PRCTI20221788

ABKJ
ANDERSEN • BJORNSTAD • KANE • JACOBS

Consulting Civil and Structural Engineers

STRUCTURAL ENGINEERING CALCULATIONS

Tel: 206.340.2255 | Fax: 206.340.2266 | www.abkj.com

City of Puyallup
Building
ACCEPTED
JMontgomery
12/15/2022
2:20:59 PM

THE APPROVED CONSTRUCTION PLANS, DOCUMENTS AND ALL ENGINEERING MUST BE POSTED ON THE JOB AT ALL INSPECTIONS IN A VISIBLE AND READILY ACCESSIBLE LOCATION.

FULL SIZED LEDGIBLE COLOR PLANS ARE REQUIRED TO BE PROVIDED BY THE PERMITEE ON SITE FOR INSPECTION

Date **11/11/22**
ABKJ Project Number **21035**

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

PROJECT NAME

GSH OR#1

Structural Calculations

PROJECT LOCATION

Puyallup, WA

GREGORY J. LEE
STATE OF WASHINGTON
41387
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER

Digitally signed by Gregory J Lee
Date: 2022.11.15 16:24:33-08'00'

Expires: 06/02/2023

Submitted to:

DLR Group | Salus
Dale Anderson
(206)-461-6000

PRCTI20221788

Table of Contents

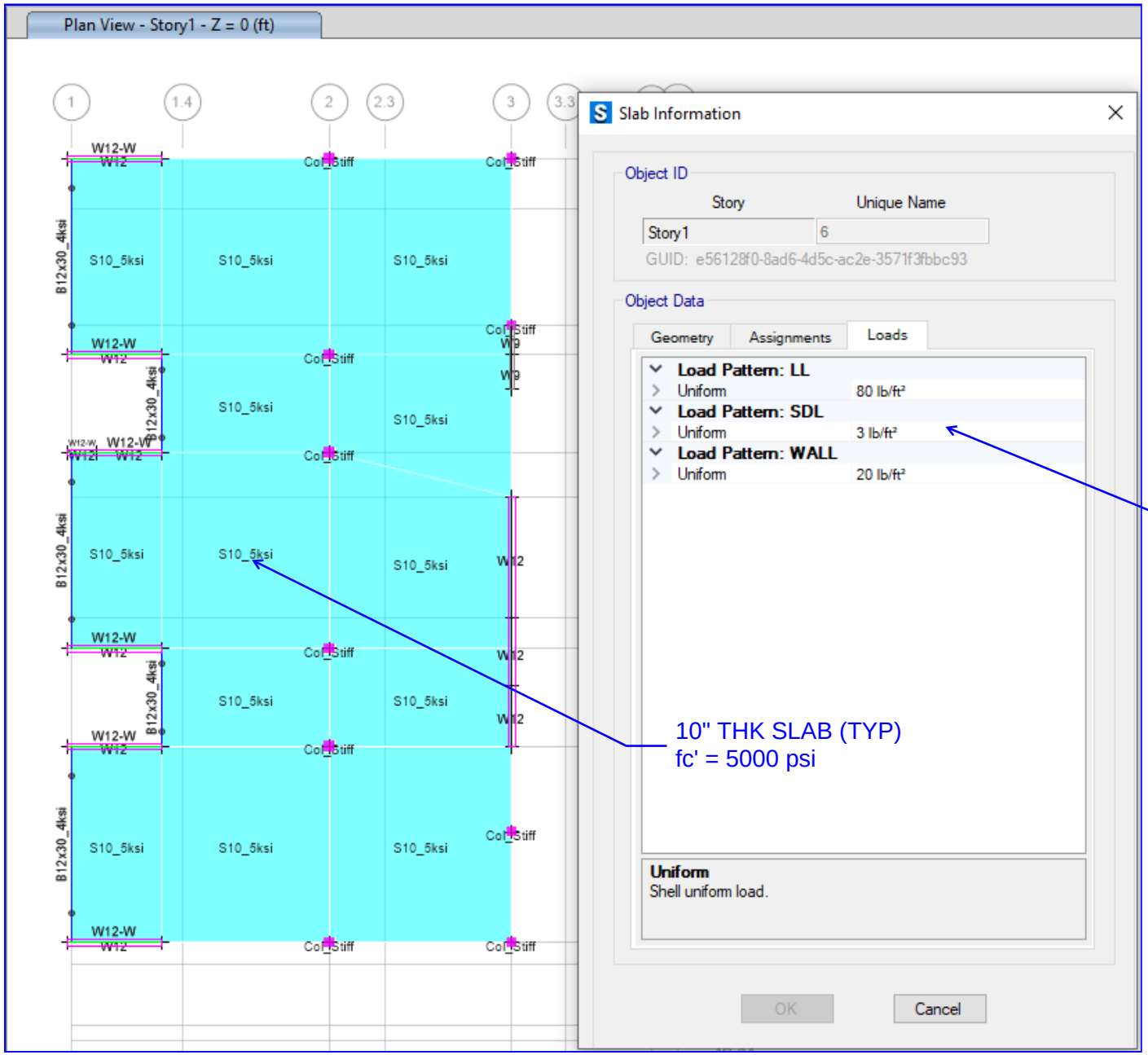
PRCTI20221788

GSH OR# 1:

EXISTING L2 CONC SLAB BETWEEN GRID (M-N & 1-2)

PRCTI20221788

L02 SLAB AND LOADS CONSIDERED IN SAFE MODEL:



Live load = 80 psf
Partitions = 20 psf

SDL = 3.0 psf (Vinyl Flooring)

10" THK SLAB (TYP)
fc' = 5000 psi

PRCTI20221788

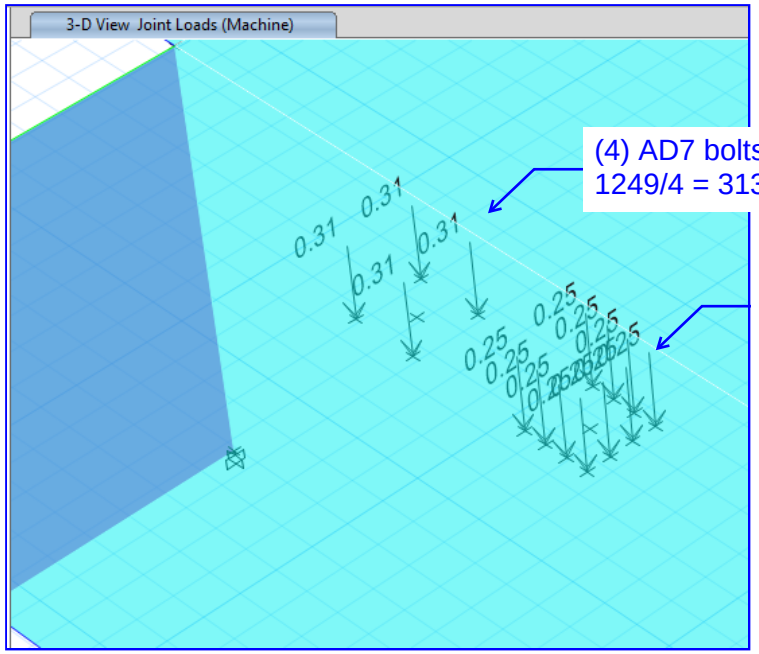
LOAD PATTERNS AND COMBINATIONS:

LOAD PATTERNS:	
DL	DEAD LOAD
SDL	SUPER IMP DL
WALL	WALL LOAD
LL	FLOOR LL
MR0	Machine Rotation 0deg
MR90	Machine Rotation 90deg
MR180	Machine Rotation 180deg
MR270	Machine Rotation 270deg
Machine	AD7 & Floor Clea Gravity Load

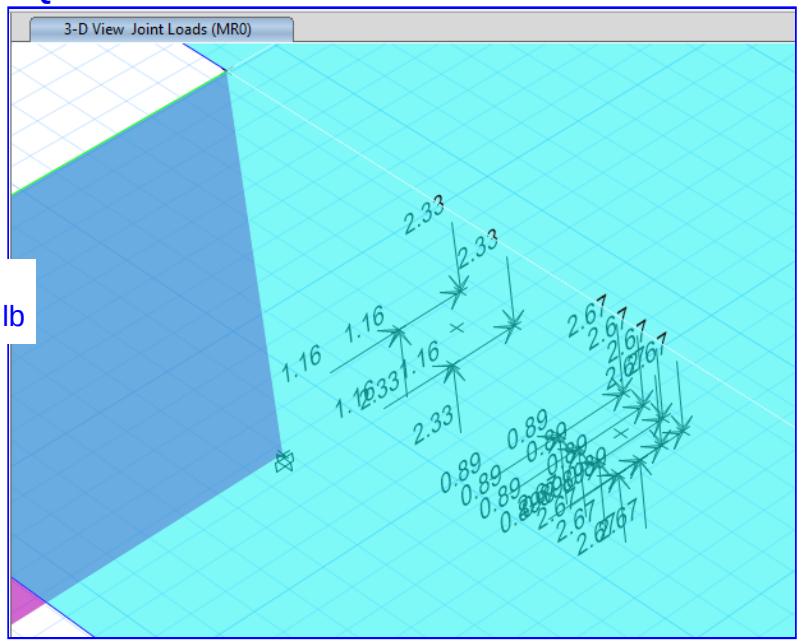
LOAD COMB:	
SERVICE COMBINATION:	
SV01	1.0(DL+SDL+WALL)+1.0LL+1.0(Mach)+1.0MR0
SV02	1.0(DL+SDL+WALL)+1.0LL+1.0(Mach)+1.0MR90
SV03	1.0(DL+SDL+WALL)+1.0LL+1.0(Mach)+1.0MR180
SV04	1.0(DL+SDL+WALL)+1.0LL+1.0(Mach)+1.0MR270
SV05	1.0(DL+SDL+WALL)+1.0LL+1.0(Mach)
SV06	1.0(DL+SDL+WALL)+1.0LL
Strength Combination :	
ST01	1.4(DL+SDL+WALL)
ST02	1.2(DL+SDL+WALL)+1.6LL+1.6Mach+1.6MR0
ST03	1.2(DL+SDL+WALL)+1.6LL+1.6Mach+1.6MR90
ST04	1.2(DL+SDL+WALL)+1.6LL+1.6Mach+1.6MR180
ST05	1.2(DL+SDL+WALL)+1.6LL+1.6Mach+1.6MR270
ST06	1.2(DL+SDL+WALL)+1.6LL+1.6Mach
ST07	1.2(DL+SDL+WALL)+1.6LL

EQUIPMENT LOAD: (FLOOR CLEA AND AD7)

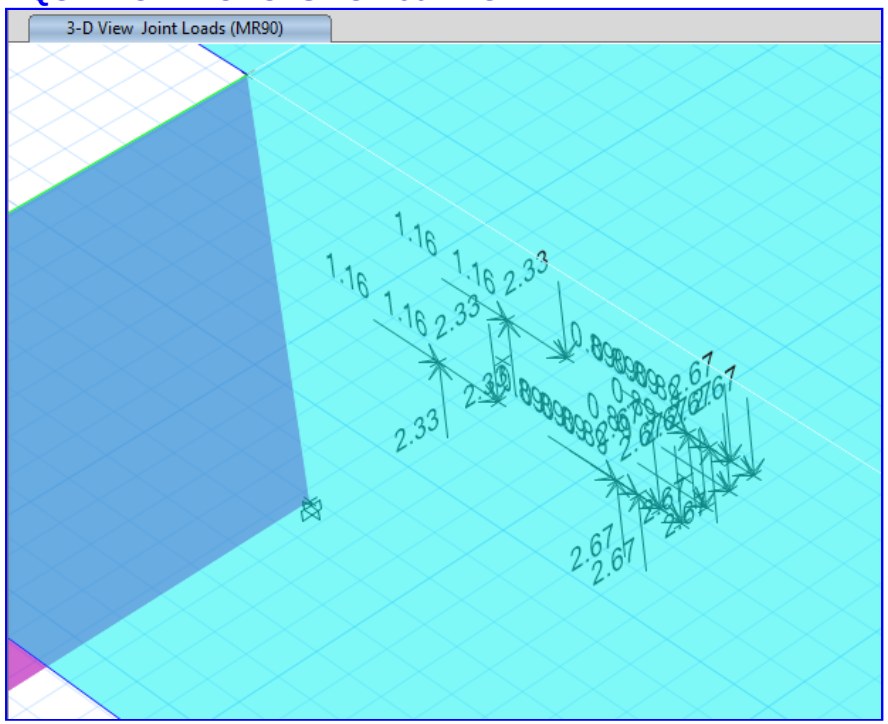
PRCTI20221788



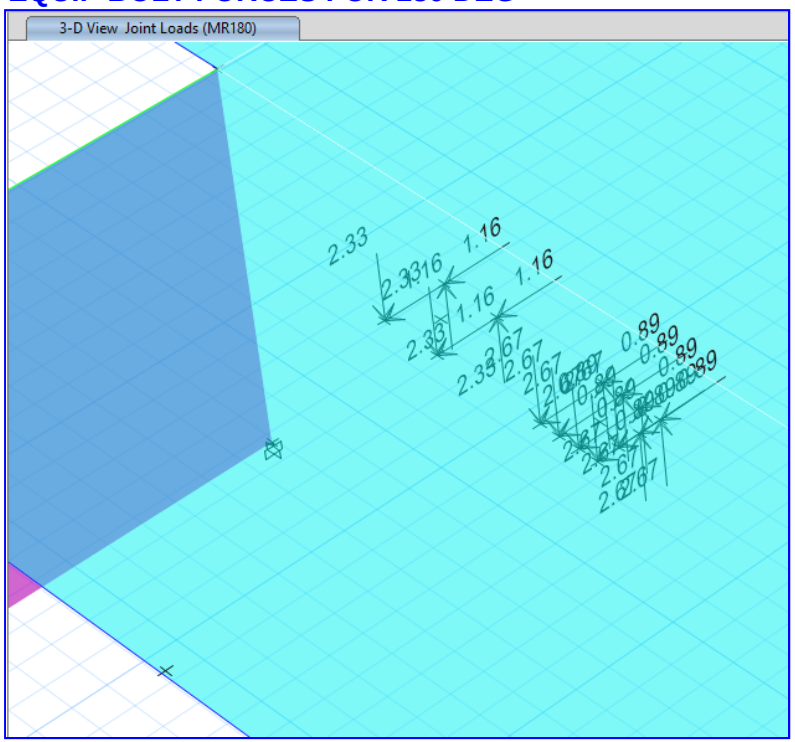
EQUIP BOLT FORCES FOR 0 DEG



EQUIP BOLT FORCES FOR 90 DEG



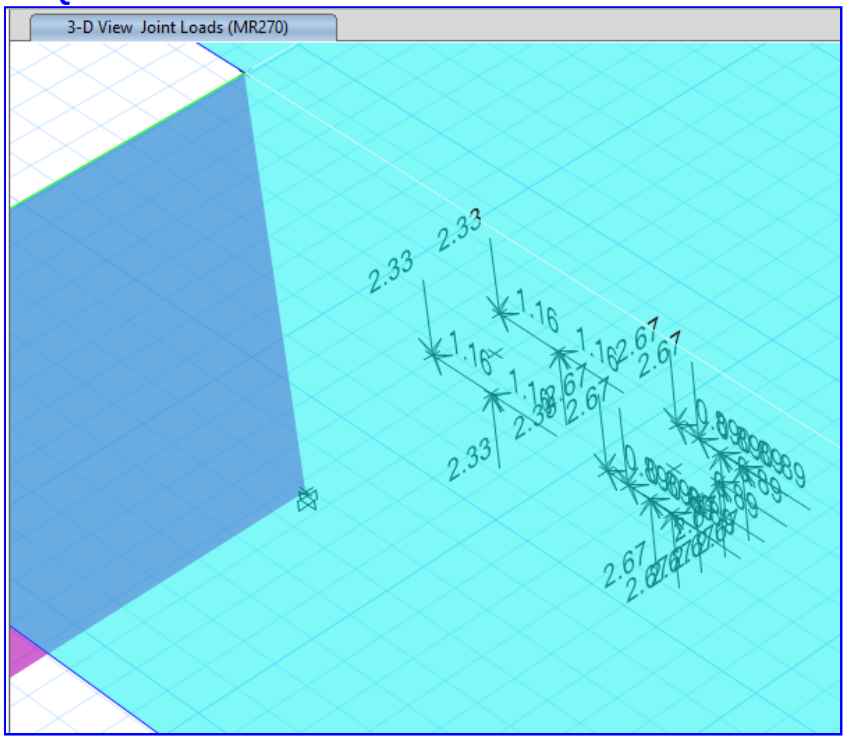
EQUIP BOLT FORCES FOR 180 DEG

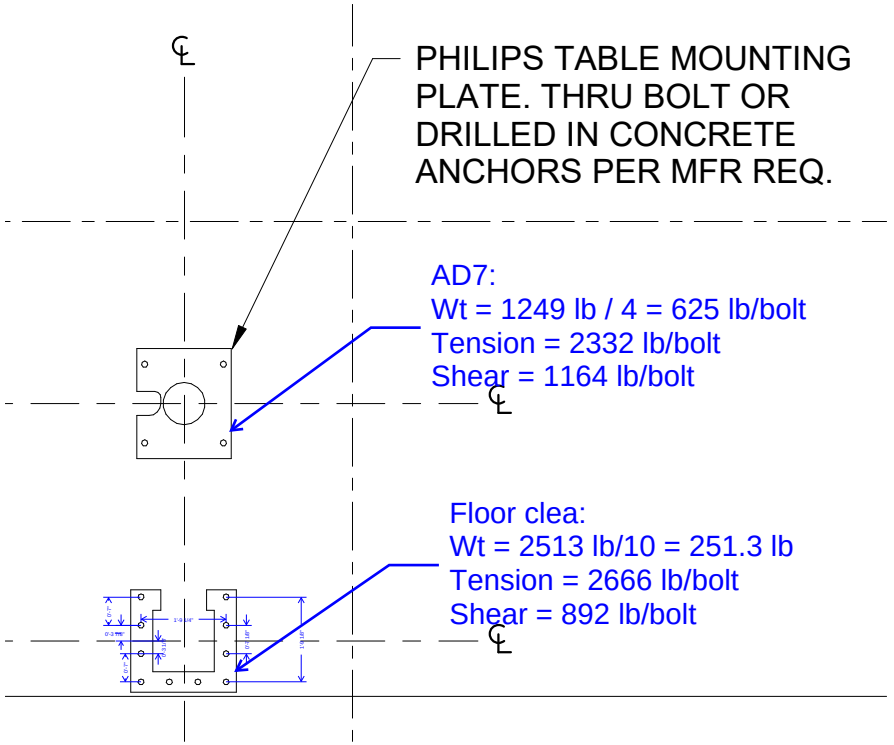


FOR LOAD REFERENCES REFER NEXT PAGE

PRCTI20221788

EQUIP BOLT FORCES FOR 270 DEG





	Floor Clea	
SP	Weight	Heat Dissipation
	2513 lbs	1706 BTU/hr

	Angio Diagnost 7 with Swivel	
MSA	Weight	Heat Dissipation
	1249 lbs	205 BTU/hr

Philips equipment weights

Floor Clea
Floor Plate to Floor Bolt Forces:
(Tension) Tmax = 2666 lbs/bolt
(Shear) Vmax = 892 lbs/bolt

AD7 Swivel Table
Floor Plate to Floor Bolt Forces:
(Tension) Tmax = 2332 lbs/bolt
(Shear) Vmax = 1164 lbs/bolt

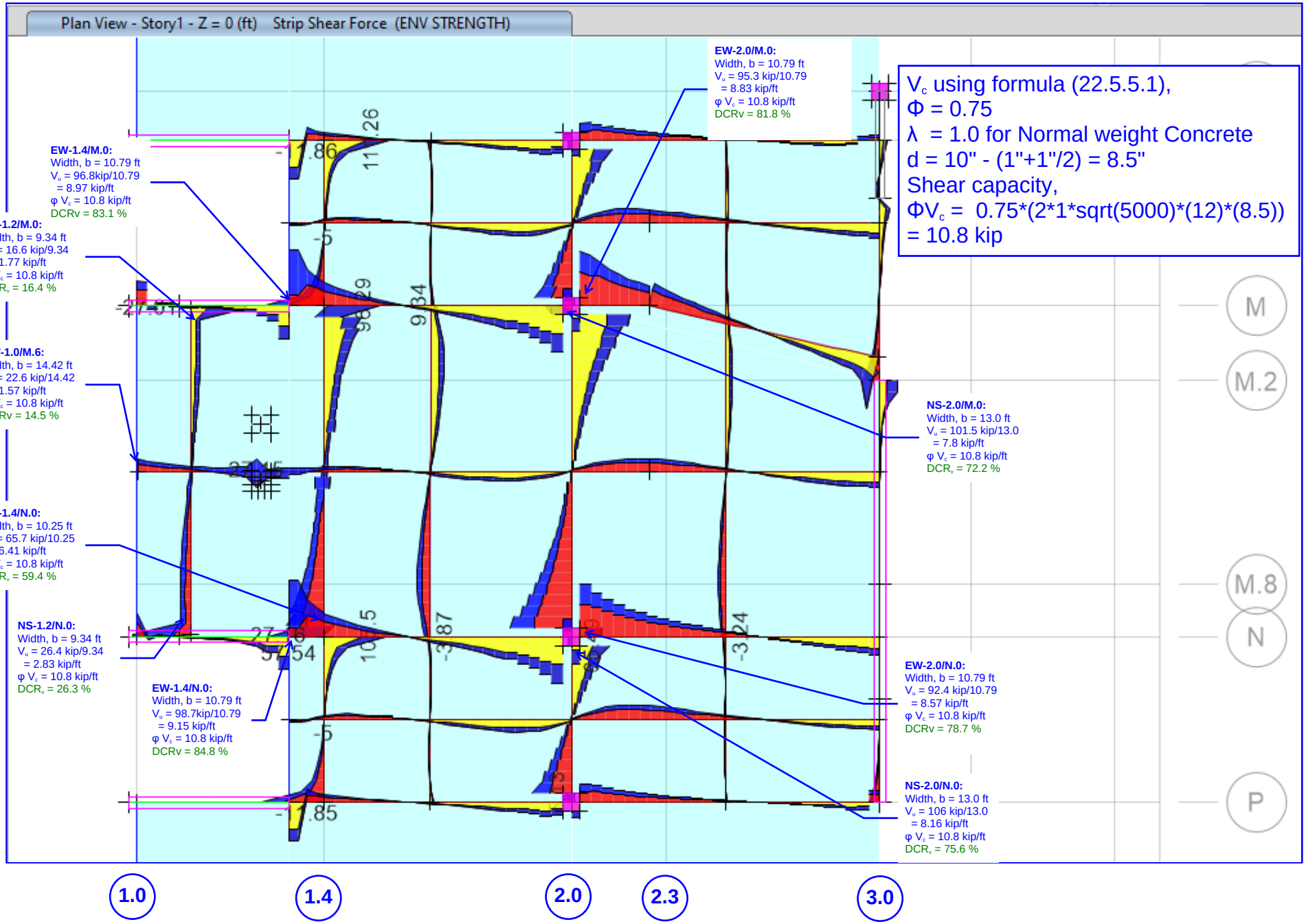
SP MSA

(19.0)

Philips table and Clea base plate maximum bolt forces

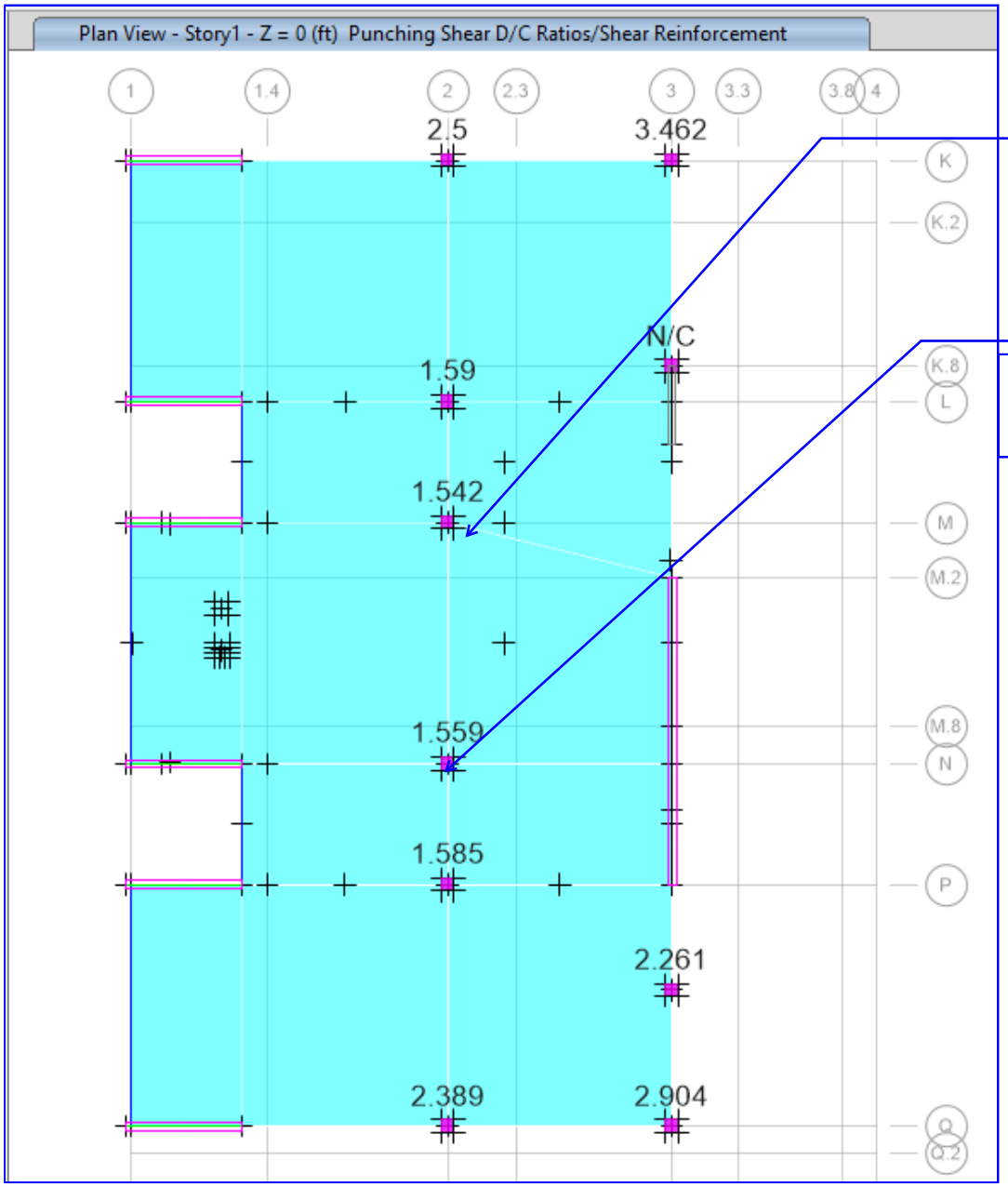
PRCTI20221788

ONE WAY SHEAR CHECK:



