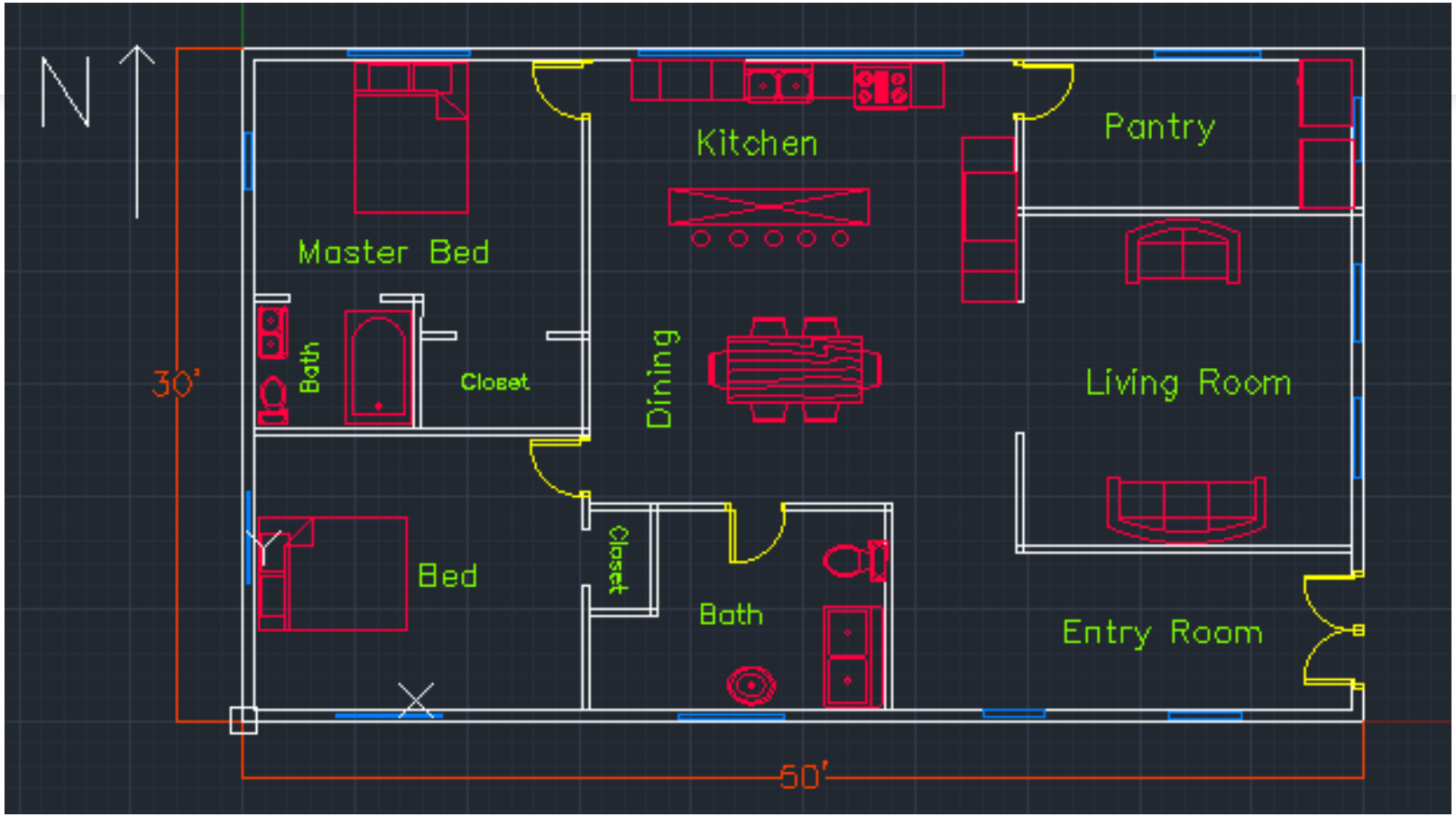
Structural engineering: final project

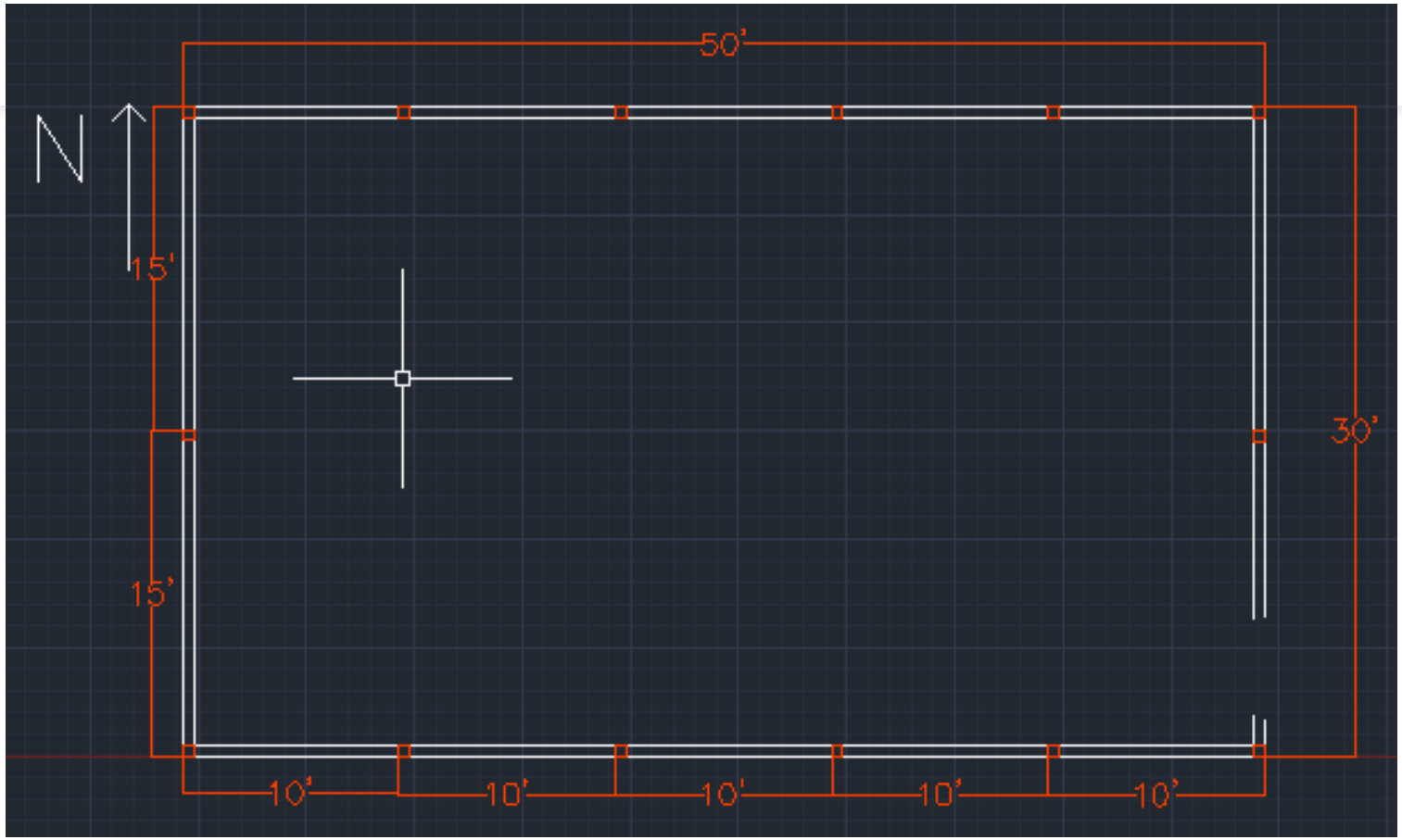
J.S

Project Overview

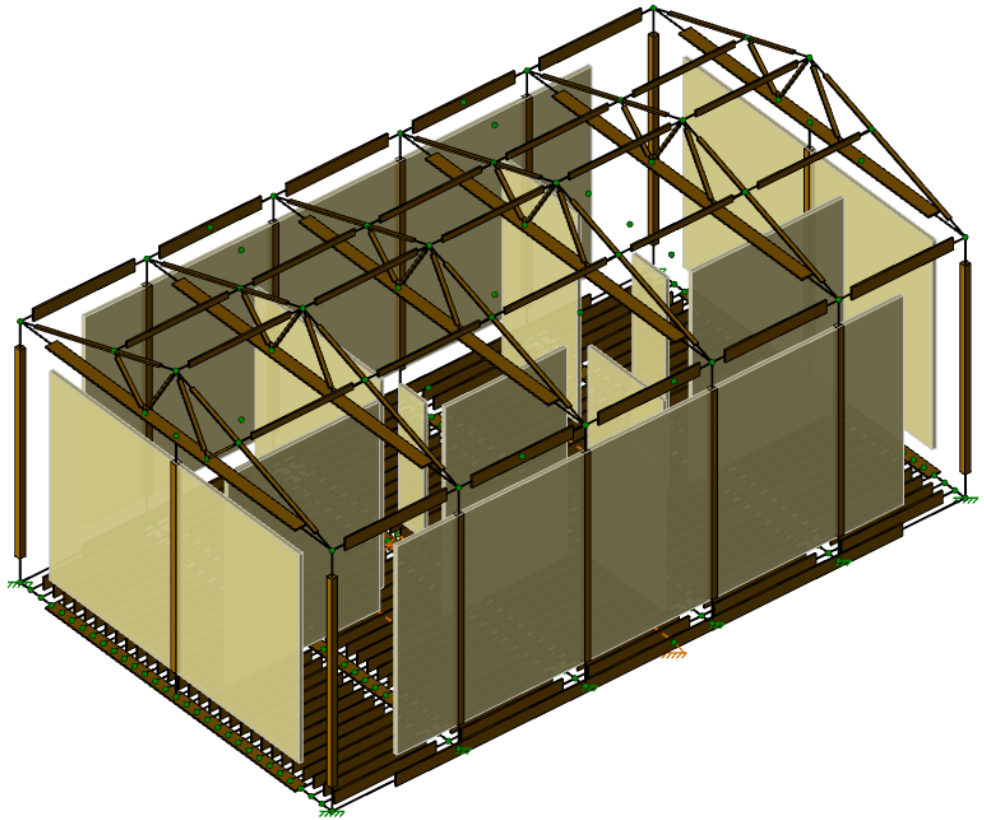
House Floor Plan

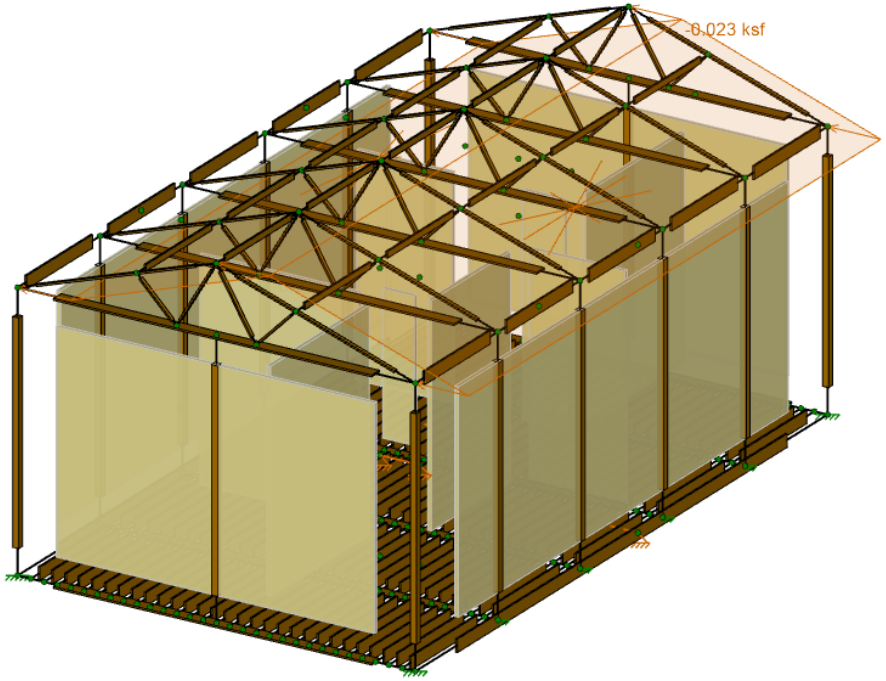


Column Plan

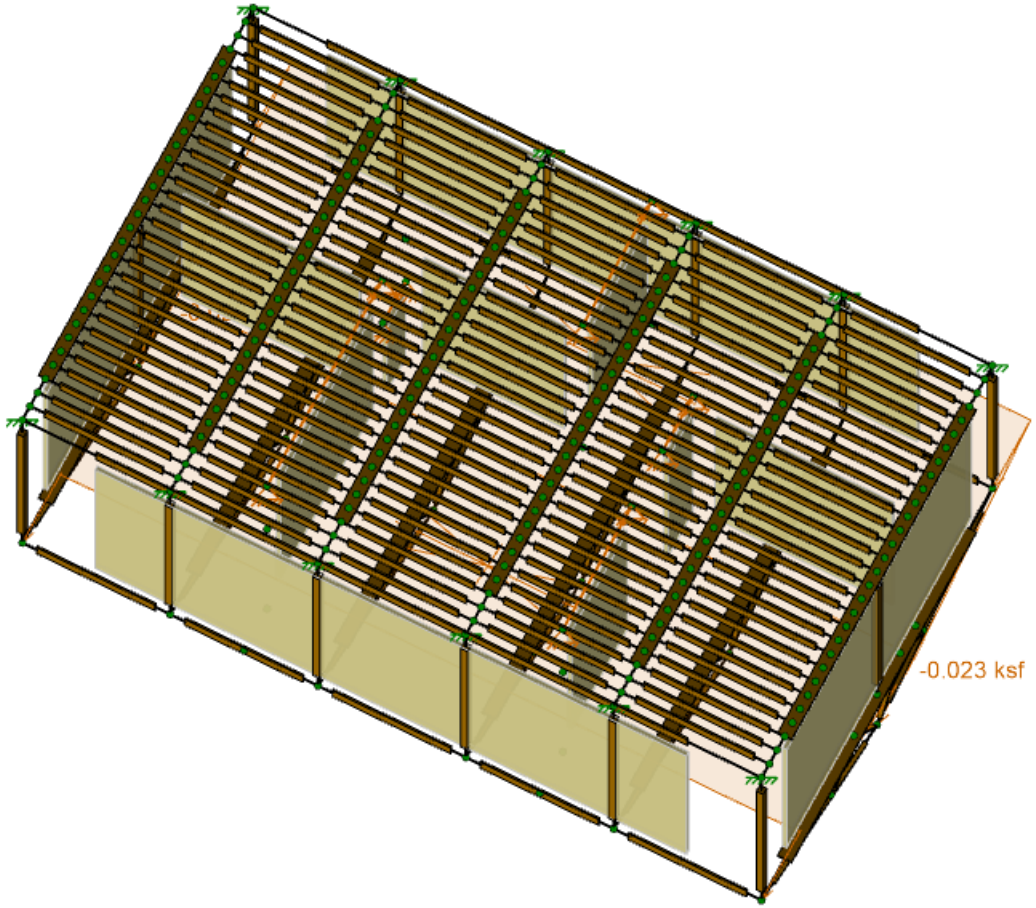


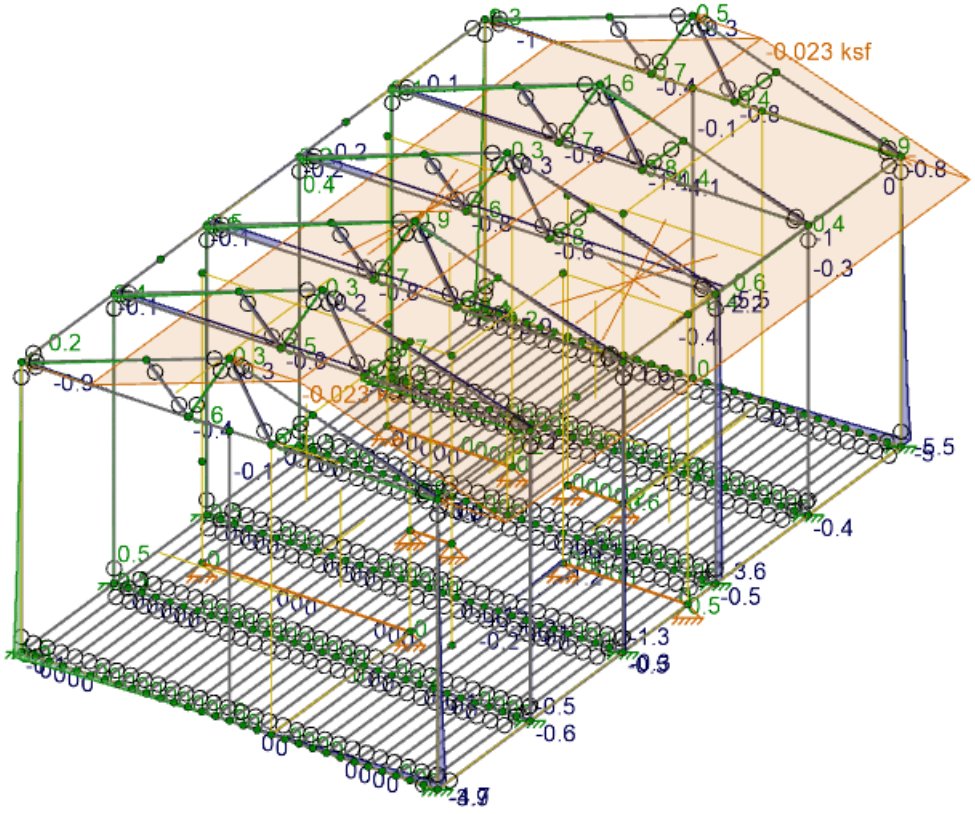
RISA Model





RISA Model





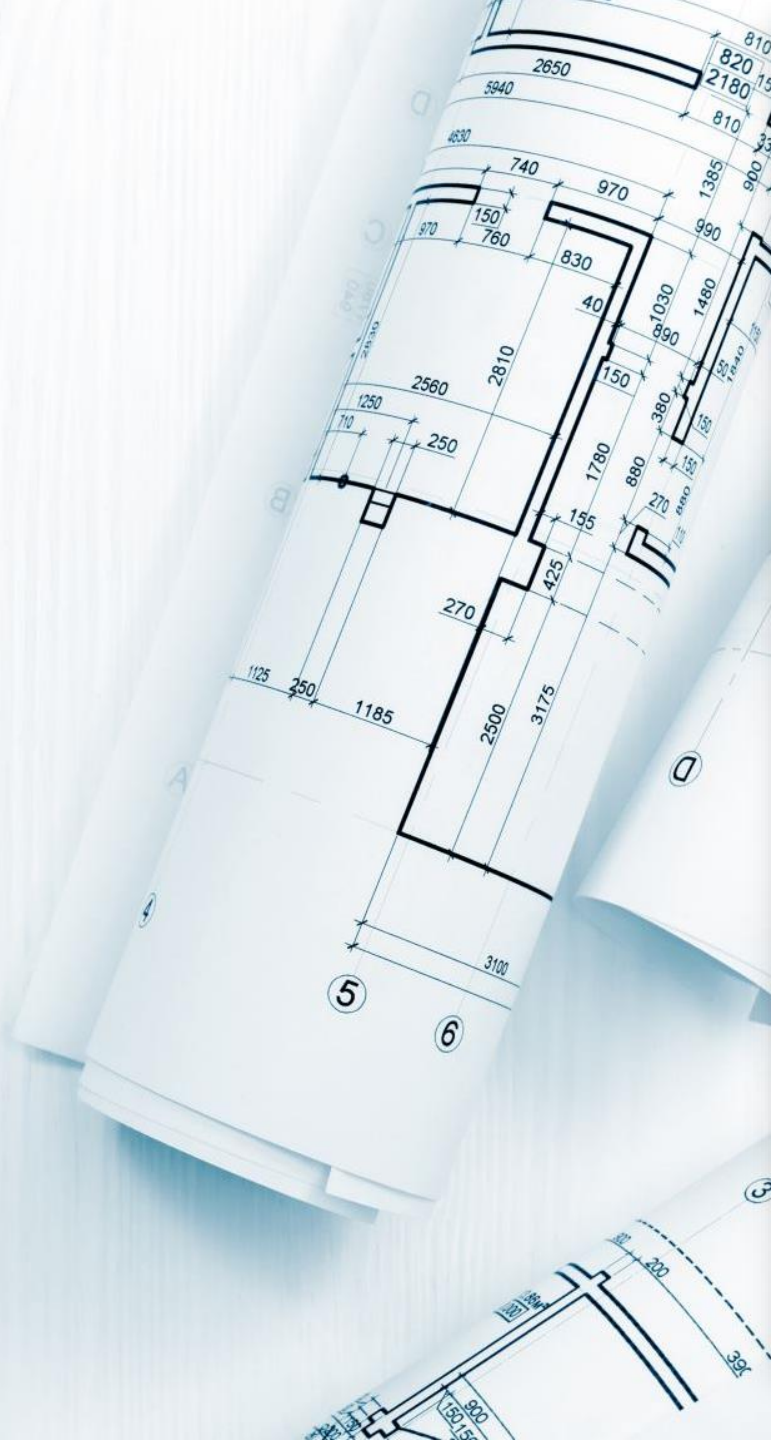
House Loads Calculation

Asphalt shingles: 1.93 psf

½” Plywood: 1.42 psf

14” Snow load: 20 psf

Total Load: 23.35 psf = 0.02335 ksf

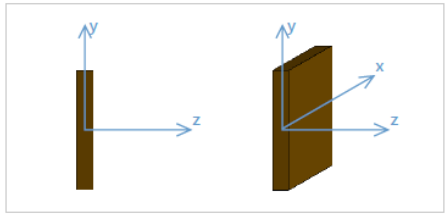


Node Reactions

Node Reactions (By Combination)

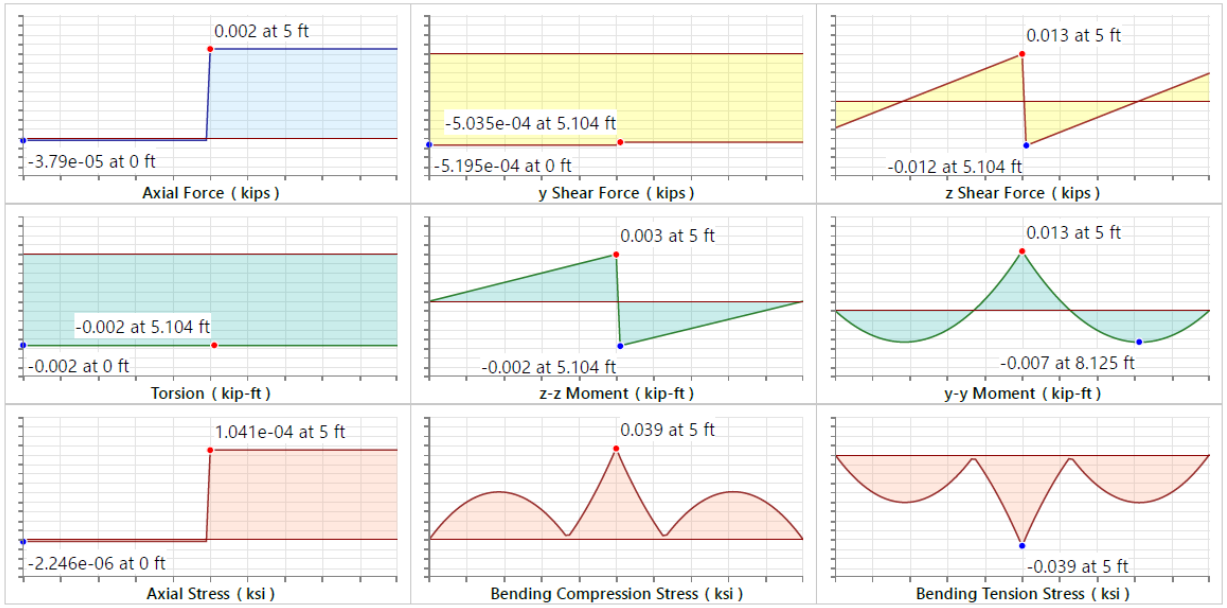
