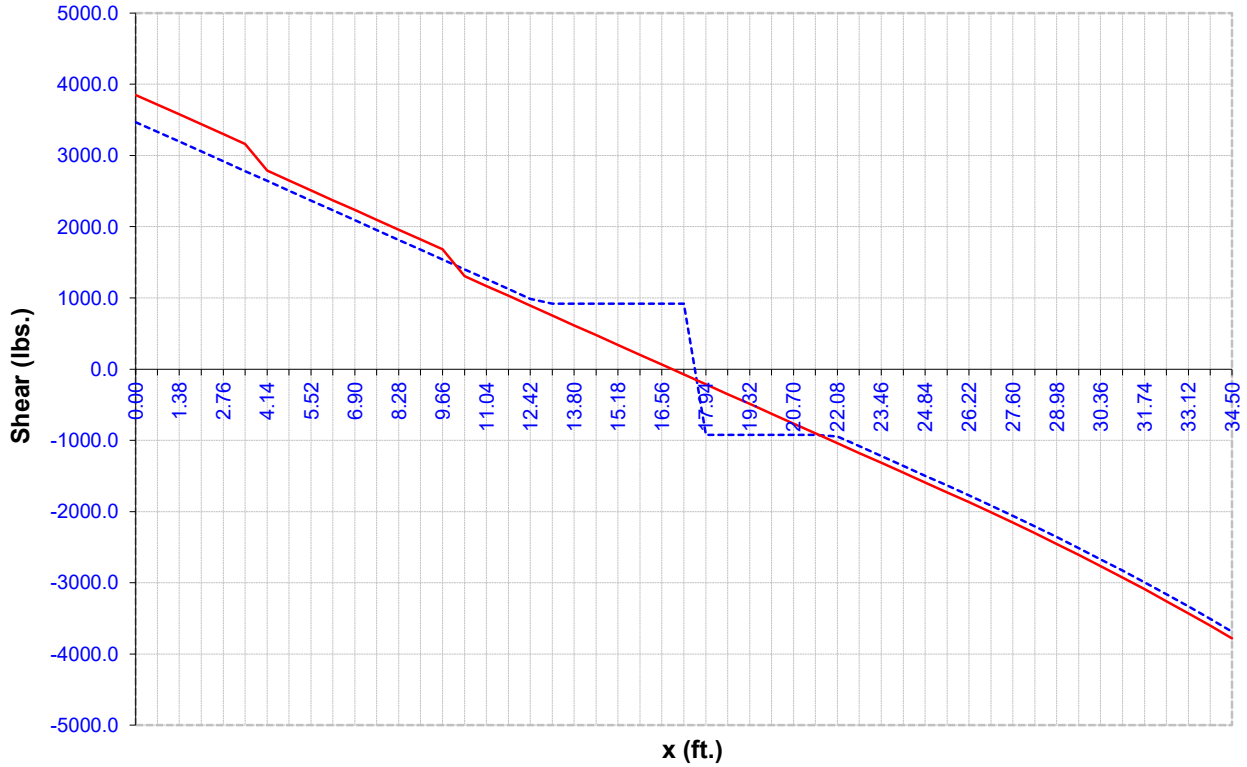
Maximum Stress Ratios:

S.R. = *1.137* for Shear @ x = 3.45 ft.