PRCTI20221788

PUNCHING SHEAR CHECK:



Grid: M.0/2.0

Shear Force = 194.71 kip

Unbalanced Moment Mu2 = -14.339 kip-ft

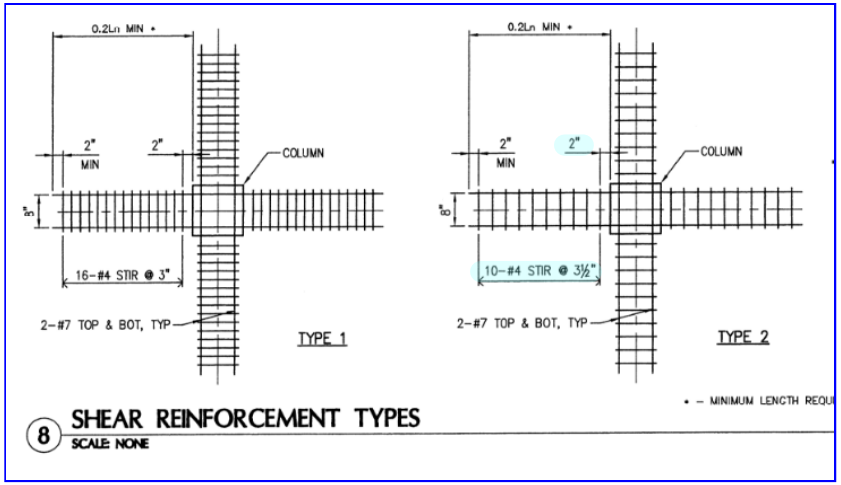
Unbalanced Moment Mu3= 51.831 kip-ft

Grid: N.0/2.0

Shear Force = 196.9 kip

Unbalanced Moment Mu2 = -15.364 kip-ft

Unbalanced Moment Mu3= -51.5749 kip-ft



PRCTI20221788

PUNCHING CHECK AT GRID M.0/2.0

CALCULATION OF PUNCHING SHEAR STRESS IN FLAT PLATES (imperial) At column near Grid M.0/2.0			
Compressive strength of concrete in the drop	fc'		5000 psi
Tensile strength of reinforcement steel	fy		60000 psi
Dimension of the column in longer direction	L		18 in
Dimension of the column in shorter direction	B		18 in
Depth of the slab drop	D		10 in
Size effect Mod fact	λs		1
Conc wt factor	λ		1
	β		1
	αs		40
	Φ		0.75
Factored axial load on the column	Vu		194.7 kip
Depth of the slab at critical section	d	depth at a distance of d/2 all around the column face	8.50 in
Effective cover for outer most reinforcement bar	ce		1.50 in
Punching perimeter	bo		106 in
Nominal Punching shear stress	vu	$Vu/(b_o \times d)$	216.1 psi
Punching shear stress due to unbalanced moments	a1	= d/2 +L +d/2	26.50 in
	a2	= d/2 +B +d/2	26.50 in
	α	$= \frac{1}{1+\frac{2}{3}\sqrt{\frac{a1}{a2}}}$	0.60
	M		66.30 k-ft
	J_c	$= I_{yy} + I_{xx}$	108166.9 in4
	τ_{v2}	$= \frac{(1-\alpha)M\,c}{Jc}$	39.0 psi
Maximum pusnching shear stress	$\tau_{v\,max}$	= τv1+τv2	255.1 psi
Permissible shear stress	vc1	4*λ*λs*sqrt(fc')	282.8 psi
	vc2	(2+4/β)*λs*λ*sqrt(fc')	424.3 psi
	vc2	(2+αs*d/b0)*λs*λ*sqrt(fc')	368.2 psi
	Φvc	Φ*min (vc1, vc2, vc3)	212.1 psi
Provide shear reinforcement			

Design Of Shear reinforcement			
Max Permissible conc shear stress with shear reinf	$v_{cr,max}$	Φ*6√fc'	318.2 psi
Permissible conc shear stress with shear reinf	v_{cr}	2*λ*λs*sqrt(fc')	141.4 psi
Req area of shear reinf	Av,rq/S	{[(vu-Φvcr)*min(a1,a2)]/[Φ*fy]}	1.053 in2/ft
No of legs	no	(extent/spacing of the drop panel top bars)	2
Dia of shear reinforcement	dia		0.500 in
Spacing prov	S		3.50 in
Prov area of shear reinf	Av,pr/S	$= \frac{No\ of\ legs * Asv\ * 12}{S}$	1.346 in2/ft
Reinf shear stress	vs	Av,pr * fy/ (min(a1,a2)*S)	254.0 psi
	Φ(vcr +vs)		296.6 psi
DCRv at first critical section with stirrups			86.0%
Req Second Perimeter at critical section	b1,req	Vu/(Φvcr*d)	216 in
Req Stirrups termination distance+d/2	at,rq	{b1-2(L+B)}/{4√2}	25 in
Distance upto which stirrups is prov + d/2	at,pr		37.8 in
Revised punching perimeter	b1,pr	2(L+B)+4*at,pr*√2	286 in
Nominal Punching shear stress	τ_{v1}	$Vu/(b_o \times d)$	80.2 psi
Maximum punching shear stress	$\tau_{v\,max}$	= τv1+τv2	119.2 psi
DCRv at second critical section			56%
Provide : 2L - 0.5dia @ 3.5 in OC			

Stirrups 2L-#4 @ 3.5" OC

Total 10Nos of stirrups (refer cyan highlight in previous page)
2" + 9(3.5") + 8.5/2 = 37.8"

PRCTI20221788

PUNCHING CHECK AT GRID N.0/2.0

CALCULATION OF PUNCHING SHEAR STRESS IN FLAT PLATES (imperial)
At column near Grid N.0/2.0

Compressive strength of concrete in the drop	fc'		5000 psi
Tensile strength of reinforcement steel	fy		60000 psi
Dimension of the column in longer direction	L		18 in
Dimension of the column in shorter direction	B		18 in
Depth of the slab drop	D		10 in
Size effect Mod fact	λs		1
Conc wt factor	λ		1
	β		1
	αs		40
	Φ		0.75
Factored axial load on the column	Vu		196.9 kip
Depth of the slab at critical section	d	depth at a distance of d/2 all around the column face	8.50 in
Effective cover for outer most reinforcement bar	ce		1.50 in
Punching perimeter	bo		106 in
Nominal Punching shear stress	vu	$Vu/(b_o \times d)$	218.5 psi
Punching shear stress due to unbalanced moments	a1	= d/2 +L +d/2	26.50 in
	a2	= d/2 +B +d/2	26.50 in
	α	$= \frac{1}{1+\frac{2}{3}\sqrt{\frac{a1}{a2}}}$	0.60
	M		67.00 k-ft
	J_c	$= I_{yy} + I_{xx}$	108166.9 in4
	τ_{v2}	$= \frac{(1-\alpha)M\,c}{Jc}$	39.4 psi
Maximum pusnching shear stress	$\tau_{v\,max}$	= τv1+τv2	257.9 psi
Permissible shear stress	vc1	4*λ*λs*sqrt(fc')	282.8 psi
	vc2	(2+4/β)*λs*λ*sqrt(fc')	424.3 psi
	vc2	(2+αs*d/b0)*λs*λ*sqrt(fc')	368.2 psi
	Φvc	Φ*min (vc1, vc2, vc3)	212.1 psi
Provide shear reinforcement			

Design Of Shear reinforcement			
Max Permissible conc shear stress with shear reinf	$v_{cr,max}$	Φ*6√fc'	318.2 psi
Permissible conc shear stress with shear reinf	v_{cr}	2*λ*λs*sqrt(fc')	141.4 psi
Req area of shear reinf	Av,rq/S	{[(vu-Φvcr)*min(a1,a2)]/[Φ*fy]}	1.073 in2/ft
No of legs	no	(extent/spacing of the drop panel top bars)	2
Dia of shear reinforcement	dia		0.500 in
Spacing prov	S		3.50 in
Prov area of shear reinf	Av,pr/S	$= \frac{No\ of\ legs * Asv * 12}{S}$	1.346 in2/ft
Reinf shear stress	vs	Av,pr * fy / (min(a1,a2)*S)	254.0 psi
	Φ(vcr +vs)		296.6 psi
DCRv at first critical section with stirrups			87.0%
Req Second Perimeter at critical section	b1,req	Vu/(Φvcr*d)	218 in
Req Stirrups termination distance+d/2	at,rq	{b1-2(L+B)}/{4√2}	26 in
Distance upto which stirrups is prov + d/2	at,pr		37.8 in
Revised punching perimeter	b1,pr	2(L+B)+4*at,pr*√2	286 in
Nominal Punching shear stress	τ_{v1}	$Vu/(b_o \times d)$	81.1 psi
Maximum punching shear stress	$\tau_{v\,max}$	= τv1+τv2	120.5 psi
DCRv at second critical section			57%
Provide : 2L - 0.5dia @ 3.5 in OC			

Stirrups 2L-#4 @ 3.5" OC

Total (10) stirrups (refer cyan highlight in previous page)
2" + 9(3.5") + 8.5/2 = 37.8"

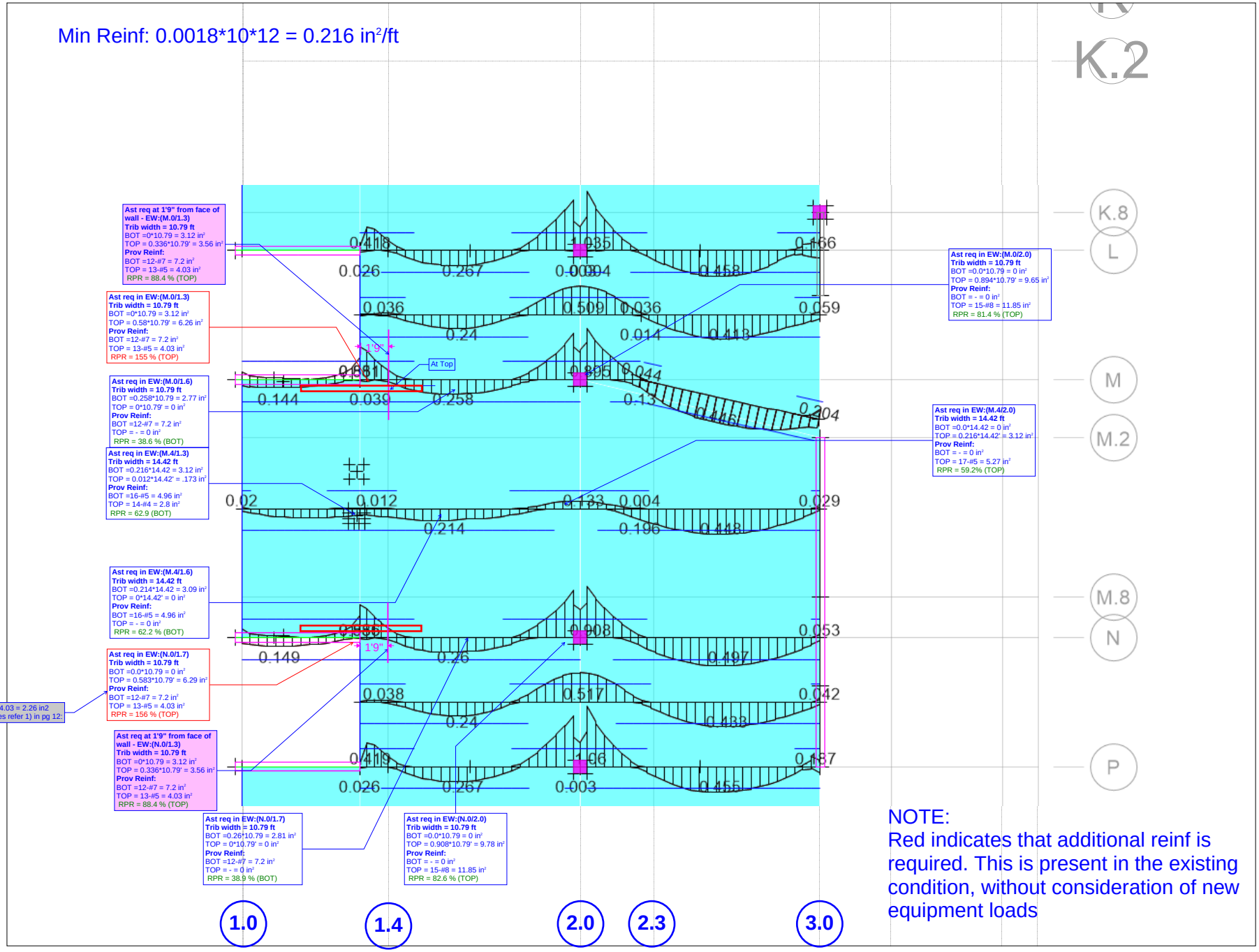
PRCTI20221788

SAFE 20.2.0

L02 REINF REQUIREMENT IN EW DIRECTION

11/7/2022

Min Reinf: 0.0018*10*12 = 0.216 in²/ft



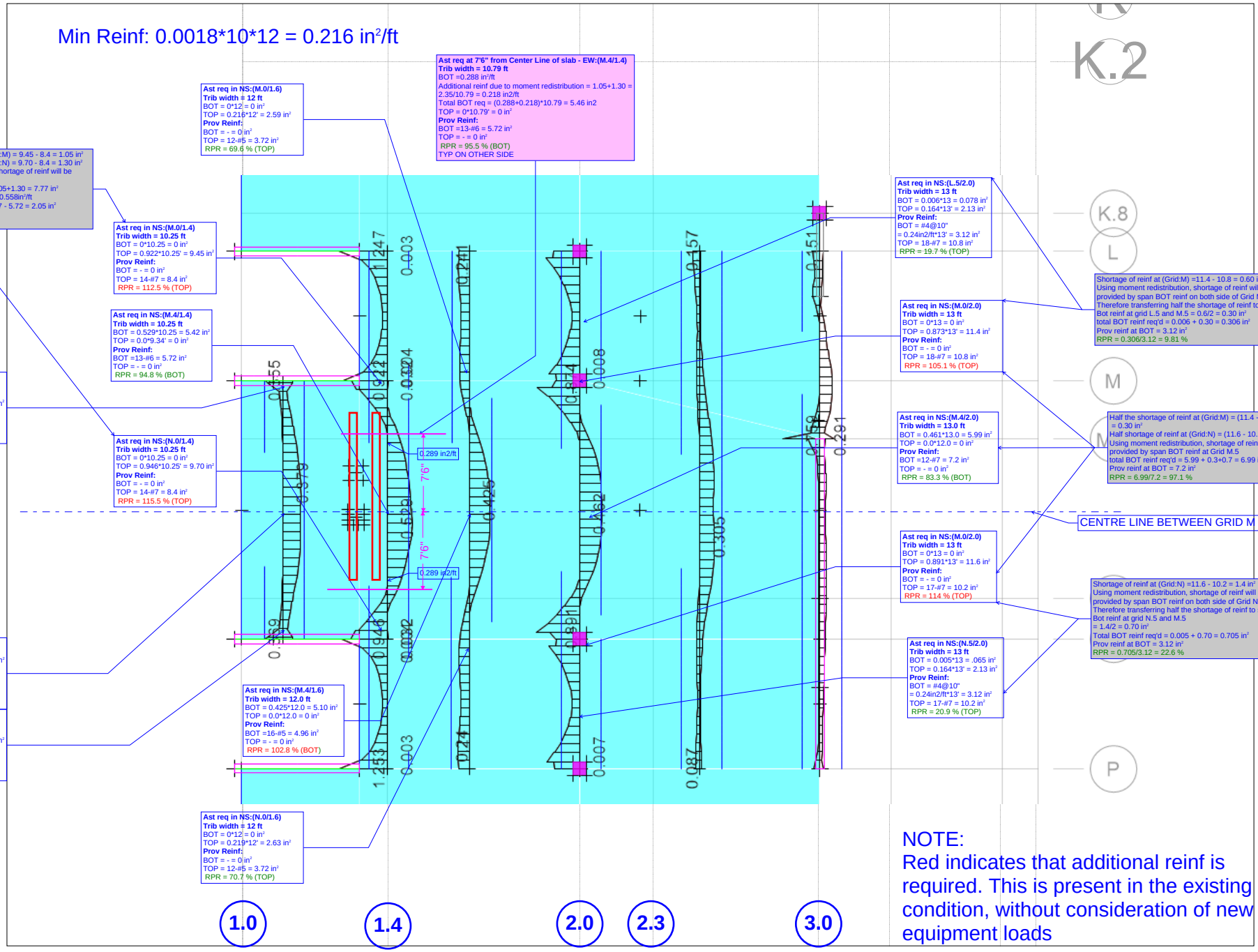
NOTE:
Red indicates that additional reinf is required. This is present in the existing condition, without consideration of new equipment loads

PRCTI20221788

SAFE 20.2.0

L02 REINF REQUIREMENT IN NS DIRECTION

11/7/2022



20221107_Slab Second Floor_T3.FDB Slab Strip Design - Layer B - Top and Bottom Reinforcement Intensity (Enveloping Flexural) [in²/ft]

PRCTI20221788

1) STRENGTHENING AT TOP OF SLAB NEAR THE CONC WALL (ALONG X-DIR)

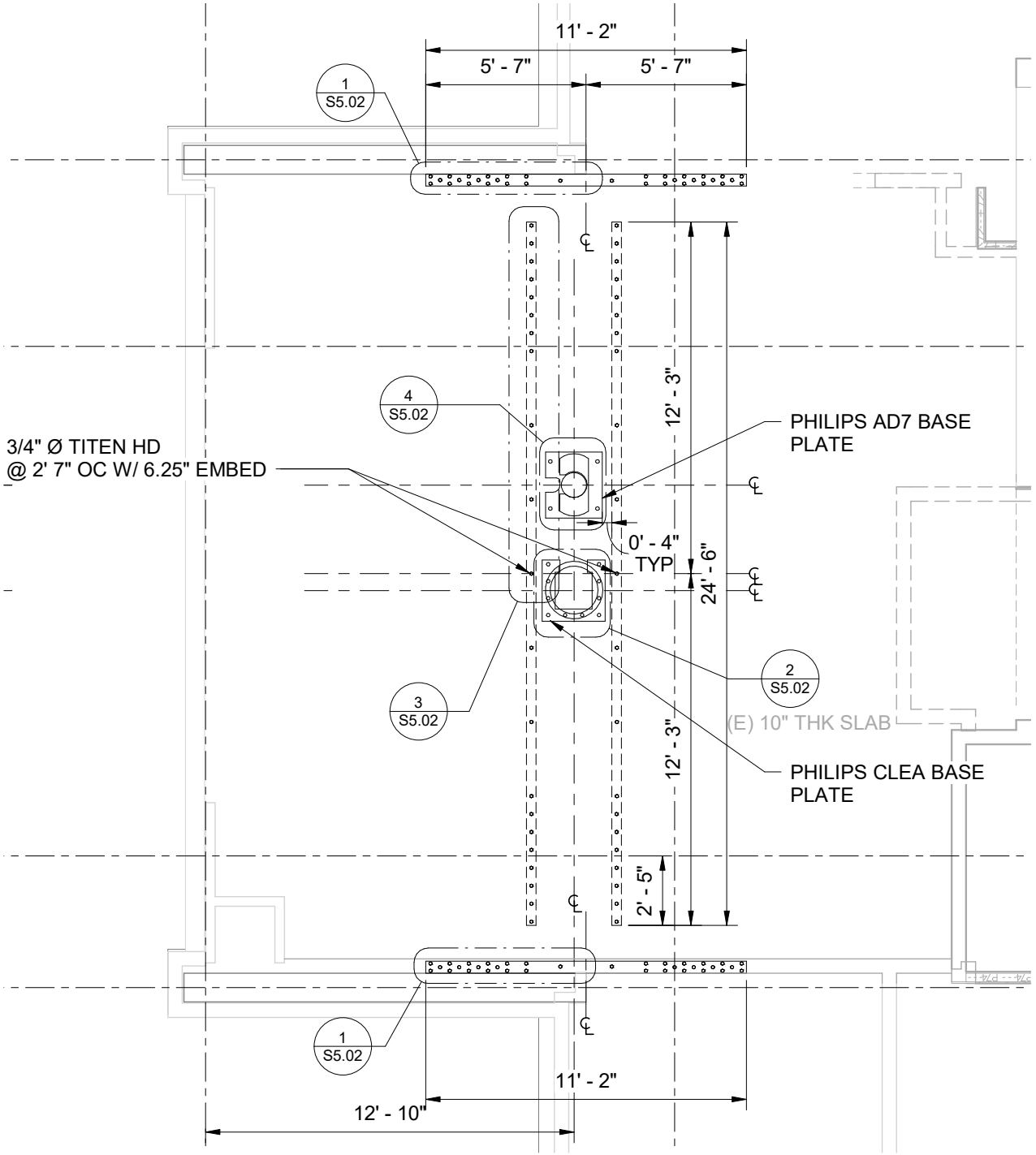
Strengthening with Plates:		
Station	**EW-M.0/1.3 or N.0/1.3**	
Req reinf,	$A_{s,req}$	6.29 in^2
Prov reinf,	$A_{s,prov}$	4.03 in^2
Shortage of reinf		2.26 in^2
Yield strength of reinf	f_y	60 ksi
Yield strength of PLT	$f_{y,plt}$	50 ksi
Shortage of capacity	=2.26*60 ksi	136 kip
Req Area of steel PLT	Asp,req =135.6/50	2.71 in^2
Size of PLT	Width, b2	5.00 in
	THK, d2	0.625 in
	No of PLT	1
Tensile capacity of PLT	= 0.9*5*0.625*50 ksi	141 kip
DCR		96.4%

2) STRENGTHENING AT BOT OF SLAB NEAR THE MID SPAN (ALONG Y-DIR)

Strengthening with Plates:		
Station	**NS-M.4/1.2**	
Req reinf,	$A_{s,req}$	7.77 in^2
Prov reinf,	$A_{s,prov}$	5.72 in^2
Shortage of reinf		2.05 in^2
Yield strength of reinf	f_y	60 ksi
Yield strength of PLT	$f_{y,plt}$	50 ksi
Shortage of capacity	=2.05*60 ksi	123 kip
Req Area of steel PLT	Asp,req =123/50	2.46 in^2
Size of PLT	Width, b2	4.00 in
	THK, d2	0.375 in
	No of PLT	2
Tensile capacity of PLT	= 0.9*4*0.375*50 ksi	135 kip
DCR		91.1%
Tensile capacity of One PLT		68 kip

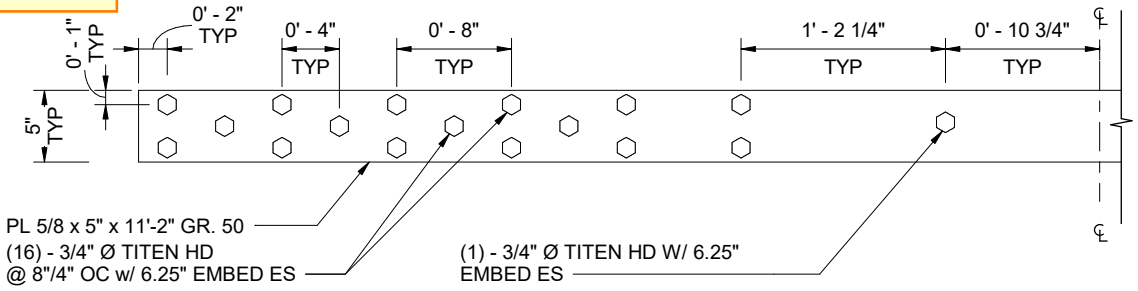
SLAB STRENGTHENING PLATES

PRCTI20221788



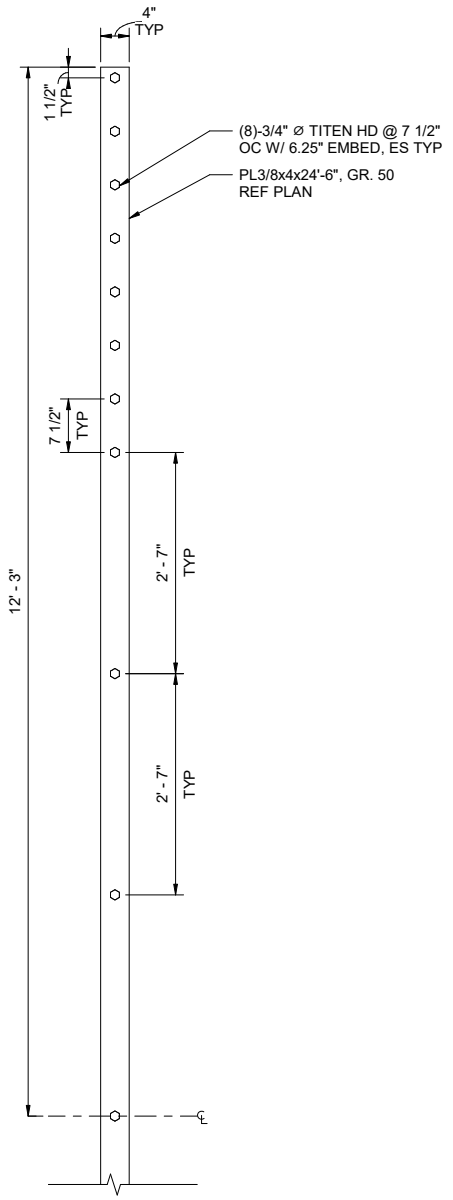
RETROFIT PLATE DETAILS:

PRCTI20221788



1 TOP REINF PLATE

1 1/2" = 1'-0"



3 SLAB BOTTOM REINF PLATE

1" = 1'-0"

ANCHOR CHECK AT TOP OF SLAB NEAR GRID M & N (ID: EW-M.0/1.3 or N.0/1.3)

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.0.7947.1

PRCTI20221788

Company:		Date:	11/9/2022
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 6.250
Effective Embedment depth, h_{ef} (inch): 4.860
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 10.00
c_{ac} (inch): 7.31
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 10.00
State: Cracked
Compressive strength, f'_c (psi): 5000
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: Yes
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: Yes
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 5.00 x 43.00 x 0.63

Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:6.25" (159mm)
Code Report: ICC-ES ESR-2713

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.0.7947.1

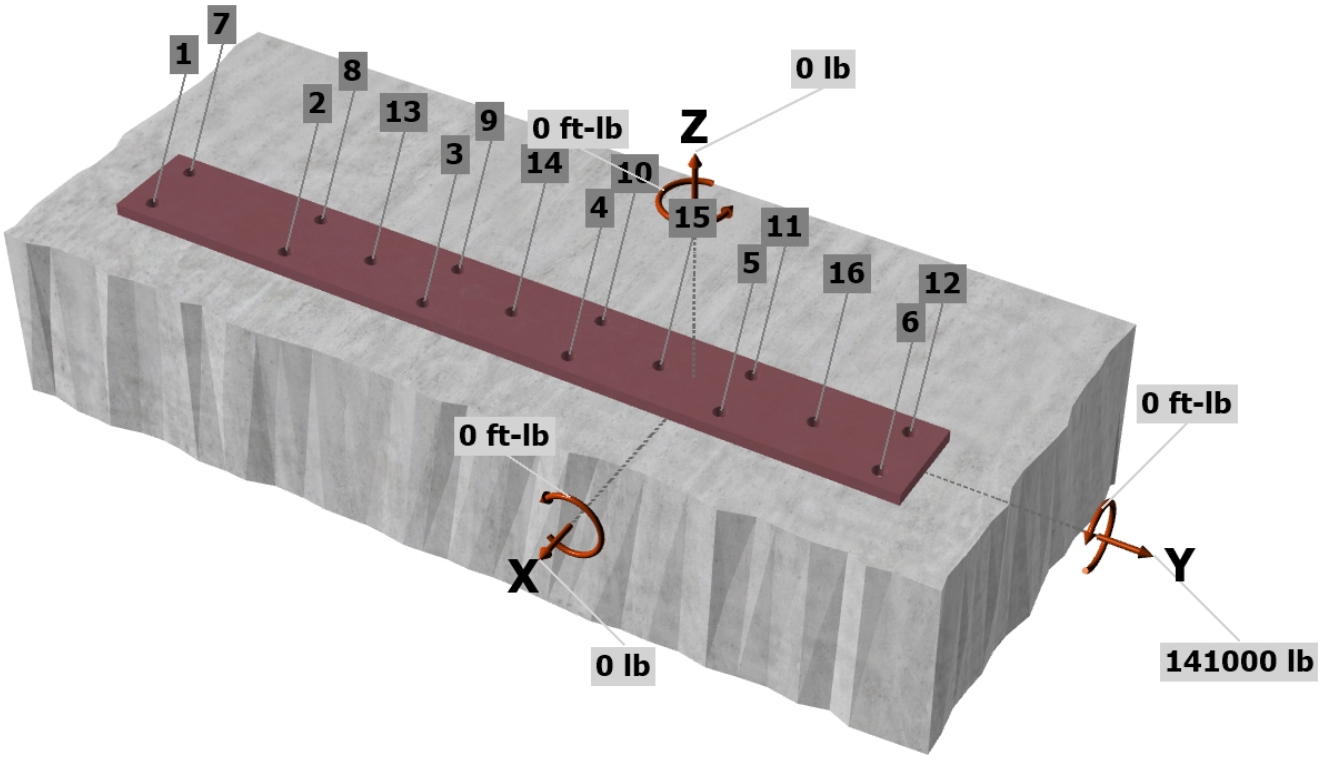
Company:		Date:	11/9/2022
Engineer:		Page:	2/5
Project:			
Address:			
Phone:			
E-mail:			

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 0
V_{uax} [lb]: 0
V_{uay} [lb]: 141000
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>

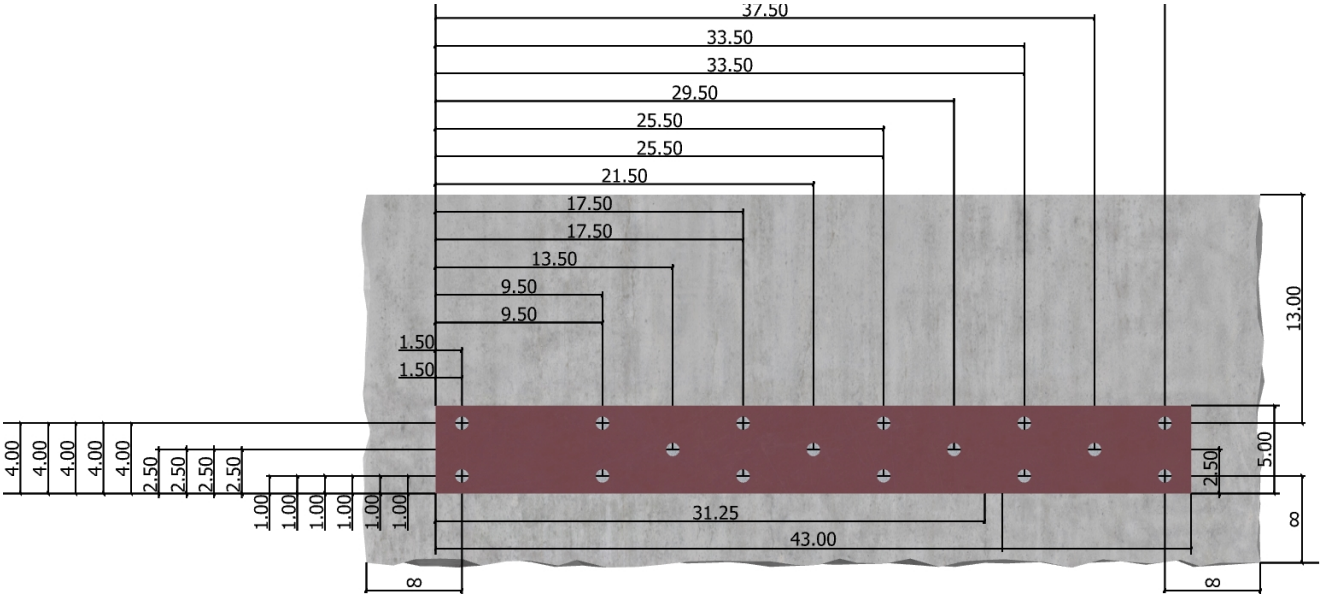


SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.0.7947.1

Company:		Date:	11/9/2022
Engineer:		Page:	3/5
Project:			
Address:			
Phone:			
E-mail:			

<Figure 2>



SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.0.7947.1

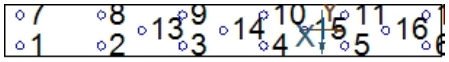
Company:		Date:	11/9/2022
Engineer:		Page:	4/5
Project:			
Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	0.0	8812.5	8812.5
2	0.0	0.0	8812.5	8812.5
3	0.0	0.0	8812.5	8812.5
4	0.0	0.0	8812.5	8812.5
5	0.0	0.0	8812.5	8812.5
6	0.0	0.0	8812.5	8812.5
7	0.0	0.0	8812.5	8812.5
8	0.0	0.0	8812.5	8812.5
9	0.0	0.0	8812.5	8812.5
10	0.0	0.0	8812.5	8812.5
11	0.0	0.0	8812.5	8812.5
12	0.0	0.0	8812.5	8812.5
13	0.0	0.0	8812.5	8812.5
14	0.0	0.0	8812.5	8812.5
15	0.0	0.0	8812.5	8812.5
16	0.0	0.0	8812.5	8812.5
Sum	0.0	0.0	141000.0	141000.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 0
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
16840	1.0	0.60	10104

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)

PRCTI20221788

2.0	959.52	212.58	1.000	1.000	1.000	1.000	12879	0.70	81387

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	8813	10104	0.87	Pass
Pryout	**141000**	**81387**	**1.73**	**Fail (Governs)**

FAIL! Selected anchor type and embedment do not meet the selected design criteria.

Pryout failure can be ignored as per the justification given below

12. Warnings

- For irregular anchor patterns, the designer must consider sizing of base plate holes to ensure shear loads are distributed to anchors as designed.

- Concrete breakout strength in shear has not been evaluated against applied shear load(s) per designer option. Refer to ACI 318 Section 17.3.2.1 for conditions where calculations of the concrete breakout strength may not be required.

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

As per ACI -sp-1714, pg 388, it is mentioned that, usually pryout failure occurs in shallow anchor embedment depths (< 5 d_a) and without reinf. Hence in this case, the presence of reinforcement and long anchor embedment may preclude the concrete pryout failure mode.

In this case the anchor dia = 3/4" and hef = 4.86" > (5 da = 5*3/4 = 3.75"), also including the top reinf of slab,

$A_{s,req}$ = N/(Φ fy) = 141000/(0.75*60,000 psi) = 3.13 in^2
Existing reinf = 10 - #5 = 10 * 0.31 = 3.10 in^2

DCR = 101 % < 105 % OK

Reference ACI - SP - 1714, pg 388

Usually pryout failure mode occurs in shallow anchor embedment depths (4 to 5d_a) and without reinforcement. The presence of reinforcement and the long anchor embedment may preclude the concrete pryout failure mode.

ANCHOR CHECK AT BOT OF SLAB AT MID SPAN (ID: NS-M.4/1.2)

SIMPSON Strong-Tie

Anchor Designer™ Software
Version 3.0.7947.1

PRCTI20221788

Company:		Date:	11/9/2022
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 6.250
Effective Embedment depth, h_{ef} (inch): 4.860
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 10.00
c_{ac} (inch): 7.31
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 10.00
State: Cracked
Compressive strength, f'_c (psi): 5000
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: Yes
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 4.00 x 56.50 x 0.38

Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:6.25" (159mm)
Code Report: ICC-ES ESR-2713

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.0.7947.1

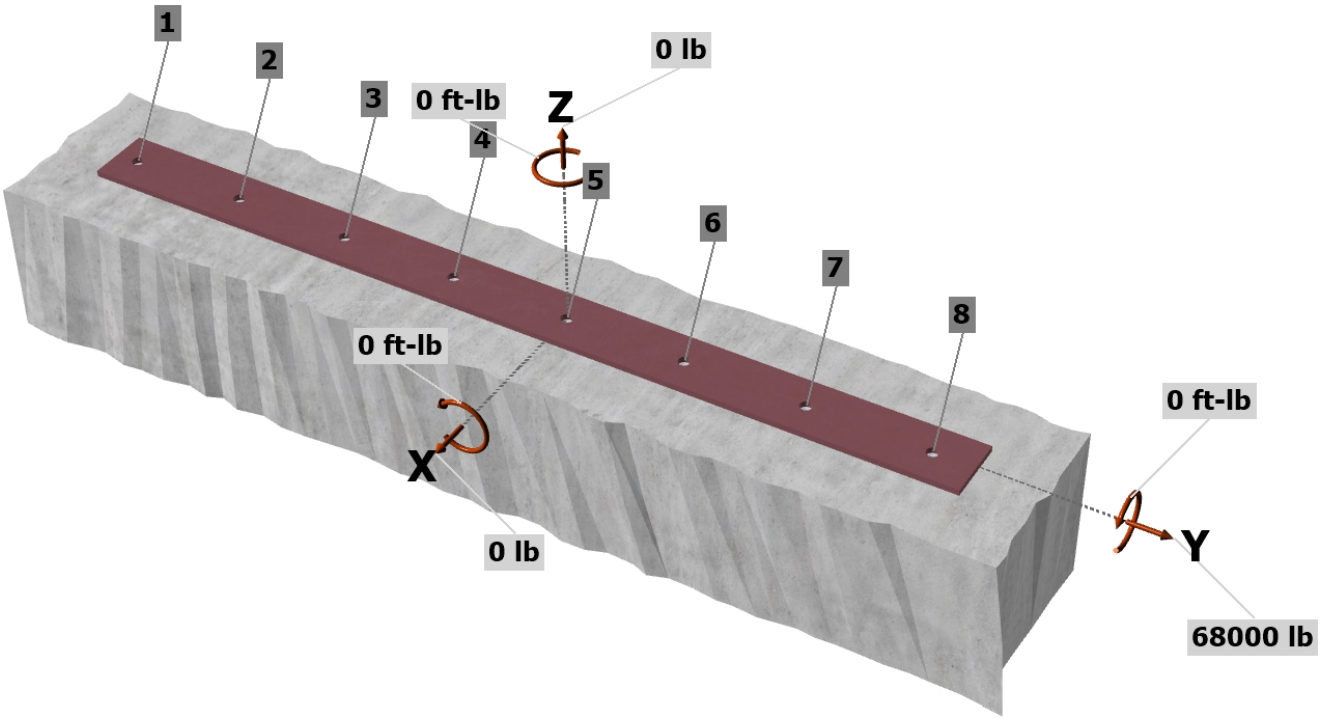
Company:		Date:	11/9/2022
Engineer:		Page:	2/5
Project:			
Address:			
Phone:			
E-mail:			

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

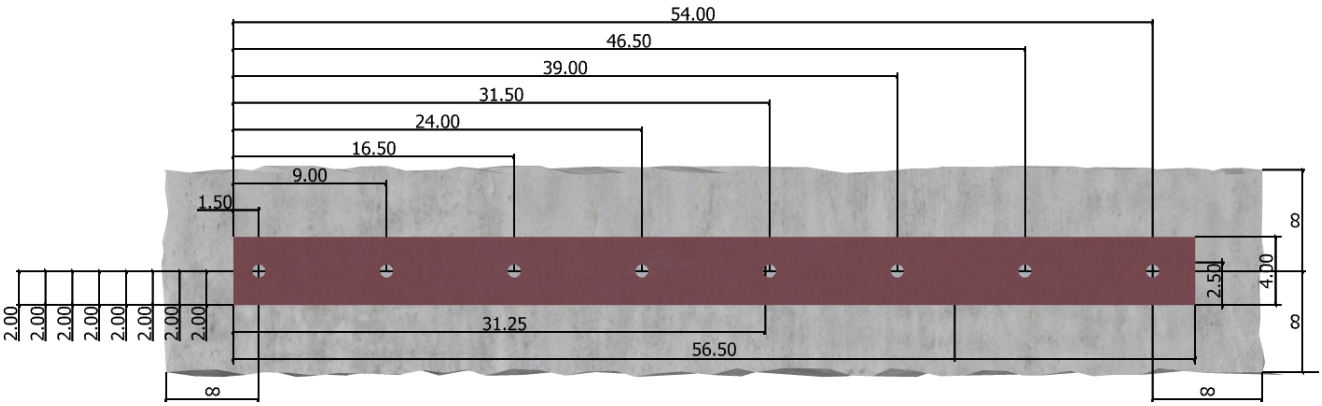
N_{ua} [lb]: 0
V_{uax} [lb]: 0
V_{uay} [lb]: 68000
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



Company:		Date:	11/9/2022
Engineer:		Page:	3/5
Project:			
Address:			
Phone:			
E-mail:			

<Figure 2>



SIMPSON Strong-Tie® Anchor Designer™ Software Version 3.0.7947.1

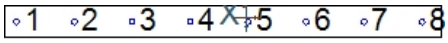
Company:		Date:	11/9/2022
Engineer:		Page:	4/5
Project:			
Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	-377.8	8500.0	8508.4
2	0.0	-269.8	8500.0	8504.3
3	0.0	-161.9	8500.0	8501.5
4	0.0	-54.0	8500.0	8500.2
5	0.0	54.0	8500.0	8500.2
6	0.0	161.9	8500.0	8501.5
7	0.0	269.8	8500.0	8504.3
8	0.0	377.8	8500.0	8508.4
Sum	0.0	0.0	68000.0	68028.8

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 0
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
16840	1.0	0.60	10104

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cp} = \phi k_{cp} N_{cb} = \phi k_{cp}(A_{Nc} / A_{Nco}) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.5.3.1a)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cp} (lb)
2.0	109.35	212.58	1.000	1.000	1.000	12879	0.70	9275

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	8508	10104	0.84	Pass

Pryout	**8504**	**9275**	**0.92**	**Pass (Governs)**

3/4"Ø Titen HD, hnom:6.25" (159mm) meets the selected design criteria.

12. Warnings

- For irregular anchor patterns, the designer must consider sizing of base plate holes to ensure shear loads are distributed to anchors as designed.

- Concrete breakout strength in shear has not been evaluated against applied shear load(s) per designer option. Refer to ACI 318 Section 17.3.2.1 for conditions where calculations of the concrete breakout strength may not be required.

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

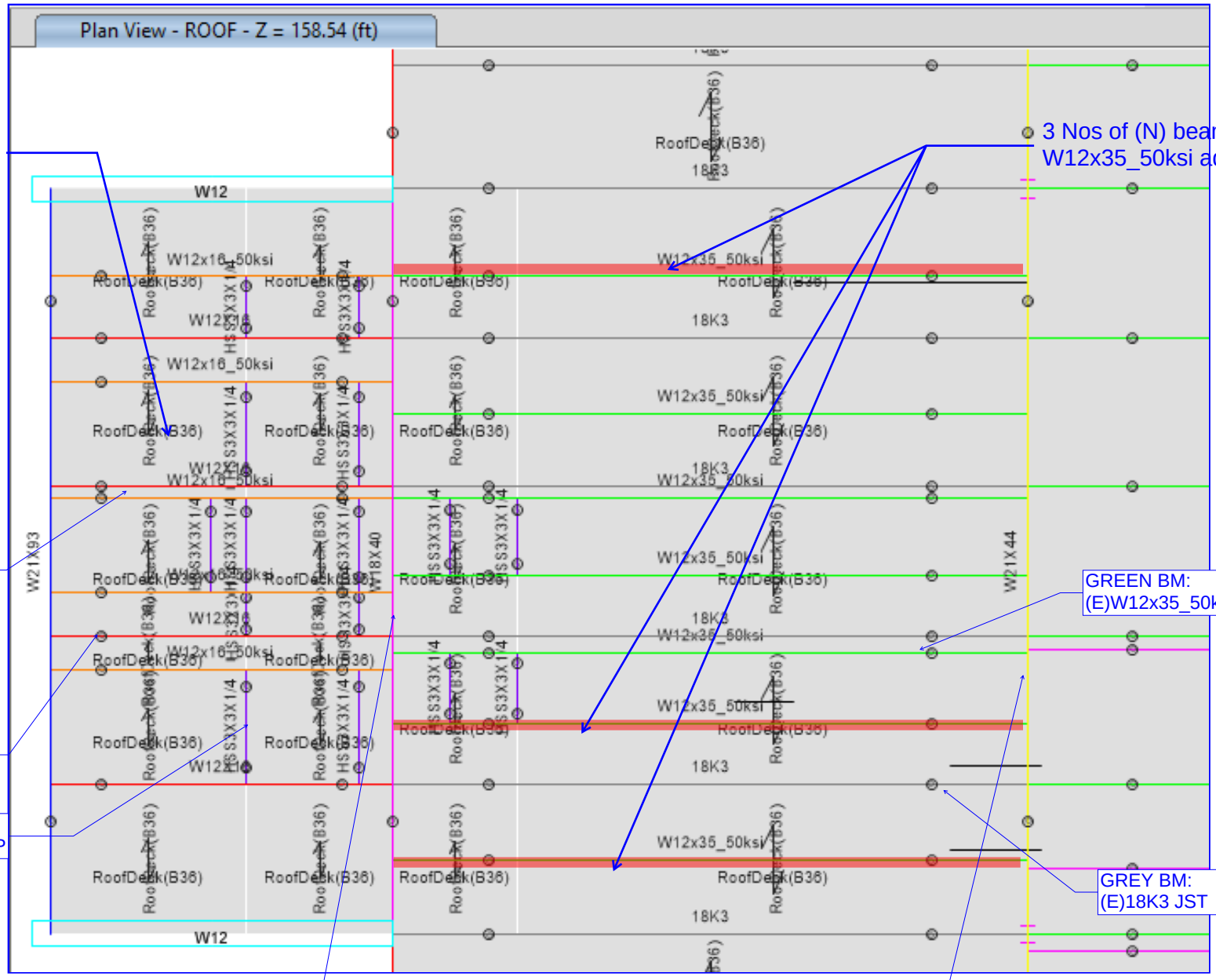
PRCTI20221788

GSH OR #1:

ROOF FRAMING GRIDS (M-N & 1-2)

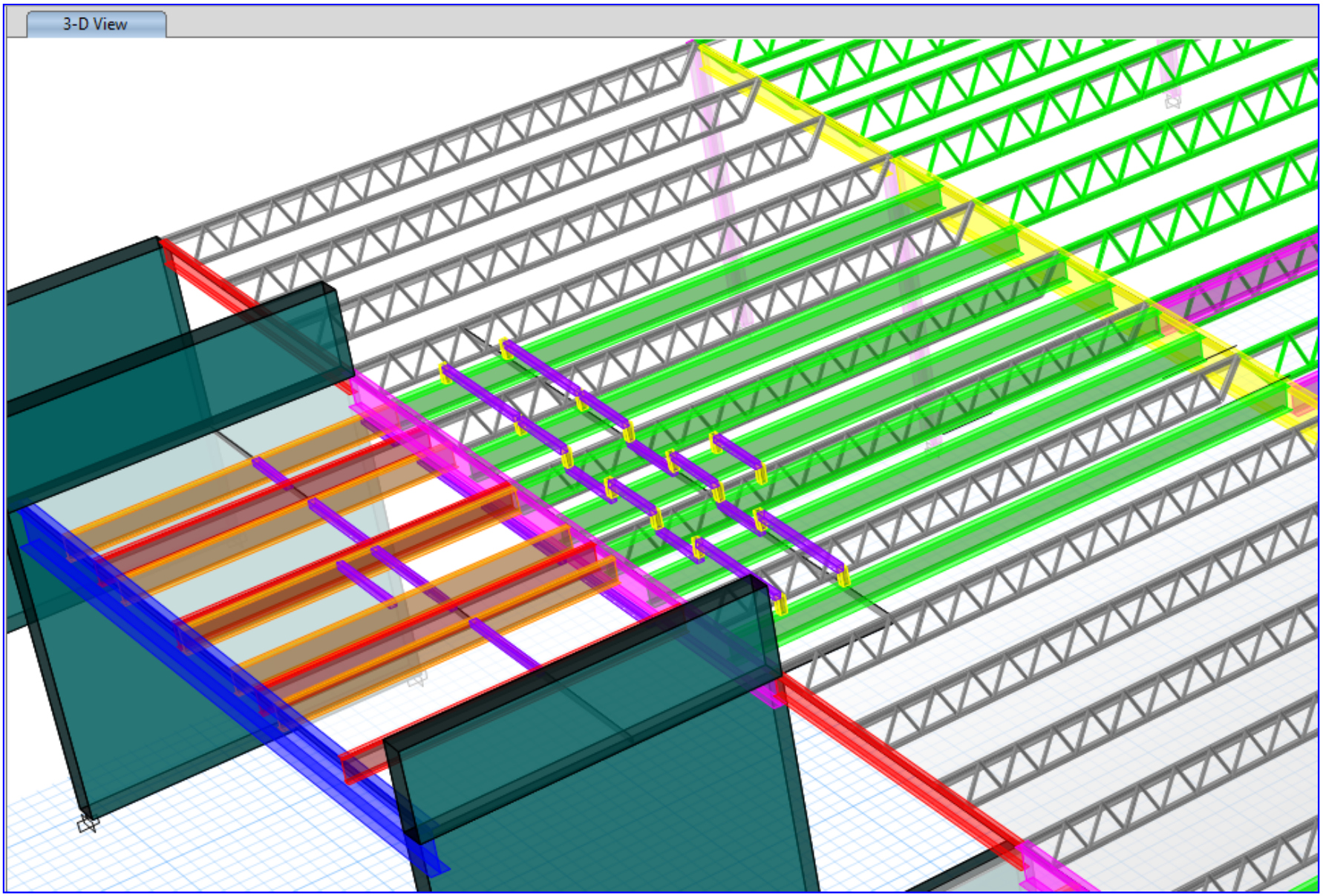
PRCTI20221788

ETABS MODEL AT ROOF LEVEL : BETWEEN GRID M-N & 1-3



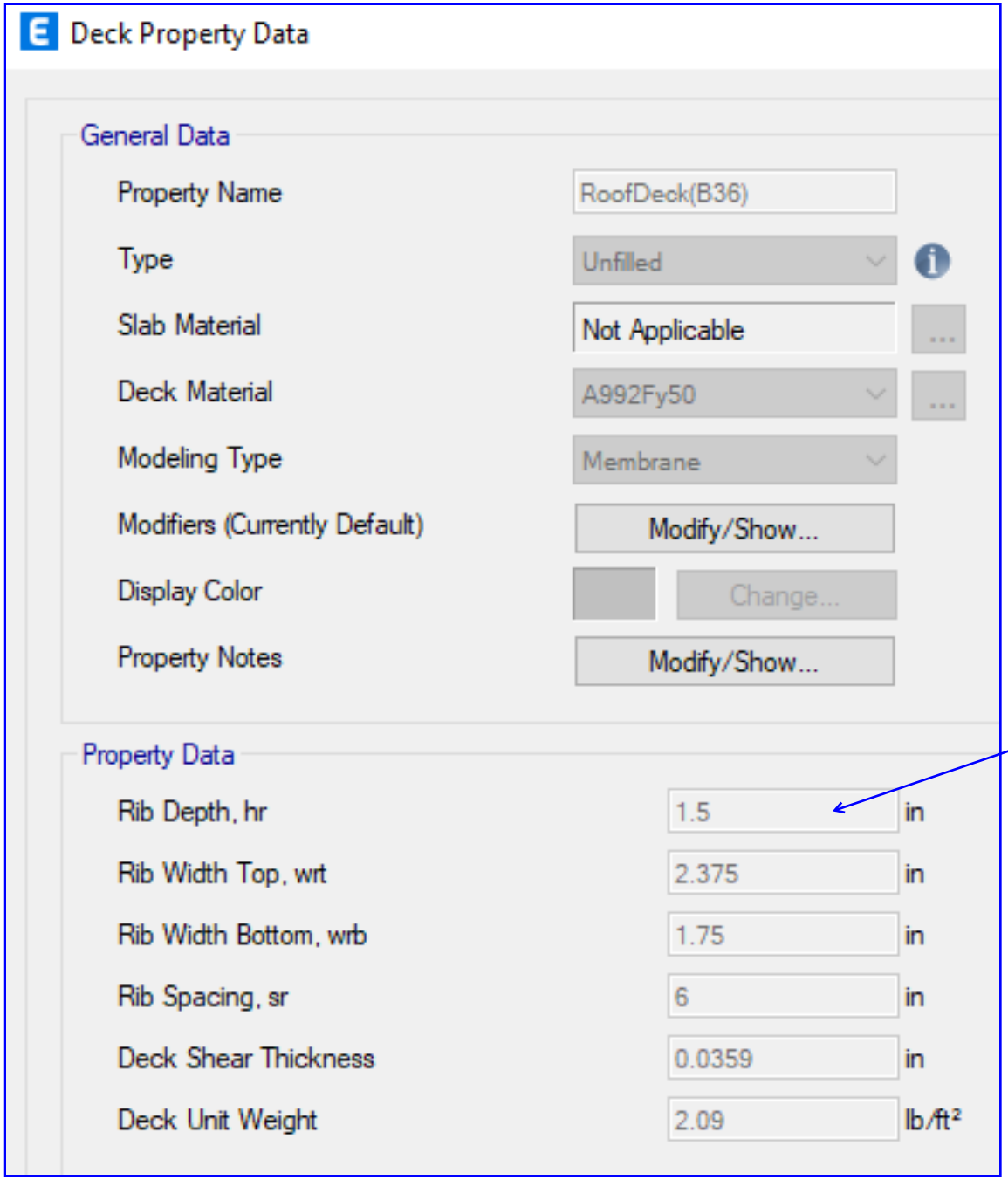
PRCTI20221788

RENDERED VIEW:



PRCTI20221788

1.5" ROOF DECK PROPERTIES:



ROOF DECK OF 1.5" RIB DEPTH

LOAD PATTERNS & COMBINATIONS

PRCTI20221788

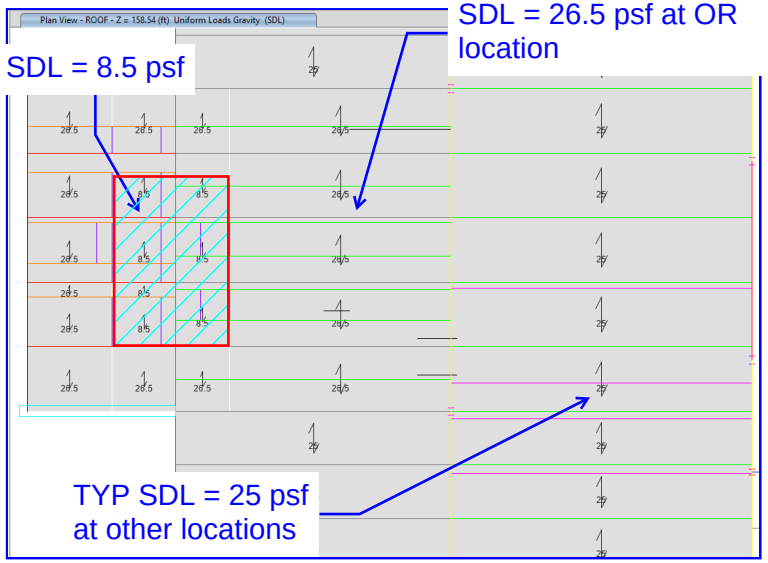
LOAD PATTERNS:	
DL	DEAD LOAD
SDL	SUPER IMP DL
WALL	WALL LOAD
SDLc	SUPER IMP DL FOR SUSPENDED FRAMES/CEILING
Llroof	ROOF LL
Pe1	PHILLIPS EQUIP - Unistrut-1
Pe2	PHILLIPS EQUIP - Unistrut-2
Pe3	PHILLIPS EQUIP - Unistrut-3
Pe4	PHILLIPS EQUIP - Unistrut-4
Pe5	PHILLIPS EQUIP - Unistrut-5
Pe6	PHILLIPS EQUIP - Unistrut-6
Pe7	PHILLIPS EQUIP - Unistrut-7
Pe8	PHILLIPS EQUIP - Unistrut-8
Pe9	PHILLIPS EQUIP - Unistrut-9
Skyboom	SKYTRON BOOM LOAD

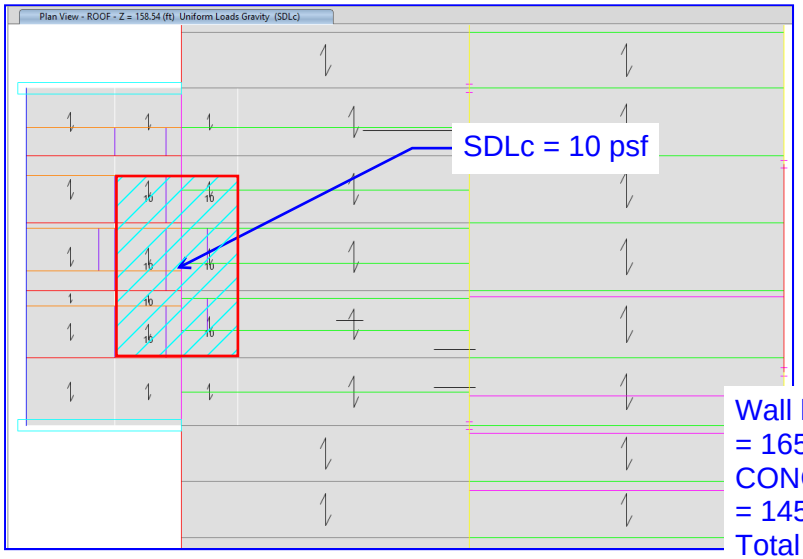
LOAD COMB:	
SERVICE COMBINATION:	
SV01	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe1
SV02	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe2
SV03	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe3
SV04	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe4
SV05	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe5
SV06	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe6
SV07	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe7
SV08	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe8
SV09	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe9
SV10	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe1
SV11	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe2
SV12	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe3
SV13	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe4
SV14	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe5
SV15	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe6
SV16	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe7
SV17	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe8
SV18	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe9

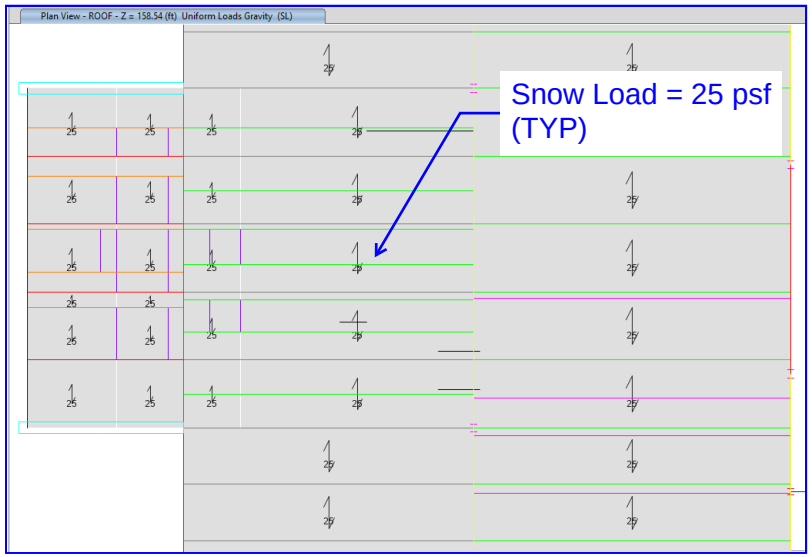
Strength Combination :	
ST01	1.4(DL+SDL+SDLc+WALL)
ST02	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe1
ST03	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe2
ST04	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe3
ST05	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe4
ST06	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe5
ST07	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe6
ST08	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe7
ST09	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe8
ST10	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe9
ST11	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe1
ST12	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe2
ST13	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe3
ST14	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe4
ST15	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe5
ST16	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe6
ST17	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe7
ST18	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe8
ST19	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe9

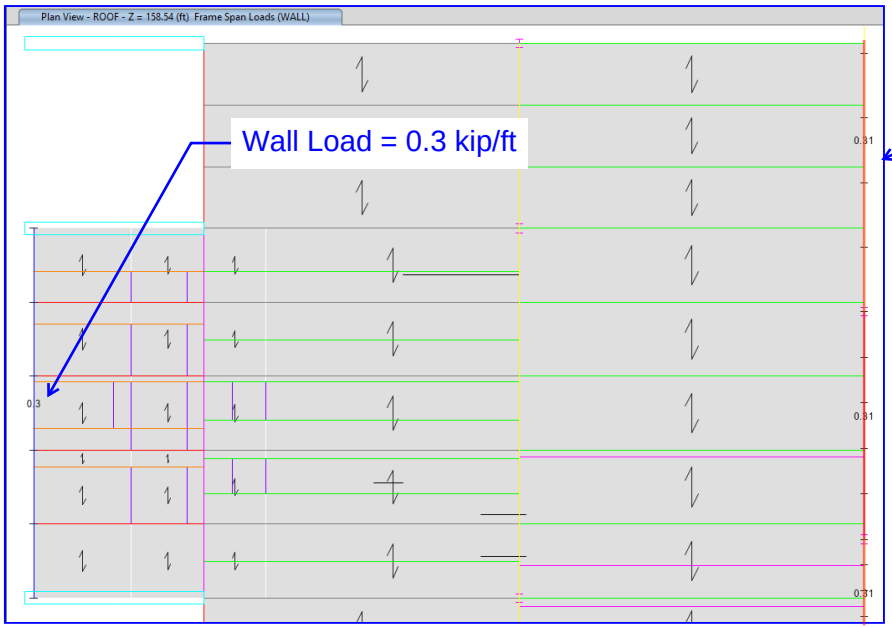
LOADS CONSIDERED: PRCTI20221788

IN ADDITION TO THE SELF WT OF MEMBERS FOLLOWING LOADS ARE CONSIDERED.



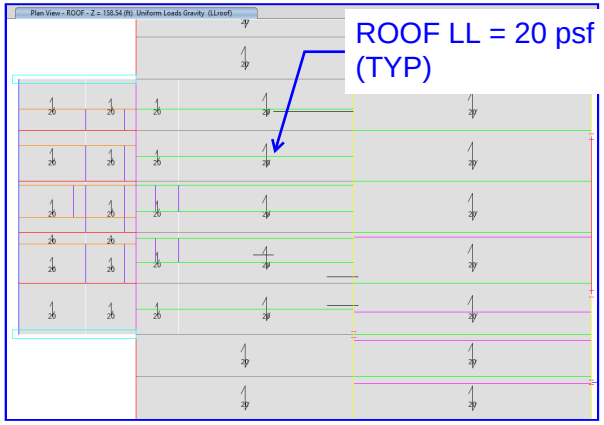




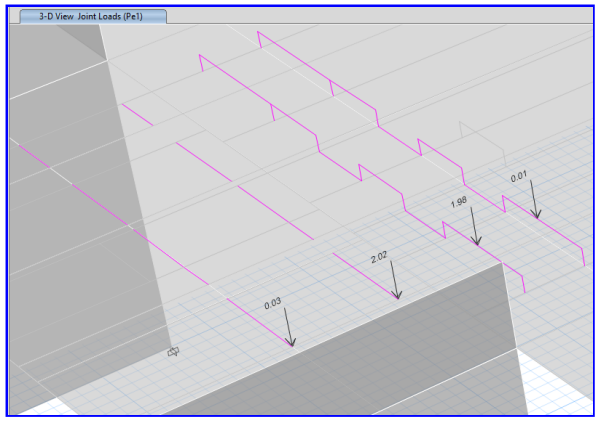


FOR CALCULATION OF LOADS REFER PG 11

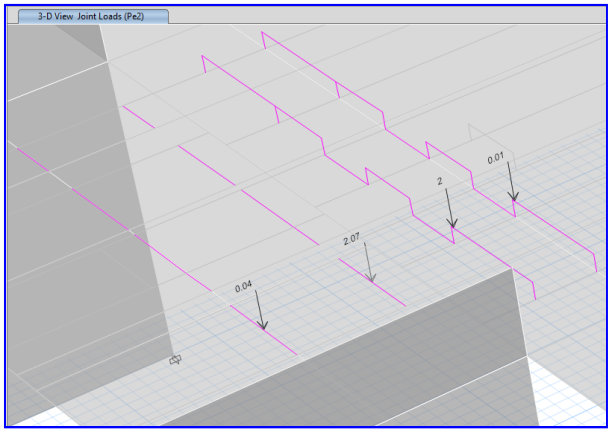
PRCTI20221788



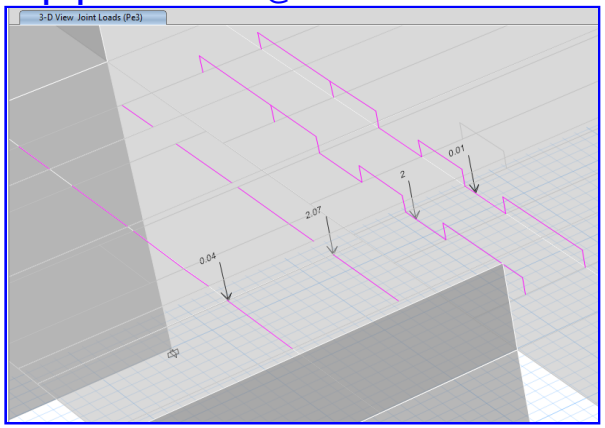
Equipments loads@ Unistrut 1



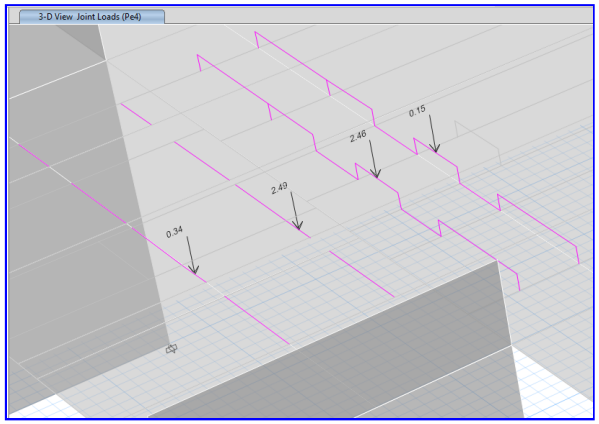
Equipments loads@ Unistrut 2



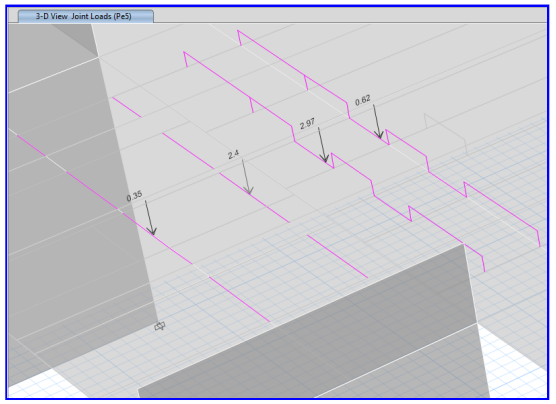
Equipments loads@ Unistrut 3



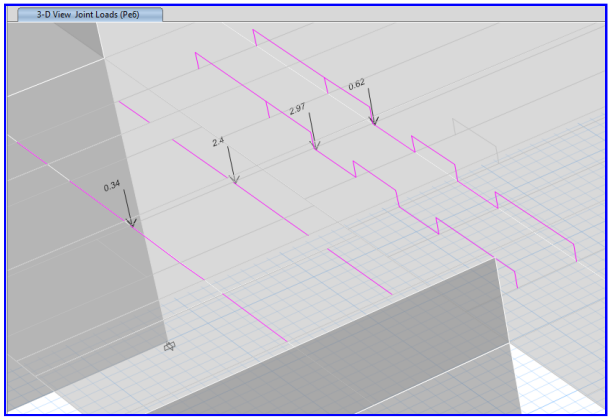
Equipments loads@ Unistrut 4



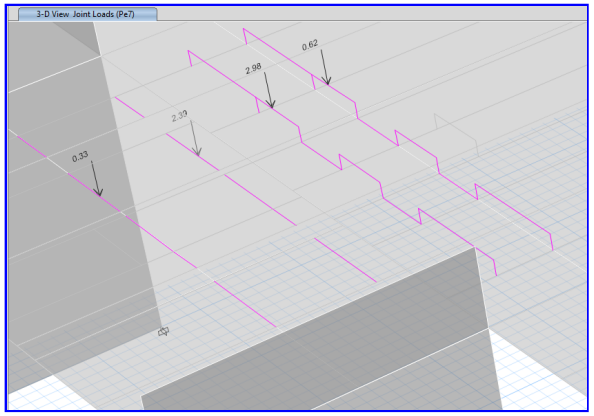
Equipments loads@ Unistrut 5



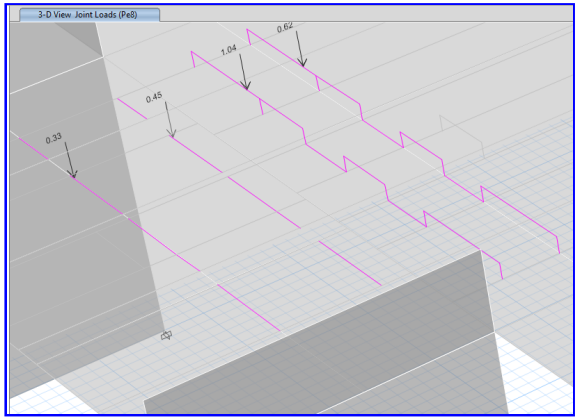
Equipments loads@ Unistrut 6



Equipments loads@ Unistrut 7



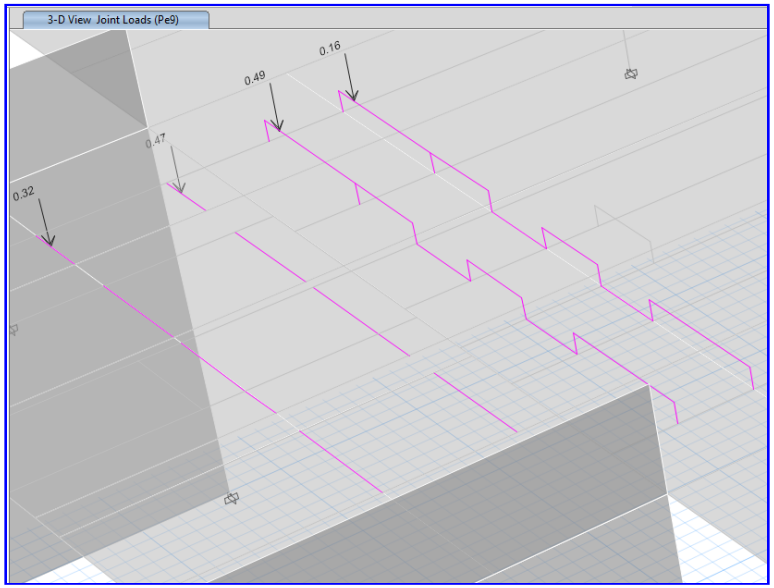
Equipments loads@ Unistrut 8



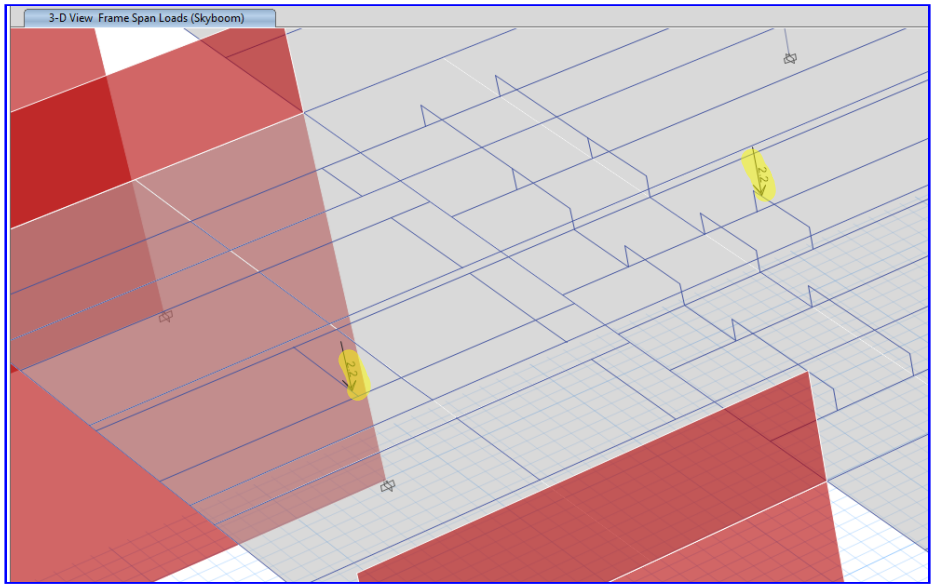
FOR CALCULATION OF LOADS REFER PG 9

Equipments loads@ Unistrut 9

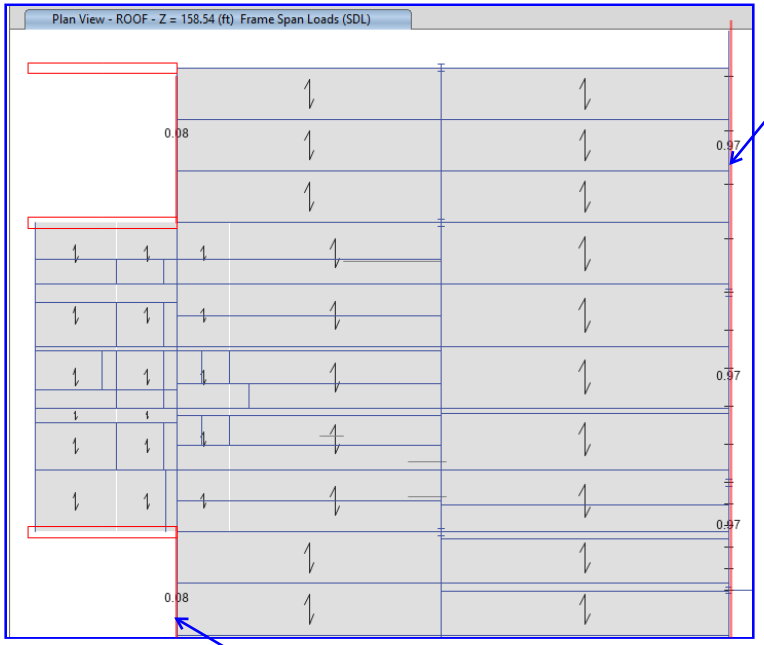
PRCTI20221788



Boom Loads



SDL Line Loads:



SDL = 968 plf
(From Penthouse
floor system)