	LC	Node Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N4	0.131	5.203	-5.538	-0.654	0.036	-0.07
2	1	N1	0.037	5.196	5.297	-0.653	0.039	-0.067
3	1	N2	0.103	6.948	7.57	-0.716	0.023	0.033
4	1	N3	-0.089	6.673	-6.503	-0.714	-0.017	0.041
5	1	N9	0.028	0.727	1.051	-2.839	0.135	-0.092
6	1	N11	0.09	1.163	0.603	-4.522	0.005	0.058
7	1	N13	0.101	1.137	0.72	-3.919	-0.003	0.005
8	1	N15	0.134	0.876	0.771	-2.266	-0.09	0.09
9	1	N16	0.123	0.842	-0.759	-1.858	0.096	0.095
10	1	N14	0.602	0.757	-2.616	-1.613	-1.243	-0.129
11	1	N12	-0.501	0.754	-5.752	-1.282	0.537	0.333
12	1	N10	-0.09	0.394	-0.435	-1.528	-0.092	-0.129
13	1	WP3	-1.095	10.608	-8.729	3.057	0	1.127
14	1	WP4	-0.122	2.466	9.928	-63.457	0	0.98
15	1	WP7	0.866	2.919	-1.756	-51.977	0	-1.886
16	1	WP8	0.011	0.878	0.003	-6.223	0	0.098
17	1	WP11	-0.33	13.913	6.144	-217.007	0	-0.923
18	1	N254	NC	NC	NC	LOCKED	NC	NC
19	1	N247	NC	NC	NC	LOCKED	NC	NC
20	1	N240	NC	NC	NC	LOCKED	NC	NC
21	1	N233	NC	NC	NC	LOCKED	NC	NC
22	1	N226	NC	NC	NC	LOCKED	NC	NC
23	1	N221	NC	NC	NC	LOCKED	NC	NC
24	1	Totals:	0	61.455	0			
25	1	COG (ft):	NC	NC	NC			

Detailed Report of Joist



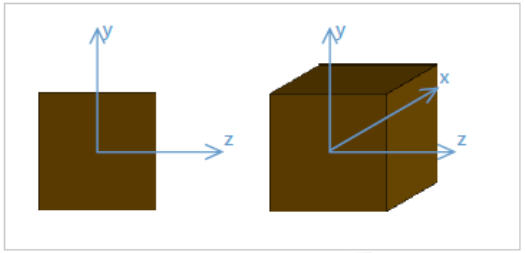
Input Data:

Shape:	2X12 (nominal)	I Node:	N107
Member Type:	Beam	J Node:	N135
Length (ft):	10	I Release:	BenPIN
Material Type:	Wood	J Release:	BenPIN
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	97	J Offset (in):	N/A