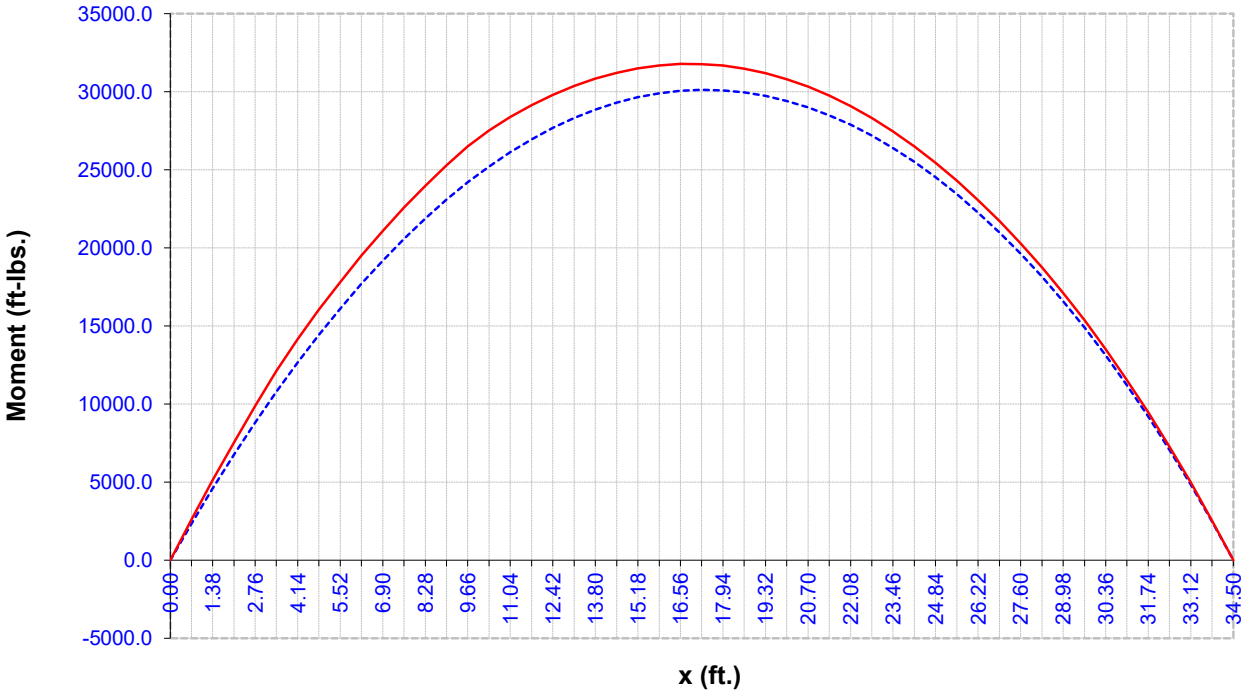
S.R. = *1.122* for Moment @ x = 3.45 ft.

Comments:

Shear Diagram



Moment Diagram



= curves for original design or capacity loads

= curves for new design loads

Joist Reinforcement:

Input Data:

Joist Data:

Joist Depth (in)	20
Joist Span (ft)	34.4167
I_J (in^4)	106.00
Rod F_y (ksi)	36
Rod F_u (ksi)	58

Analysis Calc's:

Max M_Δ (k-ft)	3.6
Max V_Δ (k)	1.1
Ten/Comp (k)	2.2

M and V above represent the max increase in forces at any point along the affected joists.

Allowable Stress Design (ASD):

Tension Design:

$A_{s,required}$ (in^2)	0.10	
A_s/rod (in^2)	0.05	
Required Rod Dia. (in)	0.25	
Rod Diameter (in)	0.500	
Weld Spacing (in)	24	*Generally 2" @ 24"
A_{rod} (in^2)	0.20	
T_{allow} (k)	8.5	OK
T_{allow} (k)	11.4	OK

Compression Design:

I_x (in^4)	0.0031	
r (in)	0.125	
Weld Spacing (in)	12	*Generally 2" @ 12" (Unbraced Length)
KL/r	96	
4.71*sqrt(E/F_y)	134	
F_e (ksi)	31.1	
F_{cr} (ksi)	22.2	
P_{allow} (k)	5.2	OK

Weld Design:

End Welds: (Flare Bevel Groove)

R_{nw} (k/in)	1.64
l_w (in)	0.7
Weld Length (in)	6.0 OK

Stitch Welds:

Shear Flow (k/in/rod)	0.028	*Omits Ij of extg joist
l_w (in)	0.4	*Per rod
Weld Length (in)	2.0	OK
Weld Spacing (in)	See Tension & Compression Sections	

Shear Design:

Ten/Comp Web (k)	1.6
Angle L_u (ft)	2.4

*Assumes web member at 45° angle

l_w (in)	0.3	OK

*Assumes 1" of 3/16" fillet weld each side of angle; adjust details if N

Deflection Design:

Original Load Δ (in)	-2.43	
New Load Δ (in)	-2.68	
I_{JT} (in^4)	181	*Ensure Ij of extg joist is cor
Reinforced Δ (in)	-1.57	
L/?	263	