Bay width = 24.33 ft
Comp floor S.wt
= 57 psf * 24.33/2 = 693.4 plf

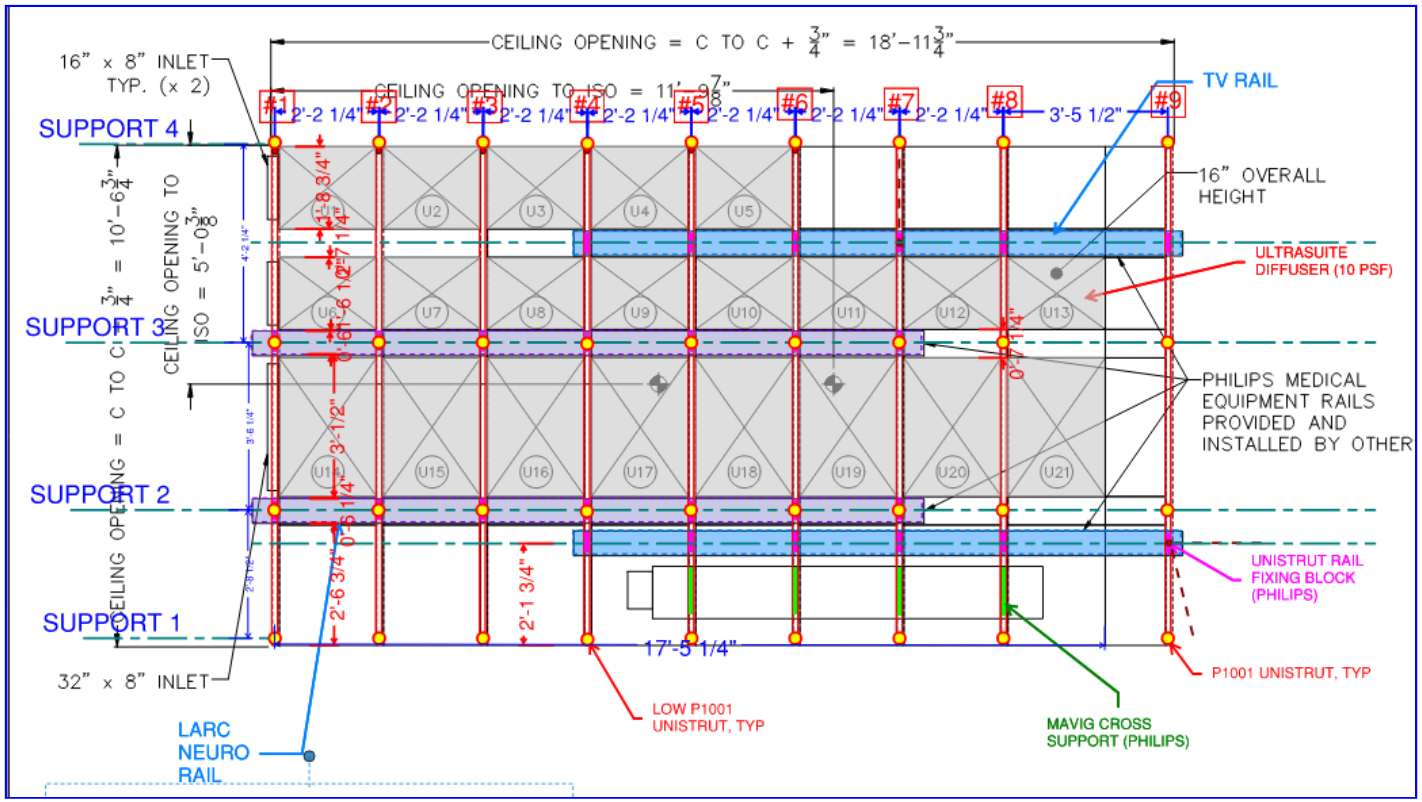
BM S.wt:
W14x22 BM
=(0.5(5*22 lb/ft*24.33ft))/24.08
= 55.6 plf

SDL (hung loads)
= 18 psf * 24.33/2 = 219 plf
Total SDL line load = 968 plf

SDL = 75 plf

FOR CALCULATION OF LOADS REFER PG 9

PRCTI20221788



BOOM LOADINGS:
EACH BOOM = 2200 lbs

FOR EQUIPMENT LOADS:
THRD ROD LOADS AS SHOWN BELOW, WHICH INCUDES, EQUIPMENT + UNISTRUT +THRD ROD LOADS

	Thrd Rd Support Line			
	1	2	3	4
UNISTRUT #1	0.01	1.982	2.025	0.03
UNISTRUT #2	0.01	1.996	2.067	0.044
UNISTRUT #3	0.01	1.996	2.067	0.044
UNISTRUT #4	0.152	2.455	2.488	0.342
UNISTRUT #5	0.618	2.972	2.403	0.353
UNISTRUT #6	0.617	2.974	2.397	0.342
UNISTRUT #7	0.617	2.976	2.391	0.330
UNISTRUT #8	0.617	1.037	0.452	0.330
UNISTRUT #9	0.155	0.488	0.467	0.315

ULTRASUITE DIFFUSER LOADS = 10 psf (PER MFR)

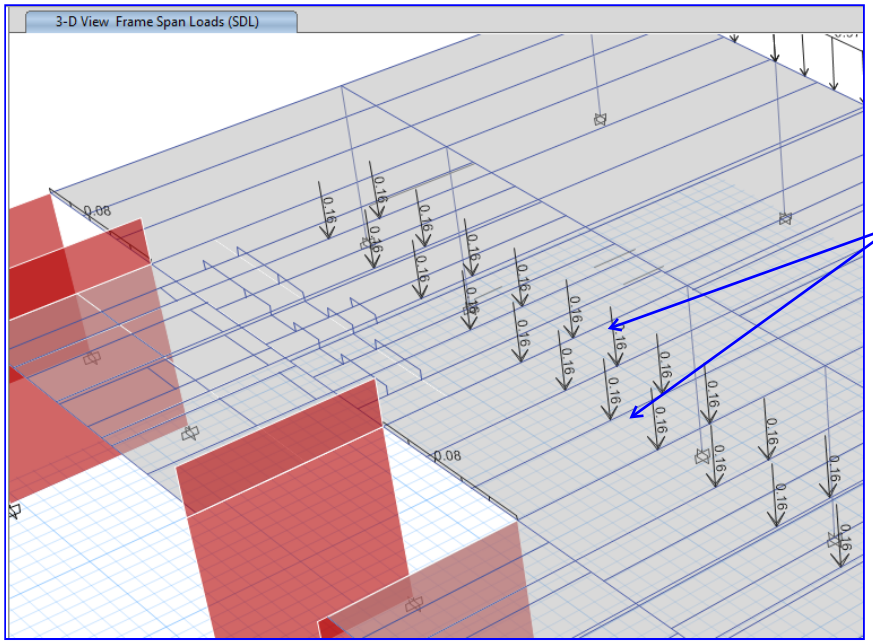
Above roof loadings:
Protection board = 3.0 psf
Membrane roof = 3.0 psf
Insulation = 0.5 psf
Fire proofing = 0.5 psf
Roof coating = 1.5 psf
Subtotal = 8.5 psf

Hung Loads:
Ceiling (studs & Gyp board)= 7.5 psf
Lighting = 2.5 psf
Duct and piping = 8.0 psf
Subtotal = 18 psf

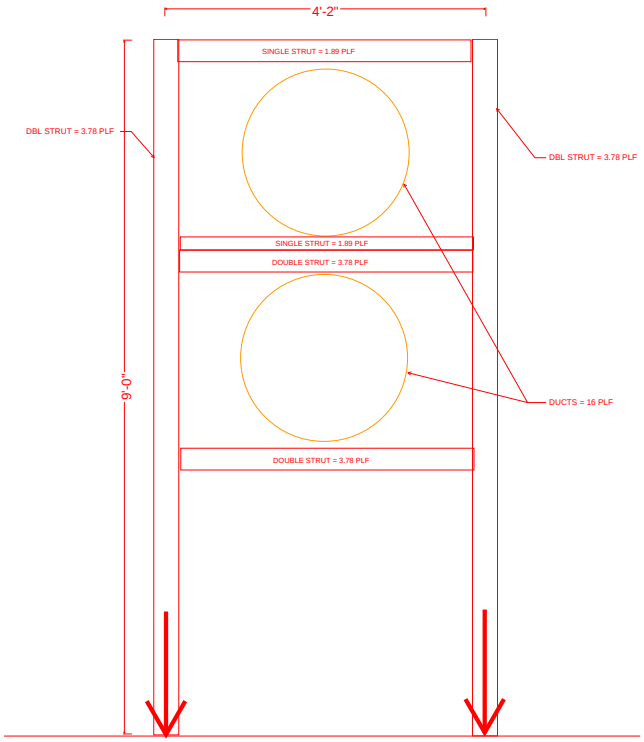
TOTAL SDL = 26.5 psf

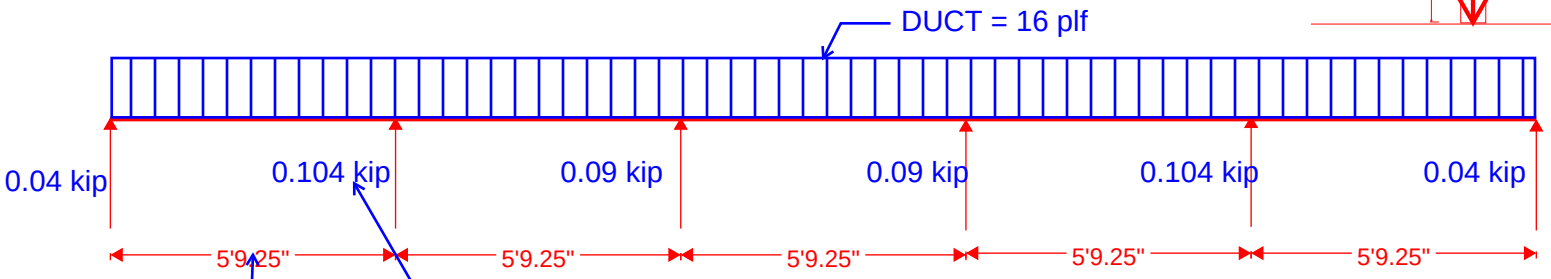
DUCT AND DUCT SUPPORTING FRAME LOADS:

PRCTI20221788



0.162 kip





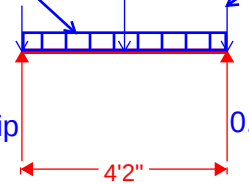
For Duct span considered the steel joist spacing

Considering the Max reaction as 0.104 kip acting on each unistrut

SINGLE & DBL STRUT = 1.89*2 + 3.78*2 = 11.34 plf

0.104*2 = 0.208 kip

DBL STRUT = 3.78 plf * 9ft = 0.034 kip



0.162 kip

0.162 kip

4'2"

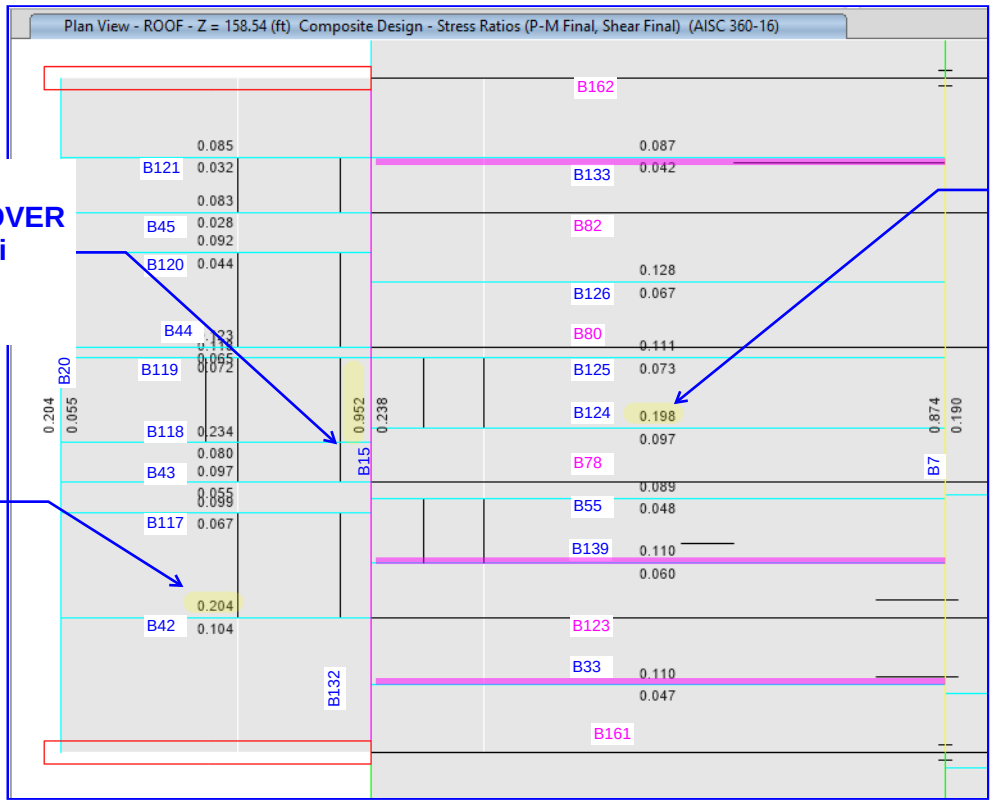
0.162 kip to be applied on steel joists

PRCTI20221788

BEAMS & GIRDER P-M RATIO:

Girder B15
(E) W18x40 w/ BOT COVER
PLT 5 1/4" x 1/2"_50ksi
DCR_M = 95.2 %
DCR_v = 23.8 %

BM B42
DCR_M = 20.4 %
DCR_v = 10.4 %

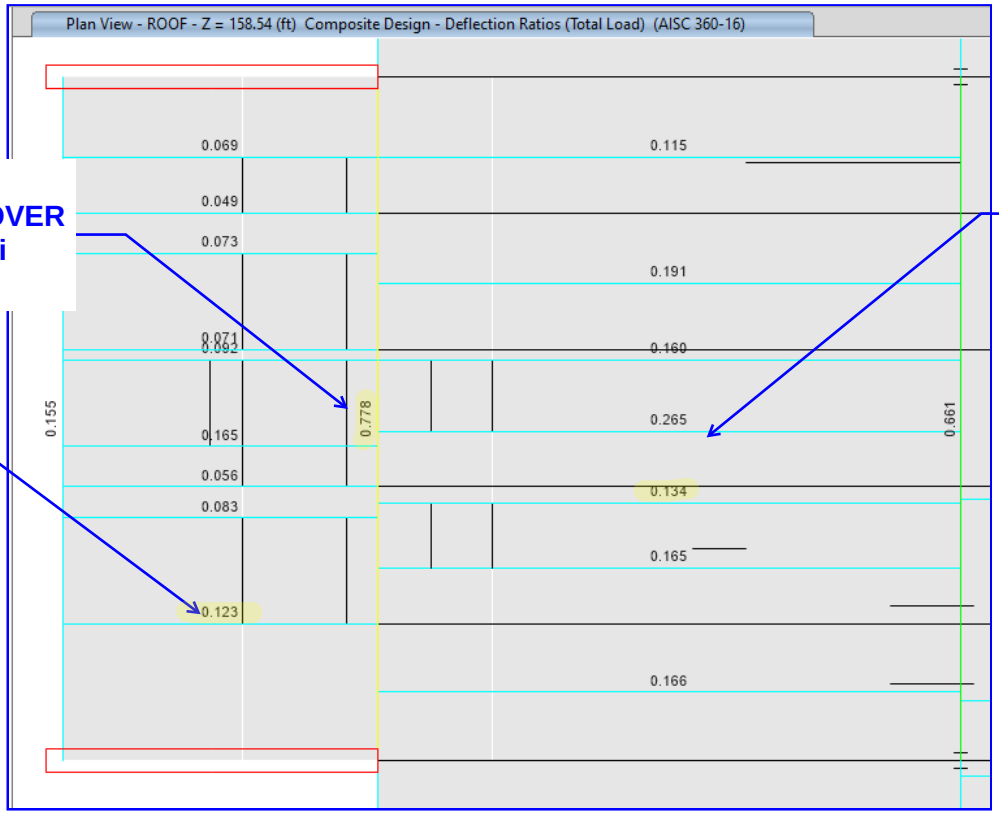


BM B124
DCR_M = 19.8 %
DCR_v = 9.7 %

BEAMS & GIRDER DEFLECTION RATIO:

Girder B15
(E) W18x40 w/ BOT COVER
PLT 5 1/4" x 1/2"_50ksi
DLR_L = 77.8 %

BM B42
DLR = 12.3 %



BM B124
DLR = 26.5 %

PRCTI20221788

GIRDER B15 RESULT

ETABS 18.1.2 | AISC 360-16 Composite Beam Details | License #

Story: ROOF
Location: X= 13.2708 ft Y= 118.335 ft
A36 rolled section, 50000 lb/in² Cover PL

Beam B15

COVER PLT 5.25" x 0.5"_50ksi

W18X40 w. 5.25 inx0.5 in Cover PL

Length: 28.83 ft Trib. Area: 476.35 ft²
No shear studs
No camber

Alternatively ,
COVER PLT 7" x 0.375" _ 50 ksi
can also be used

Composite Deck Properties

	Deck	Cover (in)	w_c (pcf)	f'_c (ksi)	b_{eff} (in)	E_c(S) (ksi)	E_c(D) (ksi)	E_c(V) (ksi)
At Left, at Right	None	N/A	N/A	0	0	N/A	N/A	N/A

Loading (ST15: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe5 combo)

	Constr.	Dead	SDL	Live NR	Snow	Factored
Line Load (kip/ft) 0 ft→28.83 ft	0.000	0.040	0.000	0.000	0.000	0.048
Point Load (kip) @ 2.8858 ft	0.000	0.557	0.939	0.000	0.886	3.212
Point Load (kip) @ 5.7708 ft	0.000	0.353	1.787	0.001	1.652	5.213
Point Load (kip) @ 8.1217 ft	0.000	0.568	0.742	0.001	0.784	2.828
Point Load (kip) @ 10.2258 ft	0.000	0.174	0.404	-0.001	0.478	1.457
Point Load (kip) @ 10.8717 ft	0.000	0.545	0.496	0.175	0.524	2.366
Point Load (kip) @ 11.5408 ft	0.000	0.257	0.803	0.000	0.711	2.410
Point Load (kip) @ 13.2458 ft	0.000	0.184	0.375	2.467	0.444	5.329
Point Load (kip) @ 13.8717 ft	0.000	0.571	0.776	3.944	0.819	9.238
Point Load (kip) @ 16.8717 ft	0.000	-0.348	-0.371	-2.427	-0.403	-5.393
Point Load (kip) @ 16.8958 ft	0.000	1.047	1.155	4.044	1.267	11.139
Point Load (kip) @ 17.3108 ft	0.000	0.285	0.942	0.000	0.870	2.865
Point Load (kip) @ 20.1217 ft	0.000	0.579	0.838	0.000	0.886	3.117
Point Load (kip) @ 21.3758 ft	0.000	0.172	0.404	0.000	0.479	1.457
Point Load (kip) @ 23.0808 ft	0.000	0.298	1.295	0.000	1.152	3.756
Point Load (kip) @ 25.4358 ft	0.000	0.718	1.441	0.000	1.359	4.766

End Reactions

	Top Cope	Bot. Cope	Constr.	Dead	SDL	Live NR	Snow	Combo	Factored
I end (kip)	0 in	0 in	0.000	3.538	5.950	4.315	5.895	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	27.723
J end (kip)	0 in	0 in	0.000	3.578	6.076	4.878	6.014	ST17: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe7	29.012

Strength Checks

	Combo	Factored	Design	Ratio	Pass
Shear at Ends (kip)	ST17: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe7	29.012	121.792	0.238	✓
Construction Bending (kip-ft)	DCmpC1	41.9925	274.5180	0.153	✓
Positive Bending (kip-ft)	ST15: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe5	261.3272	274.5180	0.952	✓

Constructability and Serviceability Checks

	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (in)	0.1906	No Limit	N/A	N/A
Post-concrete Defl. (in)	0.8681	1.4415	0.602	✓
Live Load Defl. (in)	0.5545	0.961	0.577	✓
Total Defl. (in)	1.1218	1.4415	0.778	✓

Section Properties

	PNA (in)	Area (in^2)	S_{bot} (in^3)	I (in^4)	ΦM_n (kip-ft)
Steel (L_b = 3 ft C_b = 1.025)	7.4803	14.43+2.63	71.36	793.8	274.518
Vibrations Check (E_c = 4860)	11.1242	14.43	N/A	793.8	N/A

BEAM B124 RESULT

ETABS 18.1.2 | AISC 360-16 Composite Beam Details | License #

Story: ROOF | **Beam B124** | Length: 24.5592 ft Trib. Area: 65.46 ft²

Location: X= 25.5504 ft Y= 117.7917 ft | No shear studs

A992Fy50 | **W12x35_50ksi** | No camber

Composite Deck Properties

	Deck	Cover (in)	w_c (pcf)	f'_c (ksi)	b_{eff} (in)	E_c(S) (ksi)	E_c(D) (ksi)	E_c(V) (ksi)
At Left, at Right	None	N/A	N/A	0	0	N/A	N/A	N/A

Loading (ST15: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe5 combo)

	Constr.	Dead	SDL	Live NR	Snow	Factored
Line Load (kip/ft) 0 ft→4.8292 ft	0.000	0.041→0.000	0.049→0.000	0.000	0.067→0.000	0.215→0.000
Line Load (kip/ft) 4.8292 ft→24.5592 ft	0.000	0.041	0.071	0.000	0.067	0.240
Point Load (kip) @ 2.2292 ft	0.000	0.033	0.000	2.330	0.000	3.767
Point Load (kip) @ 4.8292 ft	0.000	0.033	0.000	0.484	0.000	0.814
Point Load (kip) @ 6.6633 ft	0.000	0.020	0.000	1.959	0.000	3.159

End Reactions

	Top Cope	Bot. Cope	Constr.	Dead	SDL	Live NR	Snow	Combo	Factored
I end (kip)	0.775 in	0 in	0.000	0.571	0.776	3.944	0.819	ST15: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe5	9.238
J end (kip)	0.7 in	0 in	0.000	0.516	0.856	0.830	0.817	ST15: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe5	4.281

Strength Checks

	Combo	Factored	Design	Ratio	Pass
Shear at Ends (kip)	ST15: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe5	9.238	94.973	0.097	✓
Construction Bending (kip-ft)	DCmpC1	4.5613	192.0943	0.024	✓
Positive Bending (kip-ft)	ST15: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe5	38.1277	192.0943	0.198	✓

Constructability and Serviceability Checks

	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (in)	0.0428	No Limit	N/A	N/A
Post-concrete Defl. (in)	0.2696	1.228	0.220	✓
Live Load Defl. (in)	0.2022	0.8186	0.247	✓
Total Defl. (in)	0.3254	1.228	0.265	✓

Section Properties

	PNA (in)	Area (in^2)	S_{bot} (in^3)	I (in^4)	ΦM_n (kip-ft)
Steel fully braced	6.25	10.35	45.67	285.45	192.0943
Vibrations Check (E_c = 4860)	6.25	10.35	N/A	285.45	N/A

BEAM B42 RESULT

ETABS 18.1.2 | AISC 360-16 Composite Beam Details | License #

Story: ROOF | **Beam B42** | Length: 13.2708 ft Trib. Area: 67.88 ft²

Location: X= 6.6354 ft Y= 109.6908 ft | No shear studs

A36 | **W12X16** | No camber

Composite Deck Properties

	Deck	Cover (in)	w_c (pcf)	f'_c (ksi)	b_{eff} (in)	E_c(S) (ksi)	E_c(D) (ksi)	E_c(V) (ksi)
At Left, at Right	None	N/A	N/A	0	0	N/A	N/A	N/A

Loading (ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1 combo)

	Constr.	Dead	SDL	Live NR	Snow	Factored
Line Load (kip/ft) 0 ft→7.6 ft	0.000	0.027→0.000	0.135→0.000	0.000	0.128→0.000	0.399→0.000
Line Load (kip/ft) 7.6 ft→13.2708 ft	0.000	0.027	0.118	0.000	0.128	0.378
Point Load (kip) @ 7.6 ft	0.000	0.018	-2.604E-04	0.030	-3.116E-04	0.069
Point Load (kip) @ 11.98 ft	0.000	0.019	0.001	2.025	0.001	3.266

End Reactions

	Top Cope	Bot. Cope	Constr.	Dead	SDL	Live NR	Snow	Combo	Factored
I end (kip)	1.18 in	0 in	0.000	0.187	0.877	0.210	0.848	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	2.970
J end (kip)	0.775 in	0 in	0.000	0.205	0.820	1.846	0.849	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	5.541

Strength Checks

	Combo	Factored	Design	Ratio	Pass
Shear at Ends (kip)	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	5.541	53.341	0.104	✓
Construction Bending (kip-ft)	DCmpC1	0.9157	54.2700	0.017	✓
Positive Bending (kip-ft)	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	11.0473	54.2700	0.204	✓

Constructability and Serviceability Checks

	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (in)	0.0067	No Limit	N/A	N/A
Post-concrete Defl. (in)	0.0695	0.6635	0.105	✓
Live Load Defl. (in)	0.0406	0.4424	0.092	✓
Total Defl. (in)	0.0819	0.6635	0.123	✓

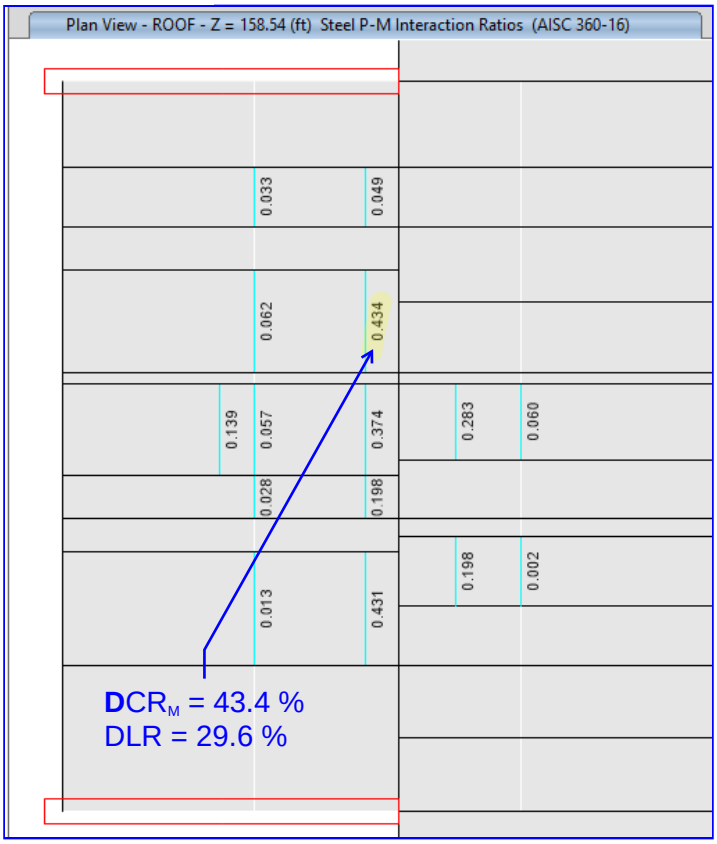
Section Properties

	PNA (in)	Area (in^2)	S_{bot} (in^3)	I (in^4)	ΦM_n (kip-ft)
Steel fully braced	6	4.71	17.17	103	54.27
Vibrations Check (E_c = 4860)	6	4.71	N/A	103	N/A