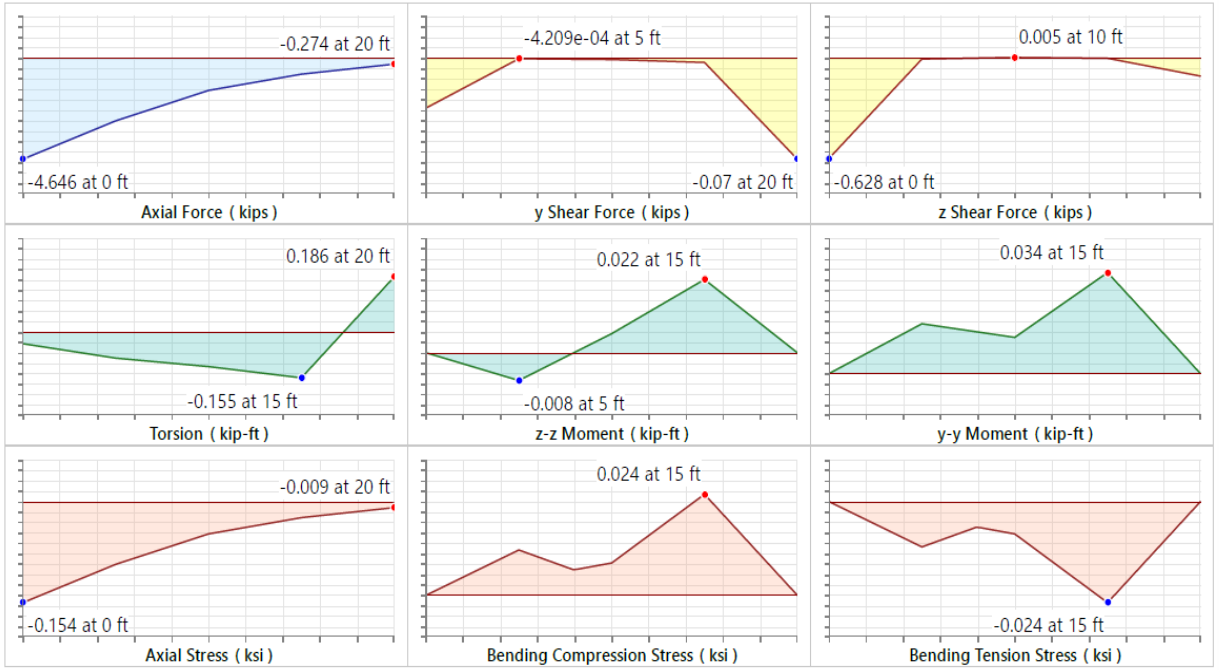
Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	-	-	-	-
Applied Loading - Shear + Torsion	-	-	-	-
Axial Compression Analysis	0.000 ksi	0.065 ksi	-	-
Axial Tension Analysis	0.000 ksi	0.45 ksi	-	-
Flexural Analysis, Fb1'	0.001 ksi	0.763 ksi	-	-
Flexural Analysis, Fb2'	0.038 ksi	1.05 ksi	-	-
Bending & Axial Compression Analysis	-	-	0.038	Pass
Bending & Axial Tension Analysis	-	-	0.037	Pass
Shear Analysis	0.005 ksi	0.135 ksi	0.034	Pass

Detailed Report of Column



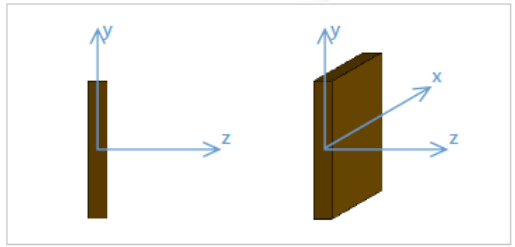
Input Data:

Shape:	6X6 (nominal)	I Node:	N4
Member Type:	Beam	J Node:	N5
Length (ft):	20	I Release:	BenPIN
Material Type:	Wood	J Release:	BenPIN
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	5	J Offset (in):	N/A



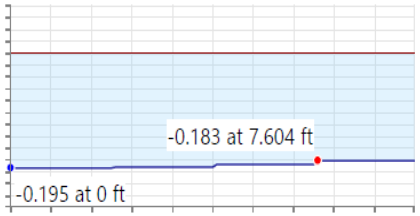
Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	-	-	-	-
Applied Loading - Shear + Torsion	-	-	-	-
Axial Compression Analysis	0.000 ksi	0.191 ksi	-	-
Axial Tension Analysis	-0.154 ksi	0.55 ksi	-	-
Flexural Analysis, Fb1'	0.006 ksi	0.85 ksi	-	-
Flexural Analysis, Fb2'	0.114 ksi	0.629 ksi	-	-
Bending & Axial Compression Analysis	-	-	0.467	Pass
Bending & Axial Tension Analysis	-	-	0.467	Pass
Shear Analysis	0.07 ksi	0.125 ksi	0.56	Pass

Detailed Report of Girder

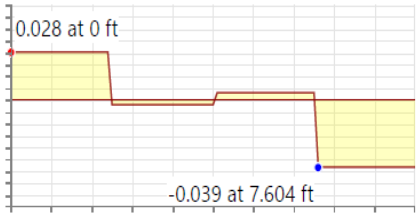


Input Data:

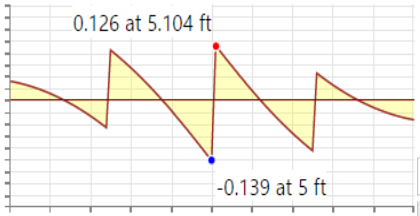
Shape:	2X12 (nominal)	I Node:	N243
Member Type:	Beam	J Node:	N236
Length (ft):	10	I Release:	Fixed
Material Type:	Wood	J Release:	Fixed
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	97	J Offset (in):	N/A



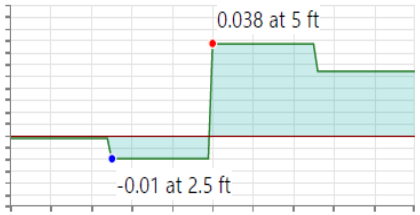
Axial Force (kips)



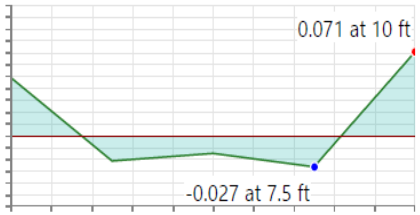
y Shear Force (kips)



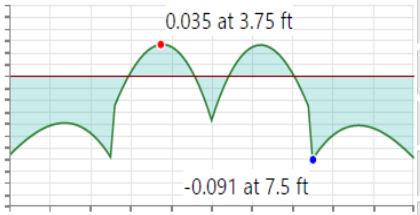
z Shear Force (kips)



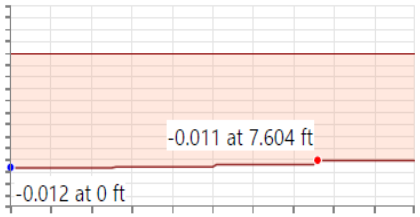
Torsion (kip-ft)



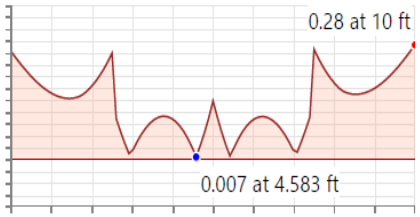
z-z Moment (kip-ft)



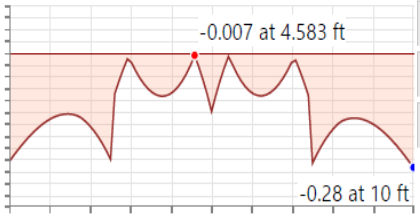
y-y Moment (kip-ft)



Axial Stress (ksi)



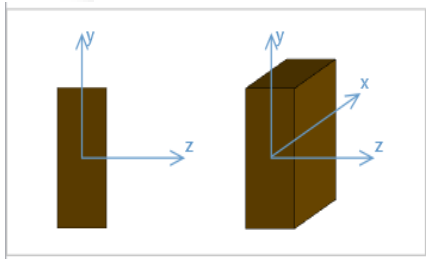
Bending Compression Stress (ksi)



Bending Tension Stress (ksi)

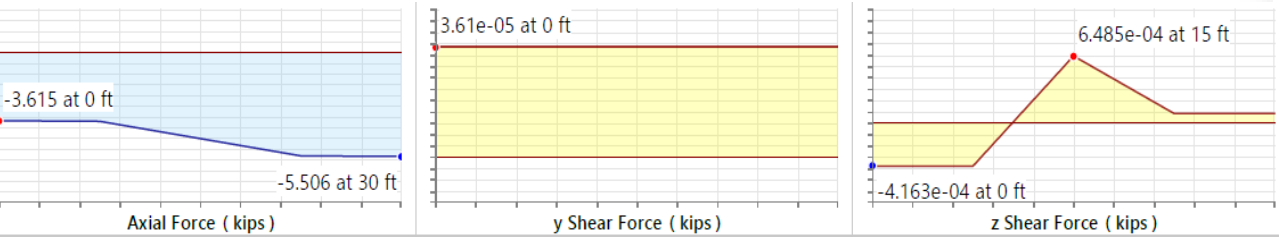
Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	-	-	-	-
Applied Loading - Shear + Torsion	-	-	-	-
Axial Compression Analysis	0.000 ksi	0.065 ksi	-	-
Axial Tension Analysis	-0.011 ksi	0.45 ksi	-	-
Flexural Analysis, Fb1'	0.027 ksi	0.763 ksi	-	-
Flexural Analysis, Fb2'	0.253 ksi	1.05 ksi	-	-
Bending & Axial Compression Analysis	-	-	0.296	Pass
Bending & Axial Tension Analysis	-	-	0.296	Pass
Shear Analysis	0.071 ksi	0.135 ksi	0.525	Pass

Detailed Report of Truss



Input Data:

Shape:	2X4 (nominal)	I Node:	N226
Member Type:	Beam	J Node:	N230
Length (ft):	15.811	I Release:	BenPIN
Material Type:	Wood	J Release:	BenPIN
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	5	J Offset (in):	N/A

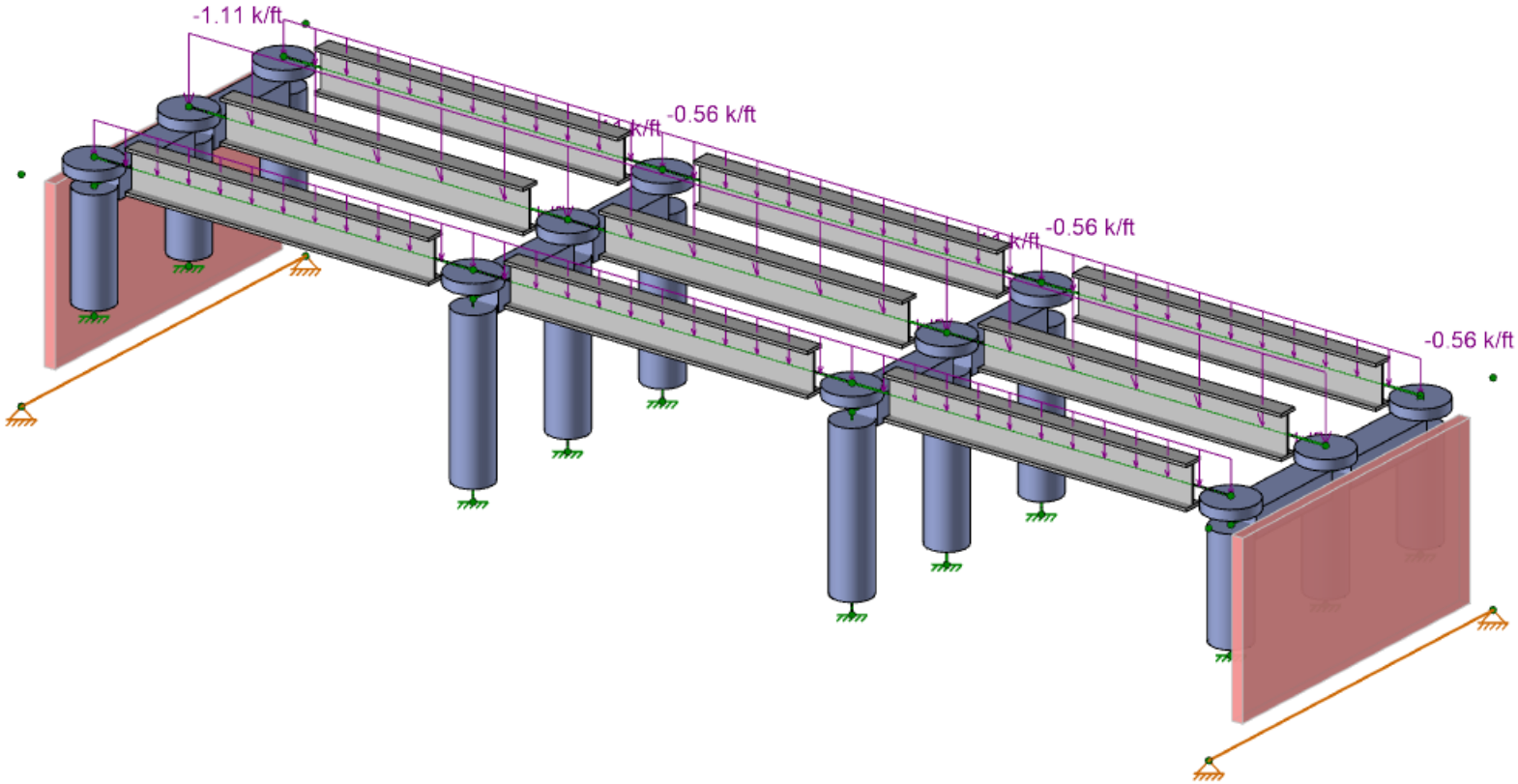


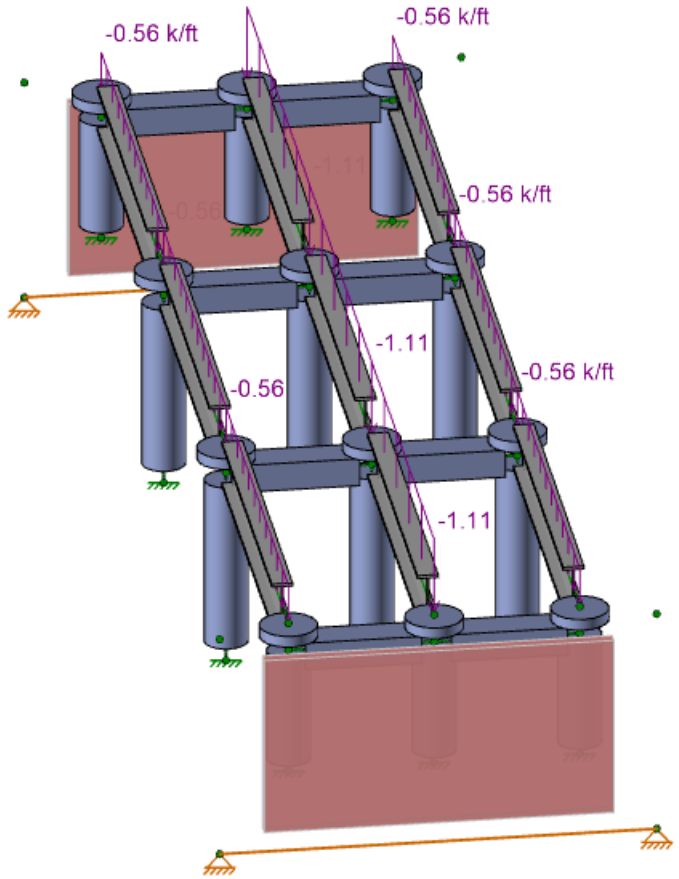
Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	-	-	-	-
Applied Loading - Shear + Torsion	-	-	-	-
Axial Compression Analysis	0.000 ksi	0.007 ksi	-	-
Axial Tension Analysis	-0.326 ksi	0.45 ksi	-	-
Flexural Analysis, Fb1'	0.000 ksi	0.331 ksi	-	-
Flexural Analysis, Fb2'	0.000 ksi	1.05 ksi	-	-
Bending & Axial Compression Analysis	-	-	0.725	Pass
Bending & Axial Tension Analysis	-	-	0.725	Pass
Shear Analysis	0.007 ksi	0.135 ksi	0.05	Pass

House Cost Analysis

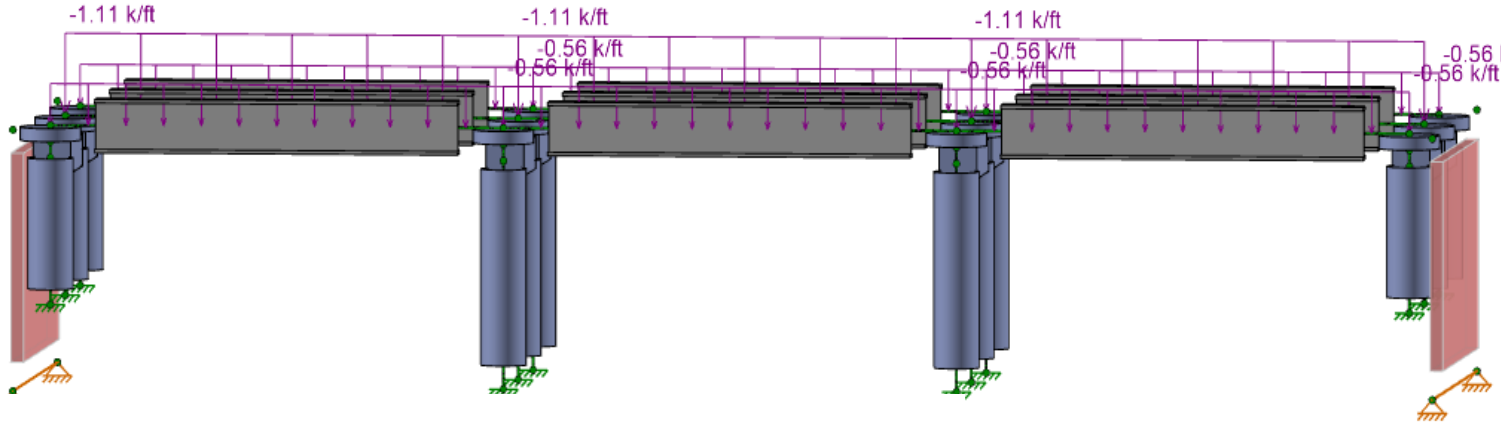
Type	Size	# of Pieces	Total Length	Cost per unit	Total Cost
SPF	2X4	48	543.6	$8.15	$391.20
SPF	2X6	12	252	$21.15	$253.80
SPF	2X8	48	950	$25.60	$1,228.80
SPF	2X12	168	2010	$22.15	$3,721.20
SPF	6X6	20	240	$45.18	$903.60
				Total Cost:	$6,498.60