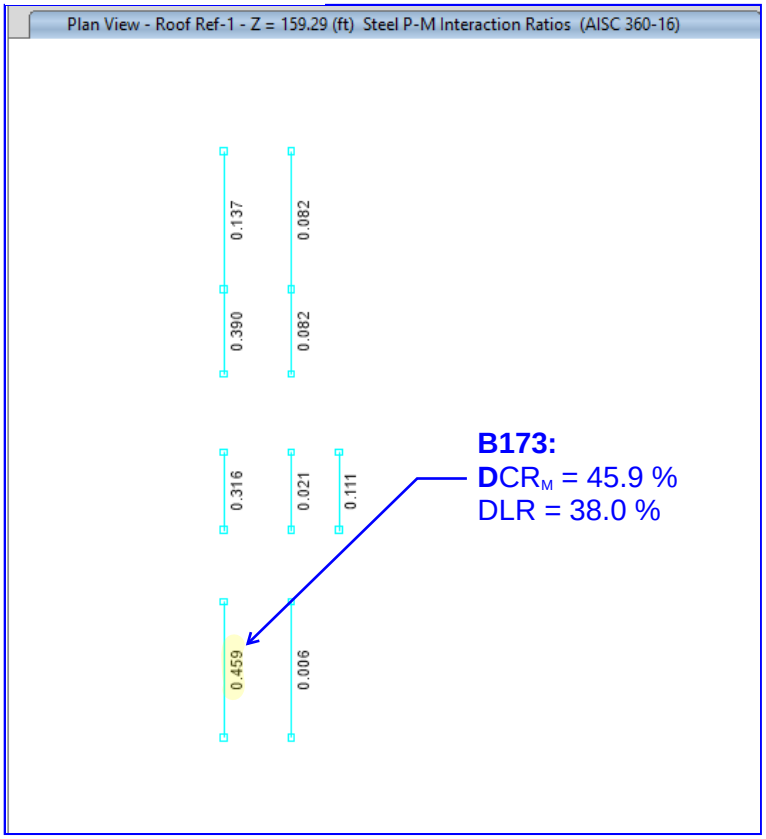
PRCTI20221788

HSS3x3x1/4 PMM RATIO:

AT ROOF LVL:



AT 9" ABV ROOF LVL:



ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (in)	Combo	Element Type	Section	Classification
Roof Ref-1	B173	164	34.85	ST02: 1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6Skyb+1.6Mach+1.6Pe1	Ordinary Moment Frame	HSS3X3X1/4	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
62.8300	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r/P_y$	$\alpha P_r/P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

Φ_b	Φ_c	Φ_{TY}	Φ_{TF}	Φ_V	$\Phi_{V\text{-}RI}$	Φ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in²)	J (in⁴)	I_{33} (in⁴)	I_{22} (in⁴)	A_{v3} (in²)	A_{v2} (in²)
2.44	5.08	3.02	3.02	1.07	1.07

Design Properties

S_{33} (in³)	S_{22} (in³)	Z_{33} (in³)	Z_{22} (in³)	r_{33} (in)	r_{22} (in)	C_w (in⁶)
2.01	2.01	2.48	2.48	1.1125	1.1125	

Material Properties

E (lb/in²)	f_y (lb/in²)	R_y	α
29000000	46000	1.1	NA

HSS Section Parameters

HSS Welding	Reduce HSS Thickness?
ERW	No

Stress Check forces and Moments

Location (in)	P_u (kip)	M_{u33} (kip-ft)	M_{u22} (kip-ft)	V_{u2} (kip)	V_{u3} (kip)	T_u (kip-ft)
34.85	0	3.9312	0	-1.401	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K_1	K_2	B_1	B_2	C_m
Major Bending	0.952	1	1	1	1	1
Minor Bending	0.952	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.952	1	1.263

Demand/Capacity (D/C) Ratio Eqn.(H1-1b)

D/C Ratio =	$(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})$
0.459 =	0 + 0.459 + 0

Axial Force and Capacities

P_u Force (kip)	ϕP_{nc} Capacity (kip)	ϕP_{nt} Capacity (kip)
0	83.157	101.016

Moments and Capacities

	M_u Moment (kip-ft)	ϕM_n (kip-ft)	ϕM_n No LTB (kip-ft)	ϕM_n Cb=1 (kip-ft)
Major Bending	3.9312	8.556	8.556	8.556
Minor Bending	0	8.556		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	ϕT_n Capacity (kip-ft)
0	8.0936	7.2843

Shear Design

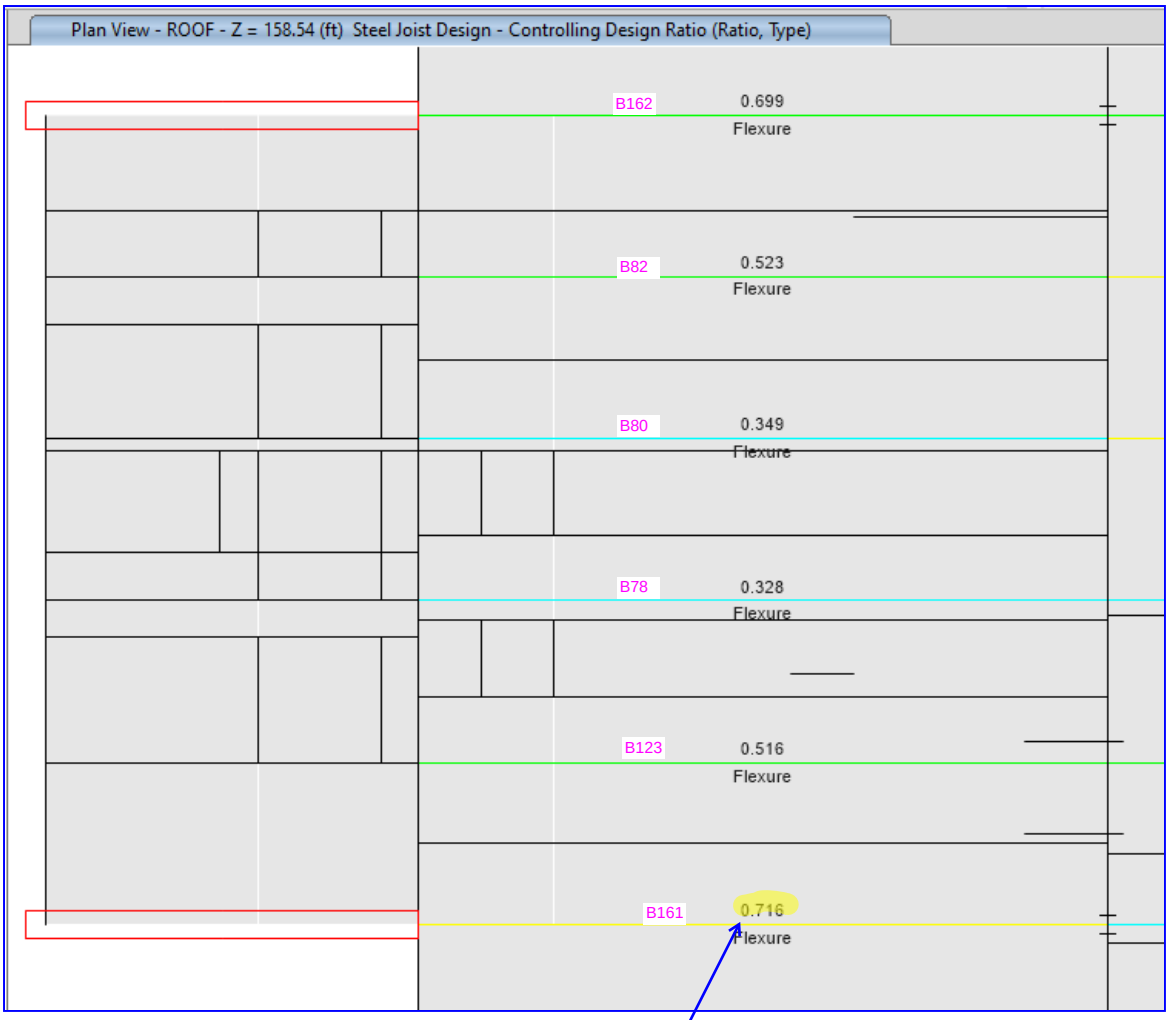
	V_u Force (kip)	ϕV_n Capacity (kip)	Stress Ratio
Major Shear	1.401	26.635	0.053
Minor Shear	0	26.635	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
1.428	ST19: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe9	3.208	ST19: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6pe9

PRCTI20221788

STEEL JOIST DESIGN RATIOS:



B161:
DCR_M = 71.6 %
Deflection = 0.763" = Span/386
Allowable Defl = Span/180
DLR = 46.6 %

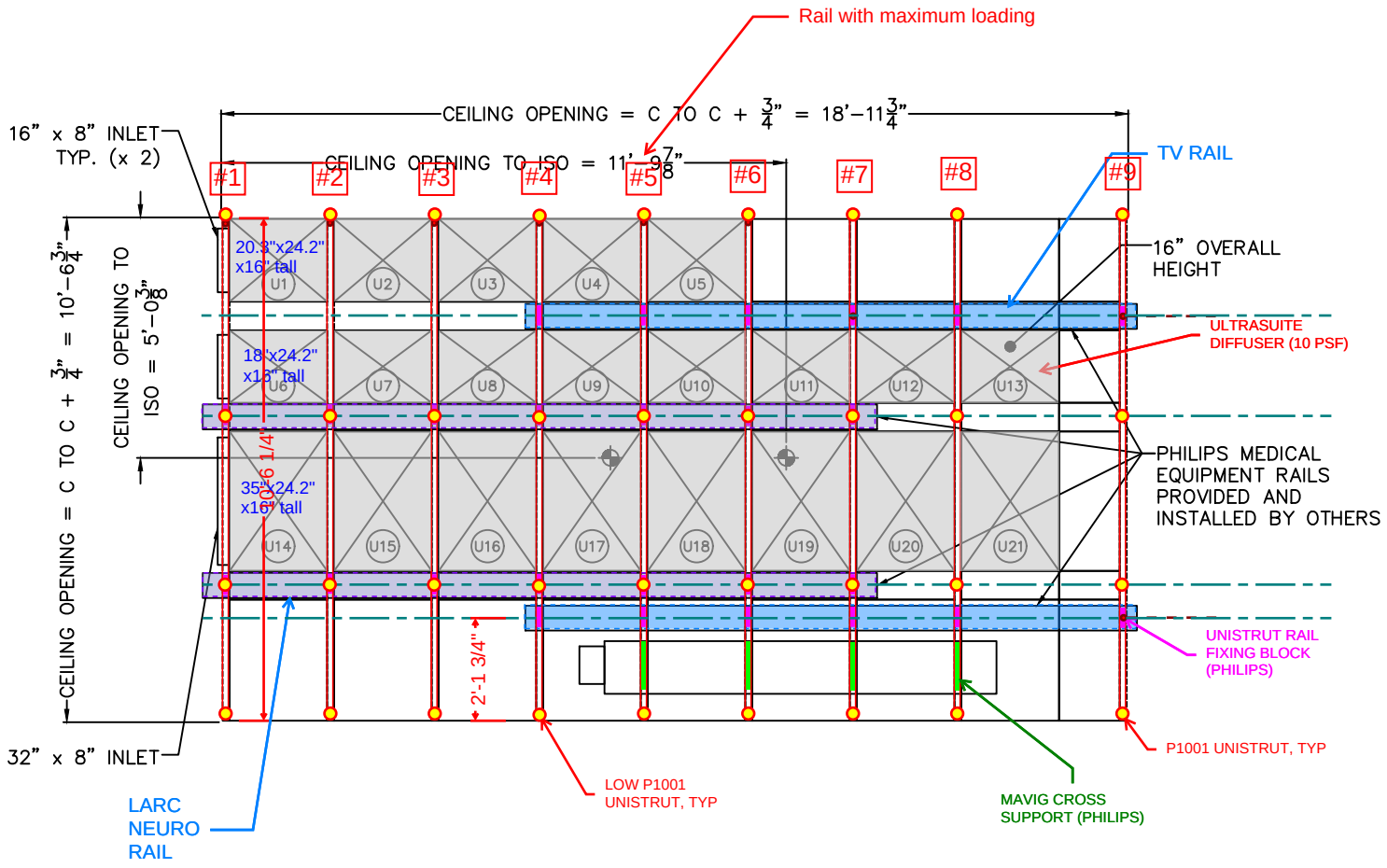
PRCTI20221788

Submittal Sheet

ULTRASUITE

OPERATING ROOM DIFFUSER SYSTEM WITH INTEGRATED LED LIGHTING

REFLECTED CEILING PLAN - LAYOUT A - HYBRID OR



TOTAL AREA = 199 sq. ft.		
USA = 88 sq. ft.	**HGWC = 111 sq. ft.**	
USA - ULTRASUITE MODULE 18 x 24.2 (x 8) 20.3 x 24.2 (x 5) 24.2 x 35 (x 8)	**SC - SOLID CORE ACCESS PANELS** EXACT SIZE AND QTY TO BE DETERMINED	**HGWC PERIMETER HALF TEE** 120" (x 8)

PRELIMINARY LAYOUT

- B12 STANDARD WHITE FINISH
- PANEL CUTOUTS FOR BOOMS DONE IN FIELD BY OTHERS
- RECOMMENDED INLET SIZE AND LOCATIONS SHOWN
- THE CEILING IS FACTORY PREMANUFACTURED TO SIZES AND TOLERANCE +/– .032"
- SITE ADJUSTMENTS TO PERIMETER SOFFITS AND/OR DRYWALL MAY BE REQUIRED AND ARE THE RESPONISIBILITY OF THE INSTALLER

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT: GSH Hybrid OR		
ENGINEER:	GH	**USA** ULTRASUITE ARRAY OPERATING ROOM DIFFUSER SYSTEM WITH INTEGRATED LED LIGHTING
CUSTOMER:	PXY87500	
SUBMITTAL DATE: / **REVISION: 0**	03/11/2022	

Printed in Canada

PRCTI20221788

General Beam

File: Multicare GSH Philips.ec6

Lic. # : KW-06000114

ABKJ- ANDERSEN-BJORNSTAD-KANE-JACOBS, INC.

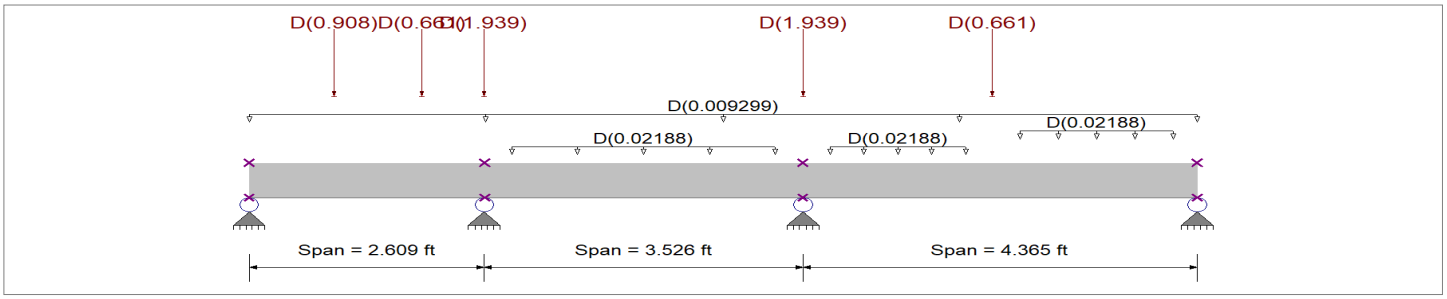
DESCRIPTION: GSH OR 1: Unistrut Rail 5

General Beam Properties

P1001 UNISTRUT RAIL

Elastic Modulus 29,000.0 ksi

Span #1	Span Length =	2.609	ft	Area =	10.0	in^2	Moment of Inertia =	0.9280 in^4
Span #2	Span Length =	3.526	ft	Area =	10.0	in^2	Moment of Inertia =	0.9280 in^4
Span #3	Span Length =	4.365	ft	Area =	10.0	in^2	Moment of Inertia =	0.9280 in^4



Applied Loads

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

Loads on all spans...

Uniform Load on ALL spans : D = 0.004250 k/ft, Tributary Width = 2.188 ft

Load(s) for Span Number 1

Point Load : D = 0.9080 k @ 0.9427 ft, (Mavig)

Point Load : D = 0.6610 k @ 1.917 ft, (TV Rail)

Load(s) for Span Number 2

Point Load : D = 1.939 k @ 0.0 ft, (Larc Rail)

Uniform Load : D = 0.010 ksf, Extent = 0.3020 -->> 3.219 ft, Tributary Width = 2.188 ft, (Diffuser)

Load(s) for Span Number 3

Point Load : D = 1.939 k @ 0.0 ft, (Larc Rail)

Uniform Load : D = 0.010 ksf, Extent = 0.3020 -->> 1.802 ft, Tributary Width = 2.188 ft, (Diffuser)

Uniform Load : D = 0.010 ksf, Extent = 2.406 -->> 4.10 ft, Tributary Width = 2.188 ft, (Diffuser)

Point Load : D = 0.6610 k @ 2.099 ft, (TV Rail)

DESIGN SUMMARY

Maximum Bending =	0.635 k-ft	Maximum Shear =	0.9117 k
Load Combination	D Only	Load Combination	D Only
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	0.958 ft	Location of maximum on span	2.609 ft

Maximum Deflection

Max Downward Transient Deflection	0.000 in	0
Max Upward Transient Deflection	0.000 in	0
Max Downward Total Deflection	0.059 in	894
Max Upward Total Deflection	-0.023 in	1823

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values (k-ft) Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Shear Values (k) Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope													
Dsgn. L = 2.61 ft	1			0.63	-0.22	0.63					0.91		
Dsgn. L = 3.53 ft	2			-0.00	-0.31	0.31					0.47		
Dsgn. L = 4.37 ft	3			0.62	-0.31	0.62					0.47		

PRCTI20221788

General Beam

File: Multicare GSH Philips.ec6

Lic. # : KW-06000114
ABKJ- ANDERSEN-BJORNSTAD-KANE-JACOBS, INC.

DESCRIPTION: GSH OR 1: Unistrut Rail 5

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values (k-ft) Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Shear Values (k) Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 2.61 ft	1			0.63	-0.22	0.63					0.91		
Dsgn. L = 3.53 ft	2			-0.00	-0.31	0.31					0.47		
Dsgn. L = 4.37 ft	3			0.62	-0.31	0.62					0.47		
+0.60D													
Dsgn. L = 2.61 ft	1			0.38	-0.13	0.38					0.55		
Dsgn. L = 3.53 ft	2			-0.00	-0.18	0.18					0.28		
Dsgn. L = 4.37 ft	3			0.37	-0.18	0.37					0.28		

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D Only	1	0.0255	1.255		0.0000	0.000
	2	0.0000	1.255	D Only	-0.0232	1.830
D Only	3	0.0586	2.265		0.0000	1.830

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

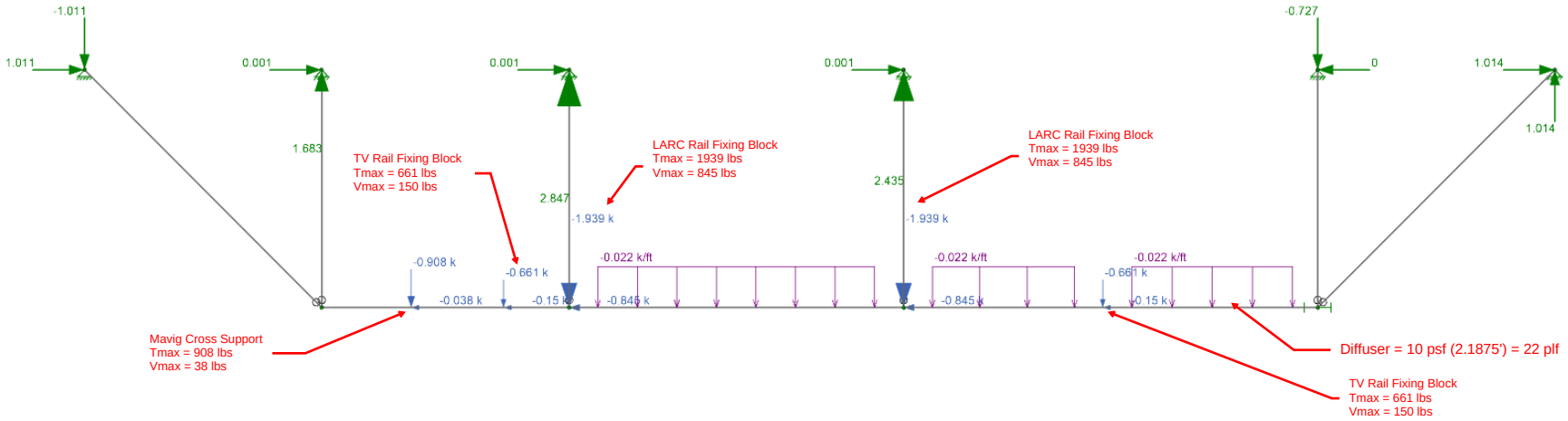
Load Combination	Support 1	Support 2	Support 3	Support 4
Overall MAXimum	0.682	2.875	2.479	0.303
Overall MINimum				
D Only	0.682	2.875	2.479	0.303
+0.60D	0.409	1.725	1.488	0.182

P1001 UNISTRUT BEAM LOADING:
Mmax = 0.635 k-ft

P1001, Mallow = 14.36 k-ft DCR = .04

PRCTI20221788

P1001 UNISTRUT W/ MANUFACTURER MAXIMUM RAIL FIXING BLOCK LOADS WITH ALL EQUIPMENT ALIGNED DIRECTLY TO SINGLE RAIL



MAXIMUM HANGER ROD TENSION: 2.85k
B7 1/2" THRD ROD, AXIAL CAPACITY, Tn/Ω = 9.20k DCR = 0.31

MAXIMUM HANGER COMPRESSION: 0.727k
THRD RD HANGER W/ P1000 ROD STIFFENER, Pallow = 1.13k DCR = 0.64

P1000 LATERAL BRACE MAXIMUM TENSION: 1.43k
P1354AW HINGE CLIP, ALLOWABLE TENSION, Tallow = 2.30k DCR = 0.62

P1000 LATERAL BRACE MAXIMUM COMPRESSION: 1.43k
P1000 COLUMN LOADING, h = 48", Pallow = 2.77k DCR = 0.52

PRCTI20221788

ABKJ
ANDERSEN • BJORNSTAD • KANE • JACOBS

Consulting Civil and Structural Engineers

STRUCTURAL ENGINEERING CALCULATIONS

Tel: 206.340.2255 | Fax: 206.340.2266 | www.abkj.com

Project:	GSH OR 1	Job #:	20135	Date:
Subject:	Stryker Tandem Mounting Plate	By:	SRB	

S_{DS} =	0.867
z/h =	1.00
R_p =	2.5
a_p =	1
I_p =	1.5

Laboratory Equipment (ASCE 7, 13.5-1)

Seismic Force (Per ASCE 7-16 Ch. 13)

$$F_p = \frac{0.4 a_p W_p S_{DS}\left(1 + 2\,z/h\right)}{\left(\frac{R_p}{I_p}\right)} = 0.624\ Wp$$

$F_{p(min)} = 0.3 S_{DS} I_p W_p = 0.390\ Wp$

$F_{p(max)} = 1.6 S_{DS} I_p W_p = 2.081\ Wp$

Component	Wp	z/h	Rp	ap	Fp
Stryker Tandem Boom (Mfr Recommend Design Load)	2200 lb	1.00	2.5	1.0	1373 lb
Stryker Installed Weight	683	1.00	2.5	1.0	426 lb

Top Tandem SFS-3-T Results - DO NOT ALTER!					
METRIC-SYSTEM	X-Direction	Y-Direction	US-SYSTEM	X-Direction	Y-Direction
Center of Gravity:	1922 mm	1188 mm	Center of Gravity:	75.7 in	46.8 in
Static Moment at Top Flange:	5435.5 Nm		Static Moment at Top Flange:	4009.1 ft-lbs	
Total Suspended Mass (Including Payload):	288.4 Kg		Total Suspended Mass (Including Payload):	635.86 lbs	
Total Allowable Payload:	127.5 Kg		Total Allowable Payload:	281.03 lbs	

CHROMOPHARE-2 RESULTS - DO NOT ALTER!					
METRIC-SYSTEM	X-Direction	Y-Direction	US-SYSTEM	X-Direction	Y-Direction
Center of Gravity:	1317 mm	681 mm	Center of Gravity:	51.9 in	26.8 in
Static Moment at Top Flange	1930.4 Nm		Static Moment at Top Flange	1423.8 ft-lbs	
Total Suspension Mass	149.4 Kg		Total Suspension Mass	329.39 lbs	

Mounting Plate Recommended Design Specifications		
	Maximum Weight kg/lb	Maximum Moment Nm/ ft-lb
Single Common	498/1,100	7,660/5,650
Tandem Common	997/2,200	15,320/11,300

Use Mfr recommended design loads for suspended boom support

9.3.3 Tandem Common Plate (US/Canada only)

Caution:

Ensure that the tandem structure is mounted in the proper orientation by referring to the Equipment Configuration Drawings specifically related to the project.

9.3.3.1 Mounting Plate Dimensions

Note: Indicated holes are used for mounting Stryker equipment to the mounting plate and may not be used or obstructed while mounting the plate to the support structure.