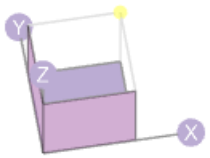
RISA Bridge Model

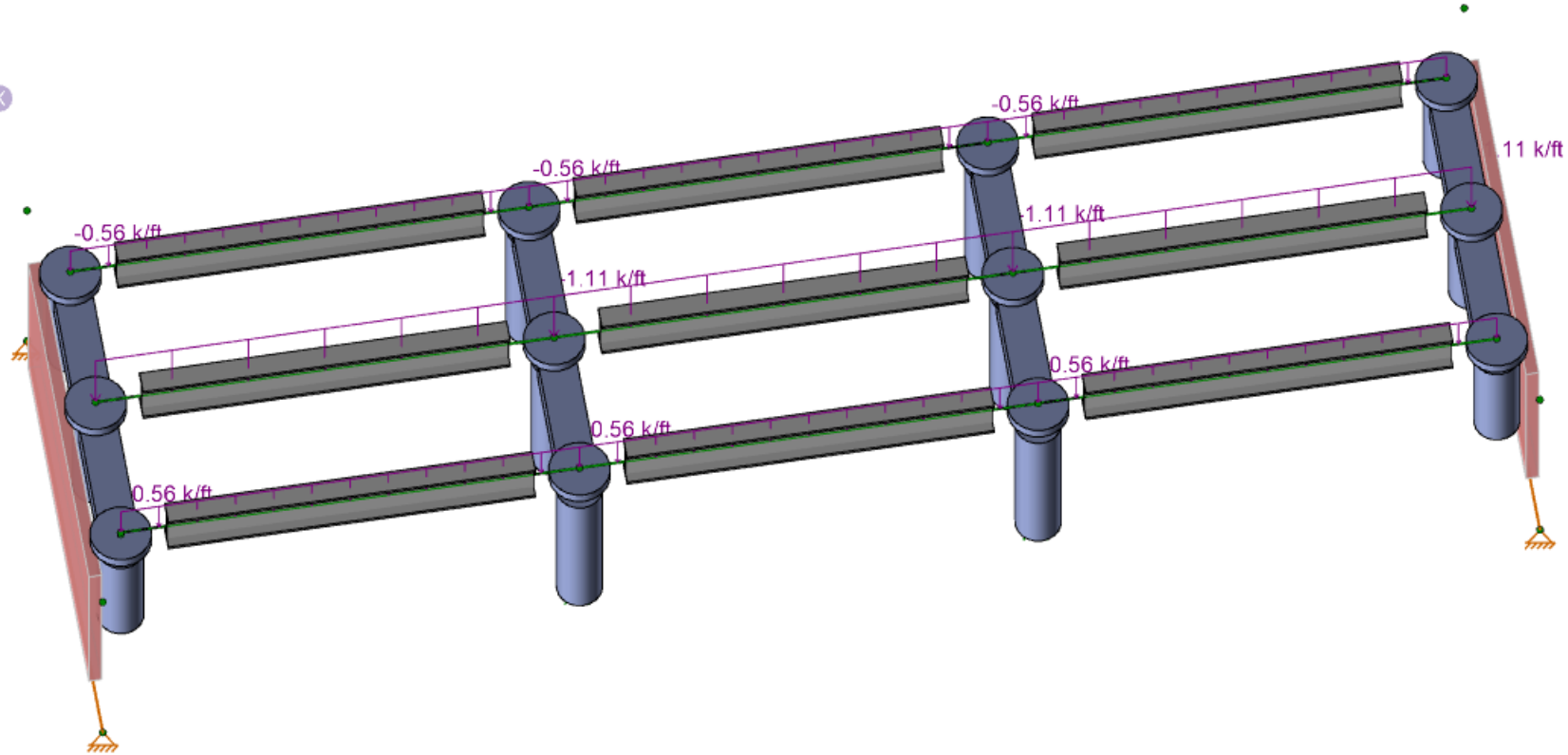




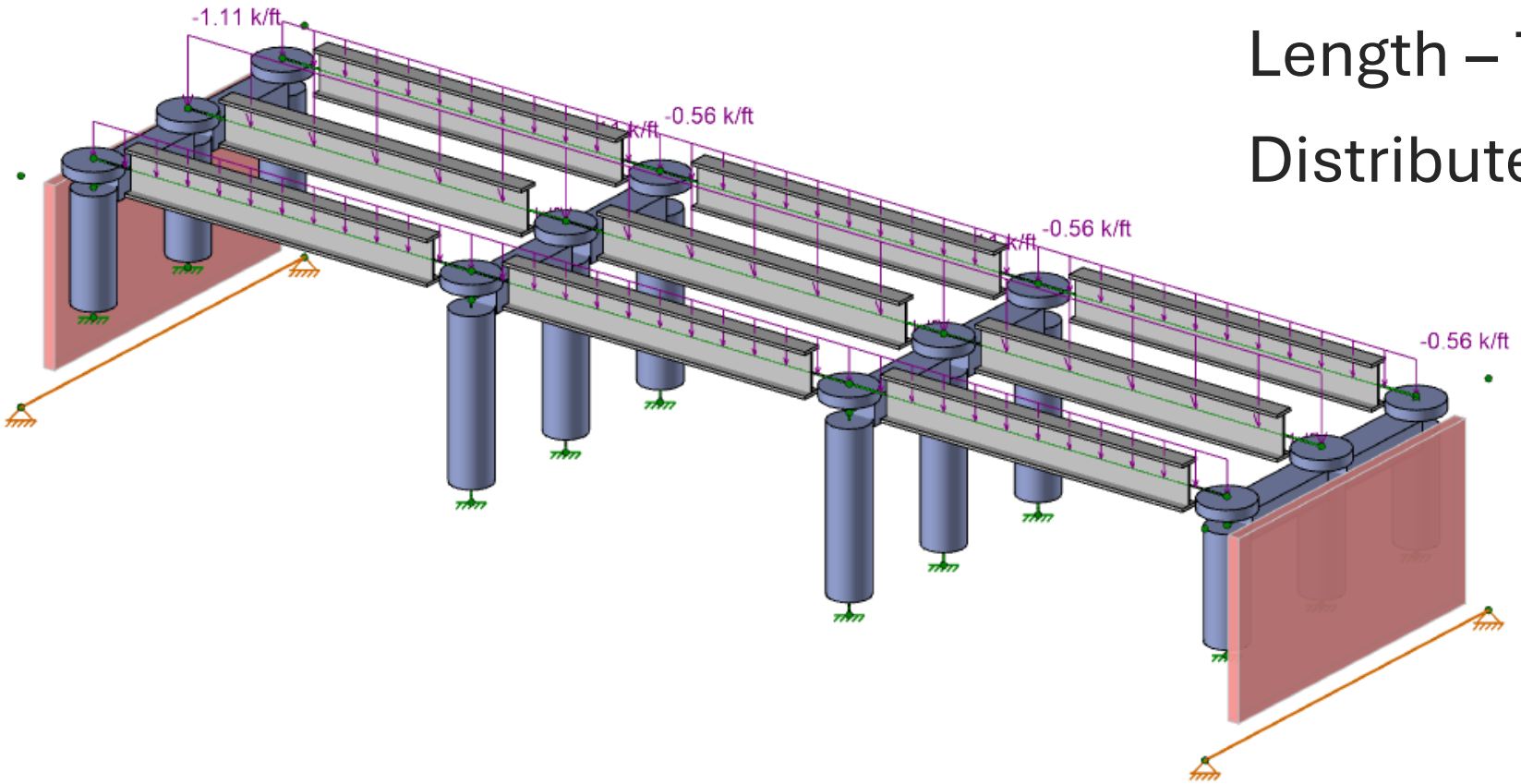
RISA Bridge Model







Bridge Load Calculations



Maximum Truck Load – 80 kips

Length – 72’

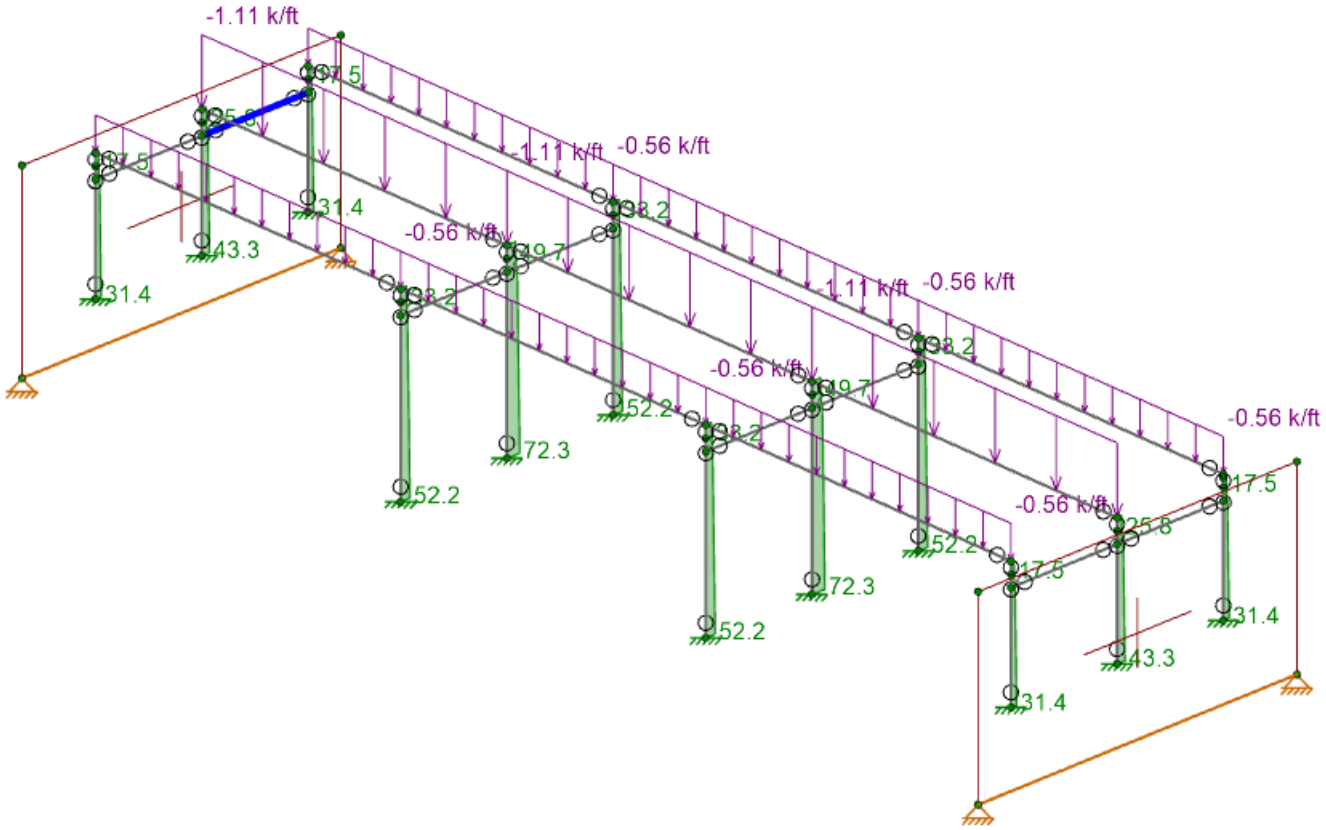
Distributed Load = 1.11kip/ft

Node Reactions

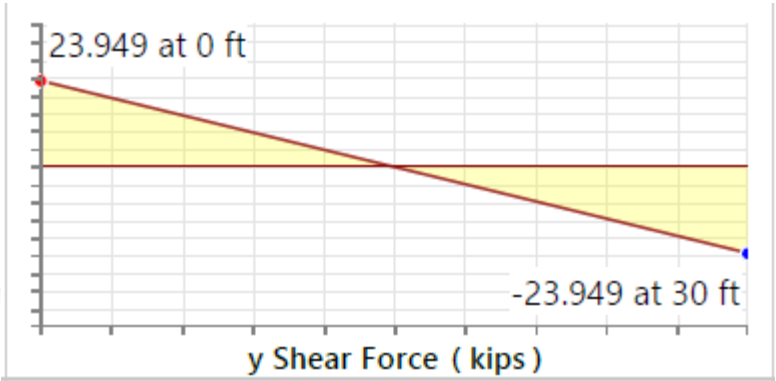
Node Reactions (By Combination)

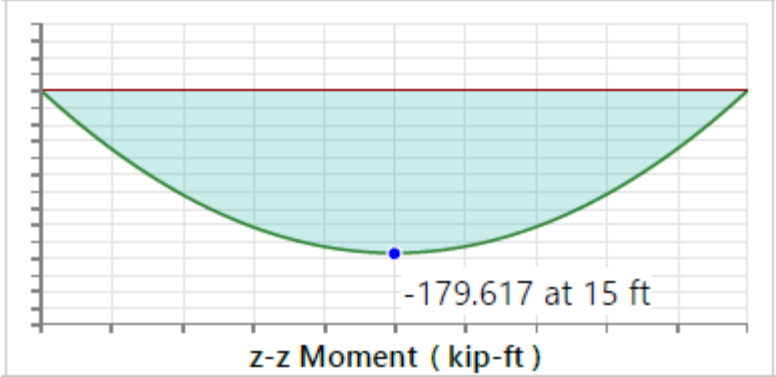
	LC	Node Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	0	0	52.219	0	0	0
2	1	N3	0	0	72.344	0	0	0
3	1	N5	0	0	52.219	0	0	0
4	1	N13	0	0	52.219	0	0	0
5	1	N15	0	0	72.344	0	0	0
6	1	N17	0	0	52.219	0	0	0
7	1	N25	0	0	31.396	0	0	0
8	1	N27	0	0	43.271	0	0	0
9	1	N29	0	0	31.396	0	0	0
10	1	N37	0	0	43.271	0	0	0
11	1	N38	0	0	31.396	0	0	0
12	1	N41	0	0	31.396	0	0	0
13	1	WP1	0	0	26.774	0	0	0
14	1	WP2	0	0	26.774	0	0	0

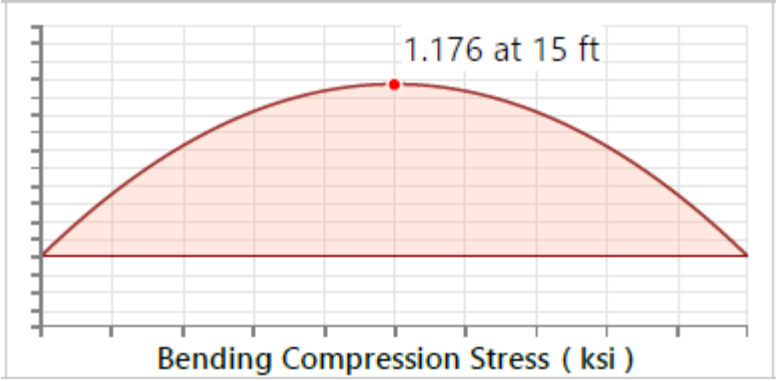
Bridge Load Reactions

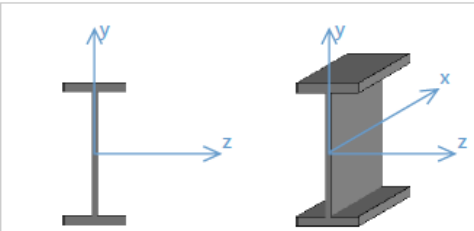


Detailed Report of Middle Beam







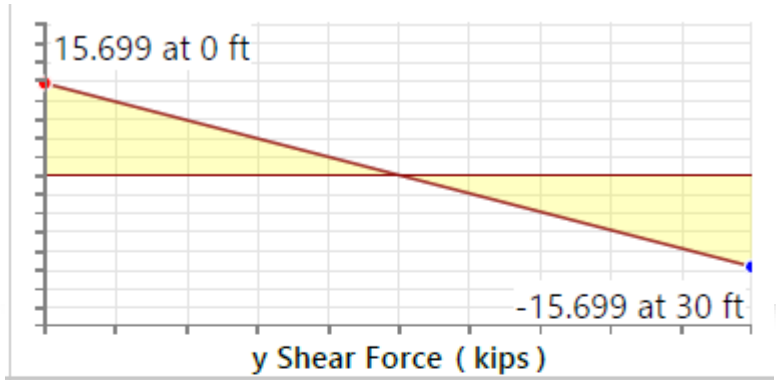


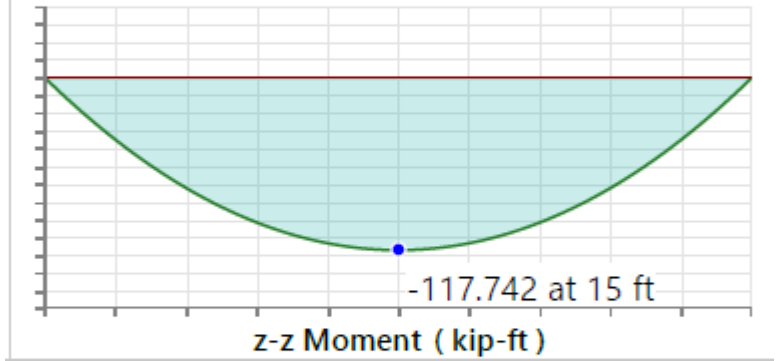
Input Data:

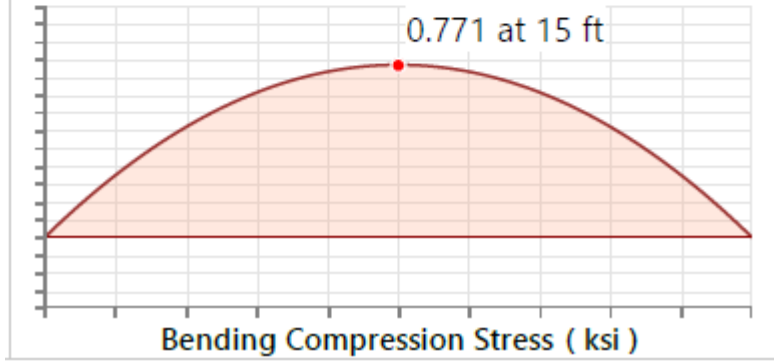
Shape:	W36X487	I Node:	N23
Member Type:	Beam	J Node:	N11
Length (ft):	30	I Release:	BenPIN
Material Type:	Hot Rolled Steel	J Release:	BenPIN
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	97	J Offset (in):	N/A

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion	-	-	-	-
Axial Tension Analysis	0.000 k	4281.437 k	-	-
Axial Compression Analysis	0.000 k	2344.416 k	-	-
Flexural Analysis (Strong Axis)	179.617 k-ft	5202.121 k-ft	-	-
Flexural Analysis (Weak Axis)	0.000 k-ft	1027.944 k-ft	-	-
Shear Analysis (Major Axis y)	23.949 k	1179 k	0.02	Pass
Shear Analysis (Minor Axis z)	0.000 k	1646.515 k	0.000	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.035	Pass