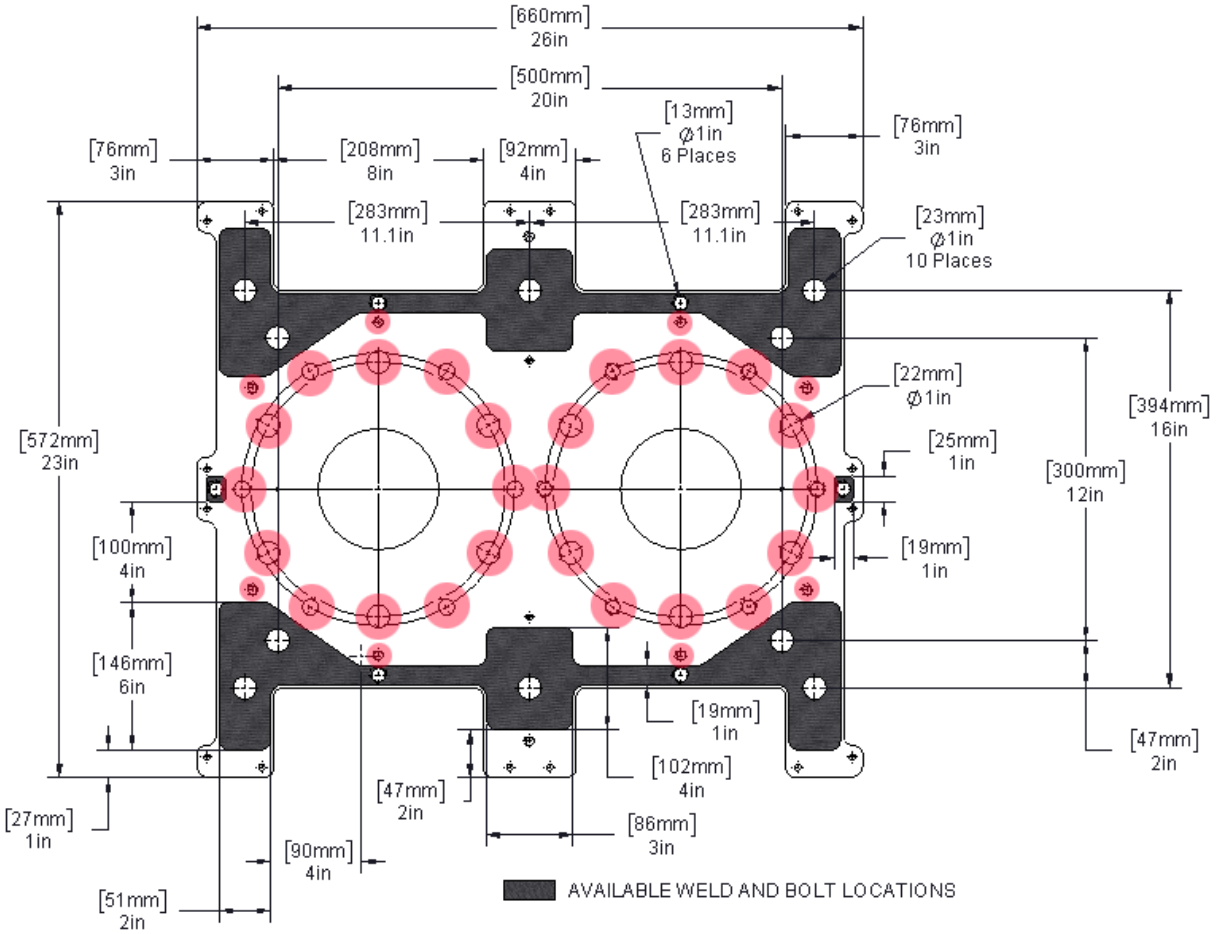


Figure 5. Tandem Common Plate P29280

Notes

- Available weld and bolt locations: marked dark gray

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0.917	0	0	
3	N3	1.833	0	0	
4	N4	0	0	1.333	
5	N5	0.917	0	1.333	
6	N6	1.833	0	1.333	
7	N7	0	2.333	0	
8	N8	0.917	2.333	0	
9	N9	1.833	2.333	0	
10	N10	0	2.333	1.333	
11	N11	0.917	2.333	1.333	
12	N12	1.833	2.333	1.333	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	N7	Reaction	Reaction	Reaction
2	N10	Reaction	Reaction	Reaction
3	N11	Reaction	Reaction	Reaction
4	N12	Reaction	Reaction	Reaction
5	N9	Reaction	Reaction	Reaction
6	N8	Reaction	Reaction	Reaction

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e^{5}°F^{-1}]	Density [k/ft^{3}]	Yield [ksi]	Ry	Fu [ksi]	Rt
1	A992	29000	11154	0.3	0.65	0.49	50	1.1	65	1.1
2	A36 Gr.36	29000	11154	0.3	0.65	0.49	36	1.5	58	1.2
3	A572 Gr.50	29000	11154	0.3	0.65	0.49	50	1.1	65	1.1
4	A500 Gr.B RND	29000	11154	0.3	0.65	0.527	42	1.4	58	1.3
5	A500 Gr.B Rect	29000	11154	0.3	0.65	0.527	46	1.4	58	1.3
6	A53 Gr.B	29000	11154	0.3	0.65	0.49	35	1.6	60	1.2
7	A1085	29000	11154	0.3	0.65	0.49	50	1.4	65	1.3
8	A913 Gr.65	29000	11154	0.3	0.65	0.49	65	1.1	80	1.1

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N4	N10	L2X2X4	Column	Single Angle	A36 Gr.36	Typical
2	M2	N1	N7	L2X2X4	Column	Single Angle	A36 Gr.36	Typical
3	M3	N5	N11	L2X2X4	Column	Single Angle	A36 Gr.36	Typical
4	M4	N2	N8	L2X2X4	Column	Single Angle	A36 Gr.36	Typical
5	M5	N3	N9	L2X2X4	Column	Single Angle	A36 Gr.36	Typical
6	M6	N6	N12	L2X2X4	Column	Single Angle	A36 Gr.36	Typical
7	M7	N4	N1	RIGID	None	None	RIGID	Typical
8	M8	N4	N5	RIGID	None	None	RIGID	Typical
9	M9	N5	N2	RIGID	None	None	RIGID	Typical
10	M10	N1	N2	RIGID	None	None	RIGID	Typical
11	M11	N5	N6	RIGID	None	None	RIGID	Typical
12	M12	N2	N3	RIGID	None	None	RIGID	Typical
13	M13	N6	N3	RIGID	None	None	RIGID	Typical
14	M14	N4	N11	L2X2X3	Beam	Single Angle	A992	Typical
15	M15	N5	N12	L2X2X3	Beam	Single Angle	A992	Typical
16	M16	N1	N8	L2X2X3	Beam	Single Angle	A992	Typical

Member Primary Data (Continued)

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
17	M17	N2	N9	L2X2X3	Beam	Single Angle	A992	Typical
18	M18	N1	N10	L2X2X3	Beam	Single Angle	A36 Gr.36	Typical
19	M19	N3	N12	L2X2X3	Beam	Single Angle	A36 Gr.36	Typical

Hot Rolled Steel Design Parameters

	Label	Shape	Length [ft]	Lcomp top [ft]	Channel Conn.	a [ft]	Function
1	M1	L2X2X4	2.333	Lbyy	N/A	N/A	Lateral
2	M2	L2X2X4	2.333	Lbyy	N/A	N/A	Lateral
3	M3	L2X2X4	2.333	Lbyy	N/A	N/A	Lateral
4	M4	L2X2X4	2.333	Lbyy	N/A	N/A	Lateral
5	M5	L2X2X4	2.333	Lbyy	N/A	N/A	Lateral
6	M6	L2X2X4	2.333	Lbyy	N/A	N/A	Lateral
7	M14	L2X2X3	2.507	Lbyy	N/A	N/A	Lateral
8	M15	L2X2X3	2.506	Lbyy	N/A	N/A	Lateral
9	M16	L2X2X3	2.507	Lbyy	N/A	N/A	Lateral
10	M17	L2X2X3	2.506	Lbyy	N/A	N/A	Lateral
11	M18	L2X2X3	2.687	Lbyy	N/A	N/A	Lateral
12	M19	L2X2X3	2.687	Lbyy	N/A	N/A	Lateral

Node Loads and Enforced Displacements (BLC 1 : D)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N1	L	Y	-0.367
2	N2	L	Y	-0.367
3	N3	L	Y	-0.367
4	N4	L	Y	-0.367
5	N5	L	Y	-0.367
6	N6	L	Y	-0.367

Node Loads and Enforced Displacements (BLC 2 : L-z)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N1	L	Y	-2.85
2	N2	L	Y	-2.85
3	N3	L	Y	-2.85
4	N4	L	Y	2.85
5	N5	L	Y	2.85
6	N6	L	Y	2.85

Node Loads and Enforced Displacements (BLC 4 : Ev-x)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N1	L	Y	0
2	N1	L	Y	-0.064
3	N4	L	Y	-0.064
4	N5	L	Y	-0.064
5	N2	L	Y	-0.064
6	N3	L	Y	-0.064
7	N6	L	Y	-0.064

Node Loads and Enforced Displacements (BLC 6 : Ev-z)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N4	L	Y	-0.064
2	N1	L	Y	-0.064
3	N5	L	Y	-0.064
4	N2	L	Y	-0.064
5	N6	L	Y	-0.064
6	N3	L	Y	-0.064

Node Loads and Enforced Displacements (BLC 7 : L-x)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N1	L	Y	-3.08
2	N4	L	Y	-3.08
3	N6	L	Y	3.08
4	N3	L	Y	3.08

Member Point Loads (BLC 3 : Ex)

	Member Label	Direction	Magnitude [k, k-ft]	Location [(ft, %)]
1	M9	X	1.373	%50

Member Point Loads (BLC 5 : Ez)

	Member Label	Direction	Magnitude [k, k-ft]	Location [(ft, %)]
1	M9	Z	1.373	%50

Wall Panel Point Loads

No Data to Print...

Diaphragm Point Loads

No Data to Print...

Basic Load Cases

	BLC Description	Category	Y Gravity	Nodal	Point
1	D	DL	-1	6	
2	L-z	None		6	
3	Ex	None			1
4	Ev-x	None		7	
5	Ez	None			1
6	Ev-z	None		6	
7	L-x	None		4	

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	1.2D+1.6L	Yes	Y	DL	1.2	2	1.6				
2	1.2D+Ev+Ex+L	Yes	Y	DL	1	7	1	4	1	3	1
3	1.2D+Ev+Ez+L	Yes	Y	DL	1.2	2	1	6	1	5	1

Load Combination Design

	Description	Service	Hot Rolled	Cold Formed	Wood	Concrete	Masonry	Aluminum	Stainless	Connection
1	1.2D+1.6L		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	1.2D+Ev+Ex+L		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	1.2D+Ev+Ez+L	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Envelope Node Reactions

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N7	max	0	1	3.588	1	0.01	1	0	3	0	3	0	3
2		min	-0.006	3	3.142	3	-0.008	2	0	1	0	1	0	1
3	N10	max	0.011	1	4.627	2	0.723	1	0	3	0	3	0	3
4		min	-0.014	2	-2.52	1	-0.151	3	0	1	0	1	0	1
5	N11	max	-0.167	2	0.878	2	0.011	1	0	3	0	3	0	3
6		min	-0.578	1	-4.692	1	-0.007	2	0	1	0	1	0	1
7	N12	max	-0.32	3	-4.167	2	-0.249	2	0	3	0	3	0	3
8		min	-0.853	2	-5.096	1	-1.198	3	0	1	0	1	0	1
9	N9	max	0.573	1	6.178	1	0.002	2	0	3	0	3	0	3
10		min	-0.511	2	-3.436	2	-0.014	3	0	1	0	1	0	1
11	N8	max	0.443	1	5.284	1	0.001	1	0	3	0	3	0	3
12		min	0.177	2	1.183	2	-0.008	3	0	1	0	1	0	1
13	Totals:	max	0	3	3.126	3	0	2						
14		min	-1.373	2	2.669	2	-1.373	3						

Envelope Maximum Member Section Forces

	Member		Axial[k]	Loc[ft]	LCy	Shear[k]	Loc[ft]	LCz	Shear[k]	Loc[ft]	LC	Torque[k-ft]	Loc[ft]	LCy-y Moment[k-ft]	Loc[ft]	LCz-z Moment[k-ft]	Loc[ft]	LC
1	M1	max	3.768	0	1	0.012	2.333	1	0.012	2.333	2	0	2.333	0.008	0	0.047	0	1
2		min	-4.136	2.333	2	-0.011	0	2	-0.017	0	1	0	0	-0.001	0	-0.038	0	2
3	M2	max	-3.133	0	3	0.001	2.333	1	0.008	2.333	2	0	2.333	0.016	0	0.019	0	1
4		min	-3.588	2.333	1	-0.005	0	3	-0.01	0	1	0	0	-0.005	0	-0.02	0	2
5	M3	max	3.216	0	1	0.007	2.333	1	0.007	2.333	2	0	2.333	0.003	0	0.027	0	1
6		min	-1.277	2.333	2	-0.009	0	2	-0.009	0	1	0	0	-0.001	0	-0.026	0	2
7	M4	max	-0.717	0	2	-0.002	2.333	2	0.006	2.333	3	0	2.333	0.011	0	0	2.333	2
8		min	-4.14	2.333	1	-0.009	0	3	-0.003	0	1	0	0	-0.002	0	-0.024	0	3
9	M5	max	2.139	0	2	0.001	2.333	2	0.011	2.333	3	0	2.333	0.006	0	0.005	0	2
10		min	-4.691	2.333	1	-0.012	0	3	-0.002	0	2	0	0	0	2.333	-0.038	0	3
11	M6	max	2.665	0	1	0.003	2.333	1	0.007	2.333	3	0	2.333	0.006	0	0.008	0	1
12		min	1.346	2.333	3	-0.006	0	2	-0.002	0	1	0	0	-0.005	0	-0.018	0	3
13	M7	max	0.346	1.333	1	-0.234	1.333	2	-0.029	1.333	3	-0.127	1.333	0.194	0	0.37	1.333	1
14		min	-0.075	0	3	-0.544	0	1	-0.293	0	1	-0.365	0	-0.198	1.333	-0.355	0	1
15	M8	max	-0.069	0.917	2	0.447	0.917	2	0.363	0.917	1	0.395	0.917	0.142	0.917	0.155	0.917	3
16		min	-0.378	0	3	-0.596	0	1	-0.07	0	3	0.133	0	-0.194	0	-0.511	0.917	2
17	M9	max	0.665	0.666	3	-0.035	1.333	2	0.539	1.333	2	-0.151	1.333	0.286	0	0.075	1.333	3
18		min	-0.708	0.68	3	-0.105	0	3	-0.834	0	2	-0.444	0	-0.291	1.333	-0.064	0	3
19	M10	max	0.296	0.917	3	0.767	0.917	2	0.37	0.917	1	0.395	0.917	0.142	0.917	0.363	0	1
20		min	0.071	0	2	-0.052	0	3	-0.083	0	3	0.133	0	-0.198	0	-0.566	0.917	2
21	M11	max	-0.092	0.916	2	-0.53	0.916	3	0.595	0.916	3	0.433	0.916	0.255	0.916	0.434	0.916	1
22		min	-0.385	0	3	-0.845	0	2	0.237	0	2	0.145	0	-0.289	0	-0.642	0	2
23	M12	max	0.401	0.916	3	1.085	0.916	3	0.618	0.916	3	0.433	0.916	0.263	0.916	0.634	0	3
24		min	0.095	0	2	-0.292	0	2	0.011	0	2	0.145	0	-0.303	0	-0.446	0.916	1
25	M13	max	-0.234	1.333	2	0.645	1.333	1	-0.097	1.333	2	-0.146	1.333	0.255	0	0.438	0	1
26		min	-0.589	0	3	0.217	0	2	-0.389	0	3	-0.427	0	-0.263	1.333	-0.423	1.333	1
27	M14	max	1.603	0	1	0.001	0	3	0	0.078	2	0	2.507	0.001	1.253	0	2.507	3
28		min	0.429	2.507	2	-0.001	2.507	1	0	2.272	3	0	0	0	0	-0.001	1.253	3
29	M15	max	2.326	0	2	0.001	0	3	0	2.506	2	0	2.506	0.001	1.253	0	2.506	3

Envelope Maximum Member Section Forces (Continued)

	Member		Axial[k]	Loc[ft]	LC	y Shear[k]	Loc[ft]	LC	z Shear[k]	Loc[ft]	LC	Torque[k-ft]	Loc[ft]	LC	y-y Moment[k-ft]	Loc[ft]	LC	z-z Moment[k-ft]	Loc[ft]	LC
30		min	0.862	2.506	3	-0.001	2.506	1	0	0	3	0	0	1	0	0	1	-0.001	1.253	3
31	M16	max	-0.486	0	2	0.001	0	1	0	0.366	2	0	2.507	2	0.001	1.253	1	0	2.507	3
32		min	-1.228	2.507	1	-0.001	2.507	3	0	1.253	1	0	0	1	0	0	1	-0.001	1.253	1
33	M17	max	1.407	0	2	0.001	0	3	0	1.253	3	0	2.506	3	0.001	1.253	3	0	2.506	3
34		min	-1.596	2.506	1	-0.001	2.506	1	0	0	3	0	0	2	0	0	1	-0.001	1.253	3
35	M18	max	0.317	0	3	0.002	0	1	0	2.239	1	0	2.687	1	0.001	1.343	1	0	2.687	3
36		min	-1.427	2.687	1	-0.002	2.687	3	0	0.084	3	0	0	2	0	0	1	-0.001	1.343	3
37	M19	max	2.409	0	3	0.002	0	1	0	2.687	2	0	2.687	1	0.001	1.343	1	0	2.687	3
38		min	0.494	2.687	2	-0.002	2.687	3	0	0.084	1	0	0	2	0	0	1	-0.001	1.343	1

Envelope Member Section Deflections - Strength

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
1	M1	1	max	0.005	1	0.004	1	0.006	2	0	2	NC	2	NC	2
2			min	-0.005	2	-0.016	2	0.002	1	-0.001	1	NC	1	NC	1
3		2	max	0.004	1	0.004	1	0.006	2	0	2	NC	2	NC	2
4			min	-0.004	2	-0.013	2	0	1	-0.001	1	NC	1	7957.028	1
5		3	max	0.002	1	0.003	1	0.004	2	0	2	NC	2	6192.903	2
6			min	-0.003	2	-0.009	2	-0.001	1	-0.001	1	NC	1	5499.8	1
7		4	max	0.001	1	0.001	1	0.002	2	0	2	NC	2	5218.693	1
8			min	-0.001	2	-0.005	2	-0.001	1	-0.001	1	NC	1	3530.589	2
9		5	max	0	2	0	2	0	2	0	2	NC	2	5610.824	1
10			min	0	1	0	1	0	1	-0.001	1	NC	1	2399.537	2
11	M2	1	max	-0.005	2	-0.006	1	0.006	2	0	2	NC	1	NC	2
12			min	-0.005	1	-0.009	2	0.002	1	-0.001	1	3029.022	2	NC	1
13		2	max	-0.003	2	-0.005	1	0.006	2	0	2	NC	1	NC	2
14			min	-0.003	1	-0.007	2	0	1	-0.001	1	4046.724	2	7942.887	1
15		3	max	-0.002	2	-0.004	1	0.004	2	0	2	NC	1	6198.401	2
16			min	-0.002	1	-0.005	2	-0.001	1	-0.001	1	6078.716	2	5492.217	1
17		4	max	-0.001	2	-0.002	1	0.002	2	0	2	NC	2	5214.534	1
18			min	-0.001	1	-0.002	2	-0.001	1	-0.001	1	NC	1	3531.581	2
19		5	max	0	2	0	2	0	2	0	2	NC	2	5610.824	1
20			min	0	1	0	1	0	1	-0.001	1	NC	1	2399.537	2
21	M3	1	max	0.004	1	0.004	1	0.009	1	0	2	NC	2	NC	2
22			min	-0.002	2	-0.016	2	0.001	2	-0.001	1	NC	1	2979.973	1
23		2	max	0.003	1	0.004	1	0.006	1	0	2	NC	2	NC	2
24			min	-0.001	2	-0.013	2	0.002	2	-0.001	1	NC	1	4745.119	1
25		3	max	0.002	1	0.003	1	0.003	1	0	2	NC	2	NC	2
26			min	-0.001	2	-0.009	2	0.001	2	-0.001	1	NC	1	8263.548	1
27		4	max	0.001	1	0.001	1	0.002	1	0	2	NC	2	NC	2
28			min	0	2	-0.005	2	0.001	2	-0.001	1	NC	1	NC	1
29		5	max	0	2	0	2	0	2	0	2	NC	2	NC	1
30			min	0	1	0	1	0	1	-0.001	1	NC	1	9401.464	2
31	M4	1	max	-0.001	2	-0.006	1	0.009	1	0	2	NC	1	NC	2
32			min	-0.005	1	-0.009	2	0.001	2	-0.001	1	3029.022	2	2979.973	1
33		2	max	-0.001	2	-0.005	1	0.006	1	0	2	NC	1	NC	2
34			min	-0.004	1	-0.007	2	0.002	2	-0.001	1	4045.086	2	4750.23	1
35		3	max	0	2	-0.004	1	0.003	1	0	2	NC	1	NC	2
36			min	-0.003	1	-0.005	2	0.001	2	-0.001	1	6074.392	2	8281.277	1
37		4	max	0	2	-0.002	1	0.002	1	0	2	NC	2	NC	2
38			min	-0.001	1	-0.002	2	0.001	2	-0.001	1	NC	1	NC	1
39		5	max	0	2	0	2	0	2	0	2	NC	2	NC	1
40			min	0	1	0	1	0	1	-0.001	1	NC	1	9401.464	2
41	M5	1	max	0.003	2	-0.006	1	0.016	1	0	2	NC	1	NC	2
42			min	-0.006	1	-0.009	2	-0.003	2	-0.001	1	3029.022	2	1718.908	1
43		2	max	0.002	2	-0.005	1	0.012	1	0	2	NC	1	NC	2

Envelope Member Section Deflections - Strength (Continued)

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
44			min	-0.004	1	-0.007	2	-0.002	2	-0.001	1	4043.528	2	2297.385	1
45		3	max	0.001	2	-0.004	1	0.008	1	0	2	NC	1	NC	2
46			min	-0.003	1	-0.005	2	-0.002	2	-0.001	1	6070.541	2	3451.998	1
47		4	max	0.001	2	-0.002	1	0.004	1	0	2	NC	2	6911.111	1
48			min	-0.001	1	-0.002	2	-0.001	2	-0.001	1	NC	1	6847.035	2
49		5	max	0	2	0	2	0	2	0	2	NC	2	NC	1
50			min	0	1	0	1	0	1	-0.001	1	NC	1	4909.764	2
51	M6	1	max	0.003	1	0.004	1	0.016	1	0	2	NC	2	NC	2
52			min	0.002	2	-0.016	2	-0.003	2	-0.001	1	NC	1	1718.908	1
53		2	max	0.003	1	0.004	1	0.012	1	0	2	NC	2	NC	2
54			min	0.002	2	-0.013	2	-0.002	2	-0.001	1	NC	1	2296.201	1
55		3	max	0.002	1	0.003	1	0.008	1	0	2	NC	2	NC	2
56			min	0.001	2	-0.009	2	-0.002	2	-0.001	1	NC	1	3448.987	1
57		4	max	0.001	1	0.001	1	0.004	1	0	2	NC	2	6903.72	1
58			min	0.001	2	-0.005	2	-0.001	2	-0.001	1	NC	1	6851.072	2
59		5	max	0	2	0	2	0	2	0	2	NC	2	NC	1
60			min	0	1	0	1	0	1	-0.001	1	NC	1	4909.764	2
61	M7	1	max	-0.002	1	0.005	1	0.016	2	0	1	NC	2	NC	2
62			min	-0.006	2	-0.005	2	-0.004	1	0	2	NC	1	NC	1
63		2	max	-0.002	1	0.002	1	0.014	2	0	1	NC	2	NC	2
64			min	-0.006	2	-0.005	2	-0.002	1	0	2	NC	1	NC	1
65		3	max	-0.002	1	0	1	0.012	2	0	1	NC	2	NC	2
66			min	-0.006	2	-0.005	2	0.001	1	0	2	NC	1	NC	1
67		4	max	-0.002	1	-0.002	1	0.011	2	0	1	NC	2	NC	2
68			min	-0.006	2	-0.005	2	0.003	1	0	2	NC	1	NC	1
69		5	max	-0.002	1	-0.005	2	0.009	2	0	1	NC	2	NC	2
70			min	-0.006	2	-0.005	1	0.006	1	0	2	NC	1	NC	1
71	M8	1	max	0.016	2	0.005	1	0.006	2	0	2	NC	2	NC	2
72			min	-0.004	1	-0.005	2	0.002	1	-0.001	1	NC	1	NC	1
73		2	max	0.016	2	0.005	1	0.005	2	0	2	NC	2	NC	2
74			min	-0.004	1	-0.004	2	0.004	1	-0.001	1	NC	1	NC	1
75		3	max	0.016	2	0.004	1	0.006	1	0	2	NC	2	NC	2
76			min	-0.004	1	-0.003	2	0.004	2	-0.001	1	NC	1	NC	1
77		4	max	0.016	2	0.004	1	0.008	1	0	2	NC	2	NC	2
78			min	-0.004	1	-0.003	2	0.003	2	-0.001	1	NC	1	NC	1
79		5	max	0.016	2	0.004	1	0.009	1	0	2	NC	2	NC	2
80			min	-0.004	1	-0.002	2	0.001	2	-0.001	1	NC	1	NC	1
81	M9	1	max	-0.001	2	0.004	1	0.016	2	0	1	NC	2	NC	2
82			min	-0.009	1	-0.002	2	-0.004	1	0	2	NC	1	NC	1
83		2	max	-0.001	2	0.002	1	0.014	2	0	1	NC	2	NC	2
84			min	-0.009	1	-0.001	2	-0.002	1	0	2	NC	1	NC	1
85		3	max	-0.001	2	-0.001	1	0.012	2	0	1	NC	2	NC	2
86			min	-0.009	1	-0.001	2	0.001	1	0	2	NC	1	NC	1
87		4	max	-0.001	2	-0.001	2	0.011	2	0	1	NC	2	NC	2
88			min	-0.009	1	-0.003	1	0.003	1	0	2	NC	1	NC	1
89		5	max	-0.001	2	-0.001	2	0.009	2	0	1	NC	2	NC	2
90			min	-0.009	1	-0.005	1	0.006	1	0	2	NC	1	NC	1
91	M10	1	max	0.009	2	-0.005	2	0.006	2	0	2	NC	2	NC	2
92			min	0.006	1	-0.005	1	0.002	1	-0.001	1	NC	1	NC	1
93		2	max	0.009	2	-0.004	2	0.005	2	0	2	NC	2	NC	2
94			min	0.006	1	-0.005	1	0.004	1	-0.001	1	NC	1	NC	1
95		3	max	0.009	2	-0.003	2	0.006	1	0	2	NC	2	NC	2
96			min	0.006	1	-0.005	1	0.004	2	-0.001	1	NC	1	NC	1
97		4	max	0.009	2	-0.002	2	0.008	1	0	2	NC	2	NC	2
98			min	0.006	1	-0.005	1	0.003	2	-0.001	1	NC	1	NC	1