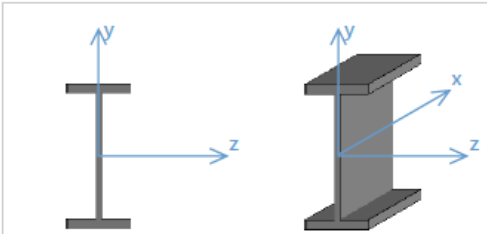
Detailed Report of Outside Beam







Detail Report: M40



Unity Check: 0.023 (axial/bending)

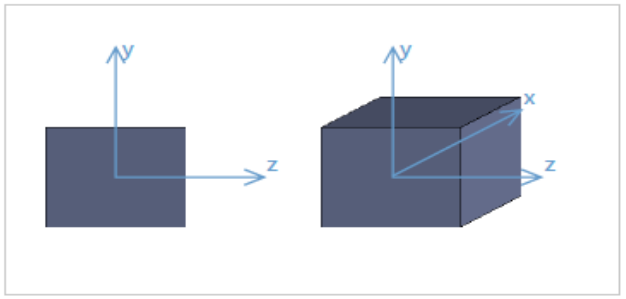
Load Combination: LC 1: DL+LL

Input Data:

Shape:	W36X487	I Node:	N12
Member Type:	Beam	J Node:	N24
Length (ft):	30	I Release:	BenPIN
Material Type:	Hot Rolled Steel	J Release:	BenPIN
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	97	J Offset (in):	N/A

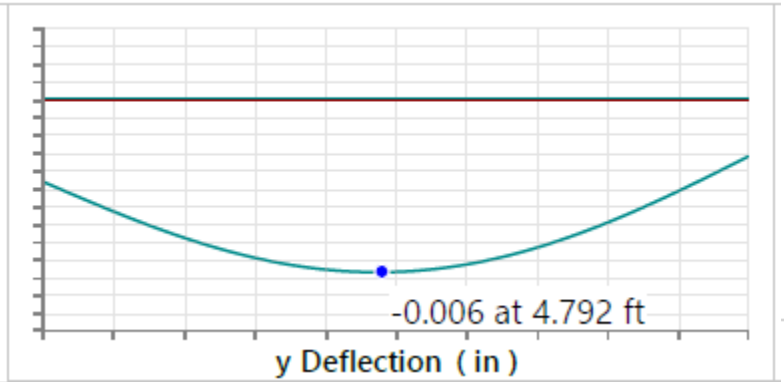
Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion	-	-	-	-
Axial Tension Analysis	0.000 k	4281.437 k	-	-
Axial Compression Analysis	0.000 k	2344.416 k	-	-
Flexural Analysis (Strong Axis)	117.742 k-ft	5202.121 k-ft	-	-
Flexural Analysis (Weak Axis)	0.000 k-ft	1027.944 k-ft	-	-
Shear Analysis (Major Axis y)	15.699 k	1179 k	0.013	Pass
Shear Analysis (Minor Axis z)	0.000 k	1646.515 k	0.000	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.023	Pass

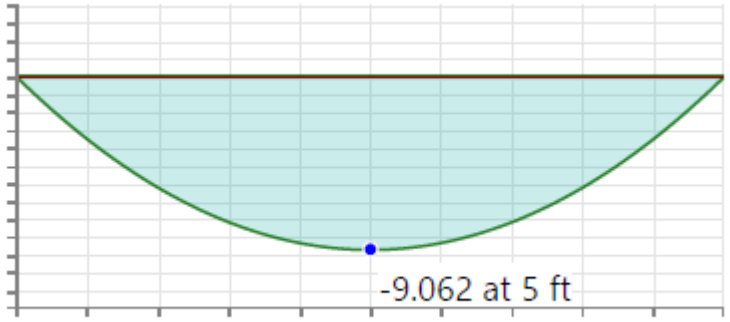
Detailed Report of Column Connector



Input Data:

Shape:	CRECT24X30	I Node:	N20
Member Type:	Beam	J Node:	N21
Length (ft):	10	I Release:	BenPIN
Material Type:	Concrete	J Release:	BenPIN
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	97	J Offset (in):	N/A
Design Code:	ACI 318-19		





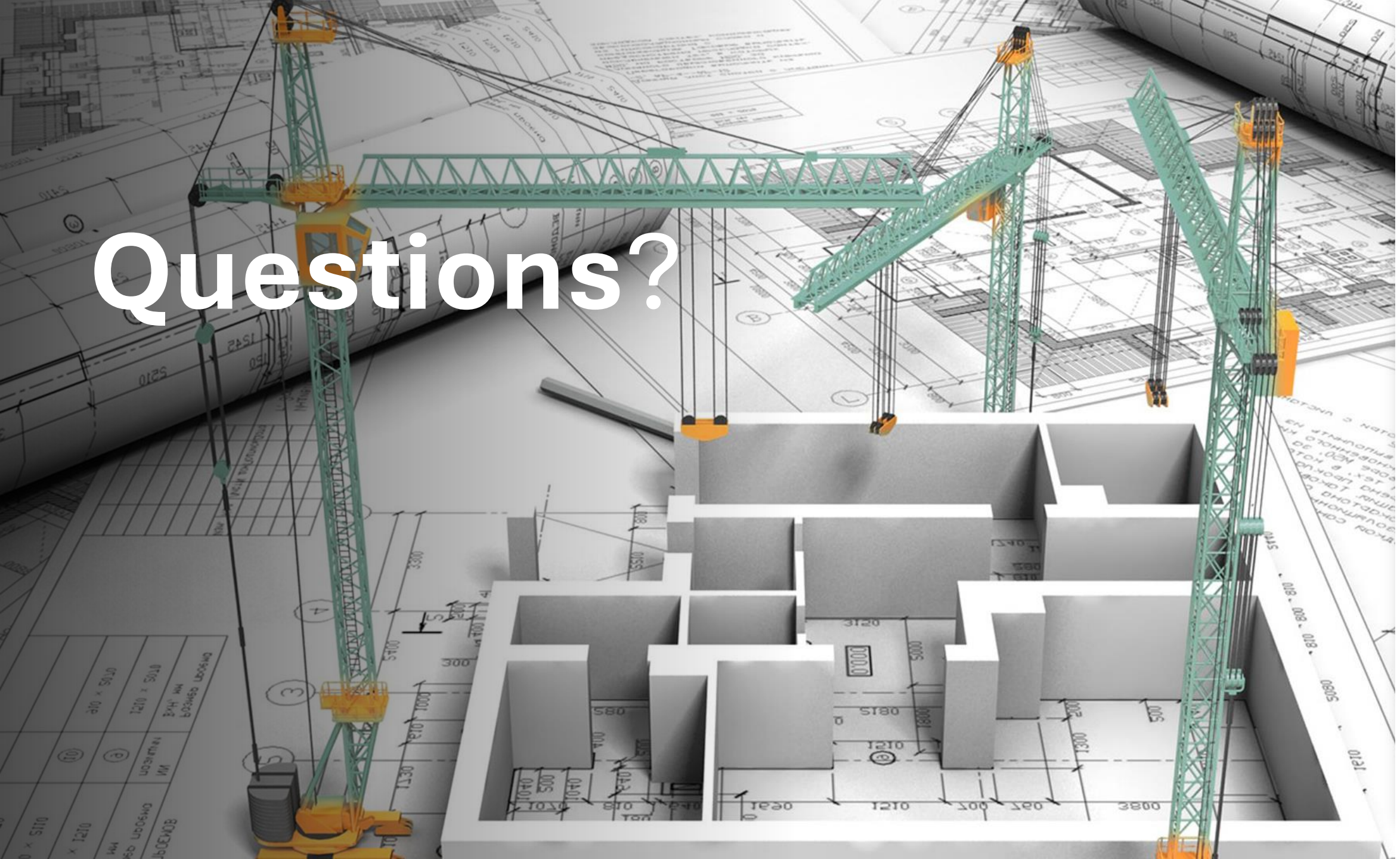
Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial					
Applied Loading - Shear					
Bottom Bending Steel Requirements		0.214 bars	4 bars	-	Pass
Bottom Flexural Minimum		4.895 bars	4 bars	-	
Bottom 4/3 Requirement					
Bottom Bending Check		9.062 k-ft	167.832 k-ft	0.054	Pass
Threshold Torsion		0.000 k-ft	18.974 k-ft	1	Pass
Shear Design Strength		2.341 k	61.546 k	0.038	Pass
Shear Reinforcement Required		30.773 k	-	-	-

Bridge Cost Analysis

Material	Size	Pieces	Length (ft)	Weight (kips)	Unit Cost	Total Cost
Hot Rolled Steel A992	W36X487	9	270	131.381	$375 per 1000 lbs	$49,267.88

Material	Size	Pieces	Volume (yds^3)	Weight (kips)	Unit Cost	Total Cost
Masonry Walls		2	28.5	61.599	$117 per yds^3	3334.5
Concrete Matl						

Material	Size	Pieces	Volume (yds^3)	Weight (kips)	Unit Cost	Total Cost
Conc4000NW	CRECT24X30	8	14.8	58	$117 per yds^3	6984.9
Conc4000NW	CRND36	12	39.3	153.742		
Conc4000NW	CRND48	12	5.6	21.865		
		Total Volume of Concrete:	59.7			
					Total Cost:	$59,587.28


Questions?