Envelope Member Section Deflections - Strength (Continued)

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
99		5	max	0.009	2	-0.001	2	0.009	1	0	2	NC	2	NC	2
100			min	0.006	1	-0.005	1	0.001	2	-0.001	1	NC	1	NC	1
101	M11	1	max	0.016	2	0.004	1	0.009	1	0	2	NC	2	NC	2
102			min	-0.004	1	-0.002	2	0.001	2	-0.001	1	NC	1	NC	1
103		2	max	0.016	2	0.004	1	0.011	1	0	2	NC	2	NC	2
104			min	-0.004	1	-0.001	2	0	2	-0.001	1	NC	1	NC	1
105		3	max	0.016	2	0.004	1	0.013	1	0	2	NC	2	NC	2
106			min	-0.004	1	0	2	-0.001	2	-0.001	1	NC	1	NC	1
107		4	max	0.016	2	0.004	1	0.015	1	0	2	NC	2	NC	2
108			min	-0.004	1	0.001	2	-0.002	2	-0.001	1	NC	1	NC	1
109		5	max	0.016	2	0.003	1	0.016	1	0	2	NC	2	NC	2
110			min	-0.004	1	0.002	2	-0.003	2	-0.001	1	NC	1	NC	1
111	M12	1	max	0.009	2	-0.001	2	0.009	1	0	2	NC	2	NC	2
112			min	0.006	1	-0.005	1	0.001	2	-0.001	1	NC	1	NC	1
113		2	max	0.009	2	0	2	0.011	1	0	2	NC	2	NC	2
114			min	0.006	1	-0.005	1	0	2	-0.001	1	NC	1	NC	1
115		3	max	0.009	2	0.001	2	0.013	1	0	2	NC	2	NC	2
116			min	0.006	1	-0.006	1	-0.001	2	-0.001	1	NC	1	NC	1
117		4	max	0.009	2	0.002	2	0.015	1	0	2	NC	2	NC	2
118			min	0.006	1	-0.006	1	-0.002	2	-0.001	1	NC	1	NC	1
119		5	max	0.009	2	0.003	2	0.016	1	0	2	NC	2	NC	2
120			min	0.006	1	-0.006	1	-0.003	2	-0.001	1	NC	1	NC	1
121	M13	1	max	0.003	2	0.003	1	0.016	2	0	1	NC	2	NC	2
122			min	-0.016	1	0.002	2	-0.004	1	0	2	NC	1	NC	1
123		2	max	0.003	2	0.002	2	0.014	2	0	1	NC	2	NC	2
124			min	-0.016	1	0.001	1	-0.002	1	0	2	NC	1	NC	1
125		3	max	0.003	2	0.002	2	0.012	2	0	1	NC	2	NC	2
126			min	-0.016	1	-0.001	1	0.001	1	0	2	NC	1	NC	1
127		4	max	0.003	2	0.003	2	0.011	2	0	1	NC	2	NC	2
128			min	-0.016	1	-0.004	1	0.003	1	0	2	NC	1	NC	1
129		5	max	0.003	2	0.003	2	0.009	2	0	1	NC	2	NC	2
130			min	-0.016	1	-0.006	1	0.006	1	0	2	NC	1	NC	1
131	M14	1	max	0.003	1	0.006	1	0.006	2	0	2	NC	2	NC	2
132			min	0.001	2	-0.016	2	0.002	1	-0.001	1	NC	1	NC	1
133		2	max	0.002	1	0.004	1	0.004	2	0	2	NC	2	NC	2
134			min	0.001	2	-0.012	2	0.002	1	-0.001	1	NC	1	NC	1
135		3	max	0.001	1	0.003	1	0.003	2	0	2	NC	2	NC	1
136			min	0	2	-0.008	2	0.001	1	-0.001	1	NC	1	5054.462	2
137		4	max	0.001	1	0.001	1	0.001	2	0	2	NC	2	7827.67	1
138			min	0	2	-0.004	2	0.001	1	-0.001	1	NC	1	3405.007	2
139		5	max	0	2	0	2	0	2	0	2	NC	2	6028.681	1
140			min	0	1	0	1	0	1	-0.001	1	NC	1	2578.239	2
141	M15	1	max	0.004	2	0.006	1	0.009	1	0	2	NC	2	NC	2
142			min	0.002	1	-0.015	2	0.001	2	-0.001	1	NC	1	NC	1
143		2	max	0.003	2	0.004	1	0.007	1	0	2	NC	2	NC	2
144			min	0.002	1	-0.011	2	0.001	2	-0.001	1	NC	1	6268.73	1
145		3	max	0.002	2	0.003	1	0.005	1	0	2	NC	2	NC	2
146			min	0.001	1	-0.008	2	0.001	2	-0.001	1	NC	1	3154.073	1
147		4	max	0.001	2	0.001	1	0.002	1	0	2	NC	2	NC	2
148			min	0.001	1	-0.004	2	0	2	-0.001	1	NC	1	2119.175	1
149		5	max	0	2	0	2	0	2	0	2	NC	2	NC	2
150			min	0	1	0	1	0	1	-0.001	1	NC	1	1600.718	1
151	M16	1	max	-0.001	2	-0.007	1	0.006	2	0	2	NC	2	NC	2
152			min	-0.002	1	-0.01	2	0.002	1	-0.001	1	NC	1	NC	1
153		2	max	-0.001	2	-0.005	1	0.004	2	0	2	NC	2	NC	2

Envelope Member Section Deflections - Strength (Continued)

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
154			min	-0.002	1	-0.008	2	0.002	1	-0.001	1	NC	1	NC	1
155		3	max	0	2	-0.004	1	0.003	2	0	2	NC	2	NC	1
156			min	-0.001	1	-0.005	2	0.001	1	-0.001	1	NC	1	5054.462	2
157		4	max	0	2	-0.002	1	0.001	2	0	2	NC	2	7827.67	1
158			min	-0.001	1	-0.003	2	0.001	1	-0.001	1	NC	1	3405.007	2
159		5	max	0	2	0	2	0	2	0	2	NC	2	6028.681	1
160			min	0	1	0	1	0	1	-0.001	1	NC	1	2578.239	2
161	M17	1	max	0.003	2	-0.007	1	0.009	1	0	2	NC	2	NC	2
162			min	-0.003	1	-0.009	2	0.001	2	-0.001	1	NC	1	NC	1
163		2	max	0.002	2	-0.006	1	0.007	1	0	2	NC	2	NC	2
164			min	-0.002	1	-0.007	2	0.001	2	-0.001	1	NC	1	6268.73	1
165		3	max	0.001	2	-0.004	1	0.005	1	0	2	NC	2	NC	2
166			min	-0.001	1	-0.005	2	0.001	2	-0.001	1	NC	1	3154.073	1
167		4	max	0.001	2	-0.002	1	0.002	1	0	2	NC	2	NC	2
168			min	-0.001	1	-0.002	2	0	2	-0.001	1	NC	1	2119.175	1
169		5	max	0	2	0	2	0	2	0	2	NC	2	NC	2
170			min	0	1	0	1	0	1	-0.001	1	NC	1	1600.718	1
171	M18	1	max	-0.001	2	-0.004	1	-0.006	1	0.001	2	NC	2	NC	2
172			min	-0.003	1	-0.007	2	-0.009	2	-0.001	1	NC	1	NC	1
173		2	max	-0.001	2	-0.004	1	-0.004	1	0.001	2	NC	2	NC	1
174			min	-0.002	1	-0.006	2	-0.007	2	-0.001	1	NC	1	7211.541	2
175		3	max	-0.001	2	-0.003	1	-0.003	1	0.001	2	NC	2	5985.499	1
176			min	-0.001	1	-0.004	2	-0.005	2	-0.001	1	NC	1	3570.006	2
177		4	max	0	2	-0.001	1	-0.002	1	0.001	2	NC	2	3894.331	1
178			min	-0.001	1	-0.002	2	-0.002	2	-0.001	1	NC	1	2351.195	2
179		5	max	0	2	0	2	0	2	0.001	2	NC	2	2858.527	1
180			min	0	1	0	1	0	1	-0.001	1	NC	1	1744.294	2
181	M19	1	max	0.003	1	0.004	2	-0.006	1	0.001	2	NC	2	NC	2
182			min	0.001	2	-0.017	1	-0.009	2	-0.001	1	NC	1	NC	1
183		2	max	0.002	1	0.003	2	-0.004	1	0.001	2	NC	2	NC	1
184			min	0.001	2	-0.013	1	-0.007	2	-0.001	1	NC	1	7211.541	2
185		3	max	0.001	1	0.002	2	-0.003	1	0.001	2	NC	2	5985.499	1
186			min	0	2	-0.009	1	-0.005	2	-0.001	1	NC	1	3570.006	2
187		4	max	0.001	1	0.001	2	-0.002	1	0.001	2	NC	2	3894.331	1
188			min	0	2	-0.005	1	-0.002	2	-0.001	1	NC	1	2351.195	2
189		5	max	0	2	0	2	0	2	0.001	2	NC	2	2858.527	1
190			min	0	1	0	1	0	1	-0.001	1	NC	1	1744.294	2

Envelope Beam Deflections

	Member Label	Span		Location [ft]	y' [in]	(n) L'/y' Ratio	LC
1	M14	1	max	2.507	0	NC	3
2		1	min	0	0	NC	1
3	M15	1	max	2.506	0	NC	3
4		1	min	0	0	NC	1
5	M16	1	max	2.507	0	NC	3
6		1	min	0	0	NC	1
7	M17	1	max	2.506	0	NC	3
8		1	min	0	0	NC	1
9	M18	1	max	2.687	0	NC	3
10		1	min	0	0	NC	1
11	M19	1	max	2.687	0	NC	3
12		1	min	0	0	NC	1

Envelope Beam Deflection Checks

	Beam	Design Rule	Span	Defl [in]	Ratio	LC	Defl [in]	Ratio	LC	Defl [in]	Ratio	LC
1	M14	Typical	1	N/A	N/A	N/A	0	NC	1(DL+2)	0	NC	2(DL+7+4...)
2	M15	Typical	1	N/A	N/A	N/A	0	NC	1(DL+2)	0	NC	2(DL+7+4...)
3	M16	Typical	1	N/A	N/A	N/A	0	NC	1(DL+2)	0	NC	2(DL+7+4...)
4	M17	Typical	1	N/A	N/A	N/A	0	NC	1(DL+2)	0	NC	2(DL+7+4...)
5	M18	Typical	1	N/A	N/A	N/A	0	NC	1(DL+2)	0	NC	2(DL+7+4...)
6	M19	Typical	1	N/A	N/A	N/A	0	NC	1(DL+2)	0	NC	2(DL+7+4...)

Envelope AISC 15TH (360-16): LRFD Member Steel Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	phi*Pnc [k]	phi*Pnt [k]	phi*Mn y-y [k-ft]	phi*Mn z-z [k-ft]	Cb	Eqn
1	M1	L2X2X4	0.204	0	1	0.002	2.333	z	1	23.22	30.586	0.691	1.577	1.5	H2-1
2	M2	L2X2X4	0.152	0	1	0.001	2.333	z	1	23.22	30.586	0.691	1.577	1.5	H2-1
3	M3	L2X2X4	0.161	0	1	0.001	2.333	z	1	23.22	30.586	0.691	1.577	1.5	H2-1
4	M4	L2X2X4	0.151	0	1	0.001	2.333	y	3	23.22	30.586	0.691	1.577	1.5	H2-1
5	M5	L2X2X4	0.174	0	1	0.001	2.333	y	3	23.22	30.586	0.691	1.577	1.5	H2-1
6	M6	L2X2X4	0.122	0	1	0.001	2.333	z	3	23.22	30.586	0.691	1.577	1.5	H2-1
7	M14	L2X2X3	0.077	1.175	1	0	2.507	y	1	20.983	32.49	0.775	1.552	1.136	H2-1
8	M15	L2X2X3	0.112	1.175	2	0	2.506	y	3	20.986	32.49	0.775	1.552	1.136	H2-1
9	M16	L2X2X3	0.039	1.306	1	0	2.507	y	1	20.983	32.49	0.775	1.552	1.136	H2-1
10	M17	L2X2X3	0.068	1.175	2	0	2.506	y	3	20.986	32.49	0.775	1.552	1.136	H2-1
11	M18	L2X2X3	0.063	1.371	1	0.001	2.687	y	2	16.293	23.393	0.558	1.175	1.136	H2-1
12	M19	L2X2X3	0.15	1.288	3	0.001	2.687	y	2	16.293	23.393	0.558	1.175	1.136	H2-1

PRCTI20221788

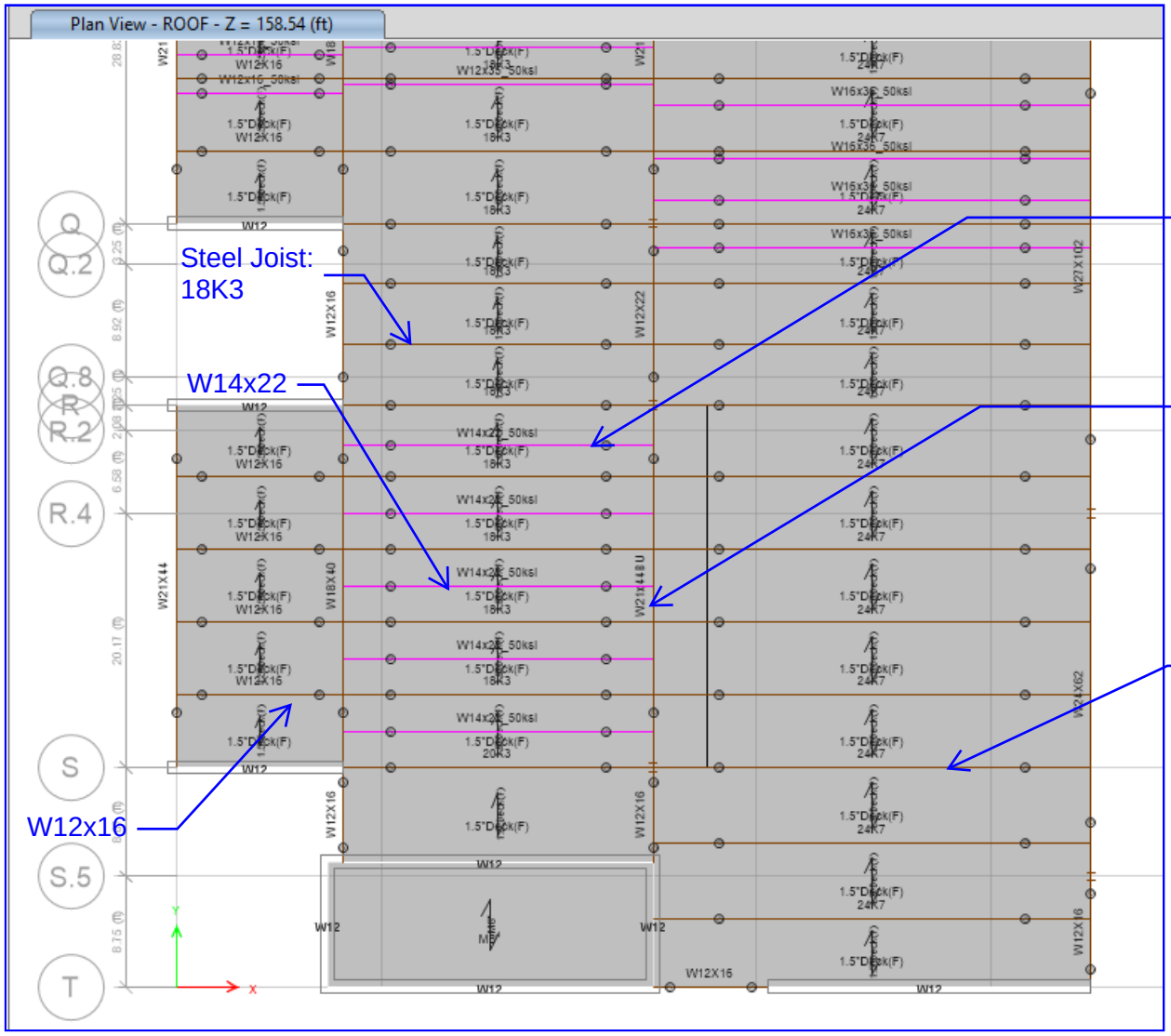
GSH OR #1:

EXISTING BEAMS AT ROOF LEVEL BETWEEN GRID (S-R & 1-3)

NEW ROOFTOP AHU

PRCTI20221788

PARTIAL GA AT SOUTH SIDE OF OR



LOAD CASES: PRCTI20221788

LOADS:	
DL	DEAD LOAD
SDL	SUPER IMP DL
WALL	WALL LOAD
SDLc	SUPER IMP DL FOR SUSPENDED FRAMES/CEILING
LL	FLOOR LL
Llroof	ROOF LL
Pe1	PHILLIPS EQUIP LOAD-CASE 1
Pe2	PHILLIPS EQUIP LOAD-CASE 2
Pe3	PHILLIPS EQUIP LOAD-CASE 3
Skyboom	SKYTRON BOOM LOAD
Machine	AHU/Tranformer/Chiller
WL_{hx}	Lateral wind load in X-DIR
WL_{v}	Vertical uplift wind load
Eq_{hx}	Lateral Seismic load in X-DIR
Eq_{v}	Vertical Seismic load

Strength Combination :	
ST01	1.4(DL+SDL+SDLc+WALL)
ST02	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe1
ST03	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe2
ST04	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe3
ST05	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe1
ST06	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe2
ST07	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6SkyB+1.6Mach+1.6Pe3
STW08a1	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe1+0.5WL_{hx}+0.5WL_{v}
STW08a2	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe2+0.5WL_{hx}+0.5WL_{v}
STW08a3	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe3+0.5WL_{hx}+0.5WL_{v}
STW08b1	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe1-0.5WL_{hx}+0.5WL_{v}
STW08b2	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe2-0.5WL_{hx}+0.5WL_{v}
STW08b3	1.2(DL+SDL+SDLc+WALL)+1.6LLr+1.6skyB+1.6Mach+1.6Pe3-0.5WL_{hx}+0.5WL_{v}
STW09a1	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6skyB+1.6Mach+1.6Pe1+0.5WL_{hx}+0.5WL_{v}
STW09a2	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6skyB+1.6Mach+1.6Pe2+0.5WL_{hx}+0.5WL_{v}
STW09a3	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6skyB+1.6Mach+1.6Pe3+0.5WL_{hx}+0.5WL_{v}
STW09b1	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6skyB+1.6Mach+1.6Pe1-0.5WL_{hx}+0.5WL_{v}
STW09b2	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6skyB+1.6Mach+1.6Pe2-0.5WL_{hx}+0.5WL_{v}
STW09b3	1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6skyB+1.6Mach+1.6Pe3-0.5WL_{hx}+0.5WL_{v}
STW10a1	1.2(DL+SDL+SDLc+WALL)+0.5LLr+1.0skyB+1.0Mach+1.0Pe1+1.0WL_{hx}+1.0WL_{v}
STW10a2	1.2(DL+SDL+SDLc+WALL)+0.5LLr+1.0skyB+1.0Mach+1.0Pe2+1.0WL_{hx}+1.0WL_{v}
STW10a3	1.2(DL+SDL+SDLc+WALL)+0.5LLr+1.0skyB+1.0Mach+1.0Pe3+1.0WL_{hx}+1.0WL_{v}
STW10b1	1.2(DL+SDL+SDLc+WALL)+0.5LLr+1.0skyB+1.0Mach+1.0Pe1-1.0WL_{hx}+1.0WL_{v}
STW10b2	1.2(DL+SDL+SDLc+WALL)+0.5LLr+1.0skyB+1.0Mach+1.0Pe2-1.0WL_{hx}+1.0WL_{v}
STW10b3	1.2(DL+SDL+SDLc+WALL)+0.5LLr+1.0skyB+1.0Mach+1.0Pe3-1.0WL_{hx}+1.0WL_{v}

PRCTI20221788

STRENGTH COMBINATION CONTINUES:

STW11a1	1.2(DL+SDL+SDLc+WALL)+0.5SL+1.0skyB+1.0Mach+1.0Pe1+1.0WL_{hx}+1.0WL_v
STW11a2	1.2(DL+SDL+SDLc+WALL)+0.5SL+1.0skyB+1.0Mach+1.0Pe2+1.0WL_{hx}+1.0WL_v
STW11a3	1.2(DL+SDL+SDLc+WALL)+0.5SL+1.0skyB+1.0Mach+1.0Pe3+1.0WL_{hx}+1.0WL_v
STW11b1	1.2(DL+SDL+SDLc+WALL)+0.5SL+1.0skyB+1.0Mach+1.0Pe1-1.0WL_{hx}+1.0WL_v
STW11b2	1.2(DL+SDL+SDLc+WALL)+0.5SL+1.0skyB+1.0Mach+1.0Pe2-1.0WL_{hx}+1.0WL_v
STW11b3	1.2(DL+SDL+SDLc+WALL)+0.5SL+1.0skyB+1.0Mach+1.0Pe3-1.0WL_{hx}+1.0WL_v
STW12a1	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe1+1.0WL_{hx}+1.0WL_v
STW12a2	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe2+1.0WL_{hx}+1.0WL_v
STW12a3	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe3+1.0WL_{hx}+1.0WL_v
STW12b1	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe1-1.0WL_{hx}+1.0WL_v
STW12b2	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe2-1.0WL_{hx}+1.0WL_v
STW12b3	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe3-1.0WL_{hx}+1.0WL_v
STE13a1	1.2(DL+SDL+SDLc+WALL)+0.2SL+1.0skyB+1.0Mach+1.0Pe1+1.0Eq_{hx}+1.0Eq_v
STE13a2	1.2(DL+SDL+SDLc+WALL)+0.2SL+1.0skyB+1.0Mach+1.0Pe2+1.0Eq_{hx}+1.0Eq_v
STE13a3	1.2(DL+SDL+SDLc+WALL)+0.2SL+1.0skyB+1.0Mach+1.0Pe3+1.0Eq_{hx}+1.0Eq_v
STE13b1	1.2(DL+SDL+SDLc+WALL)+0.2SL+1.0skyB+1.0Mach+1.0Pe1-1.0Eq_{hx}+1.0Eq_v
STE13b2	1.2(DL+SDL+SDLc+WALL)+0.2SL+1.0skyB+1.0Mach+1.0Pe2-1.0Eq_{hx}+1.0Eq_v
STE13b3	1.2(DL+SDL+SDLc+WALL)+0.2SL+1.0skyB+1.0Mach+1.0Pe3-1.0Eq_{hx}+1.0Eq_v
STE14a1	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe1+1.0Eq_{hx}-1.0Eq_v
STE14a2	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe2+1.0Eq_{hx}-1.0Eq_v
STE14a3	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe3+1.0Eq_{hx}-1.0Eq_v
STE14b1	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe1-1.0Eq_{hx}-1.0Eq_v
STE14b2	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe2-1.0Eq_{hx}-1.0Eq_v
STE14b3	0.9(DL+SDL+SDLc+WALL)+0.9skyB+0.9Mach+0.9Pe3-1.0Eq_{hx}-1.0Eq_v

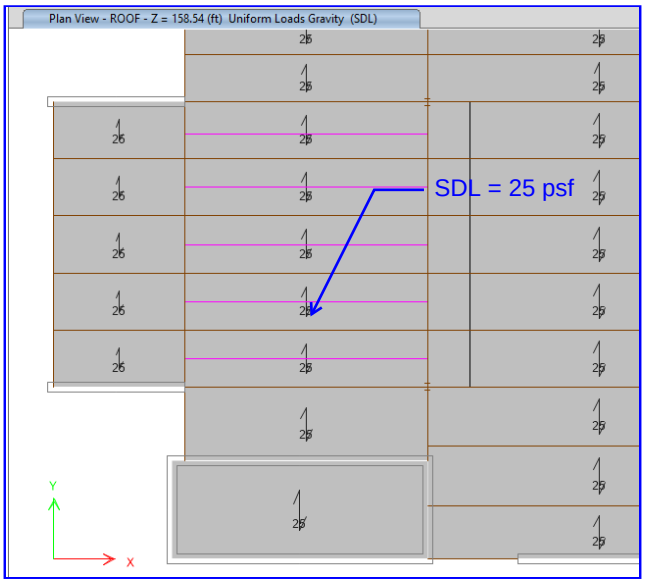
PRCTI20221788

LOAD COMB:	
SERVICE COMBINATION:	
SV01	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe1
SV02	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe2
SV03	1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0(skyB+Mach)+1.0Pe3
SV04	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe1
SV05	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe2
SV06	1.0(DL+SDL+SDLc+WALL)+1.0SL+1.0(skyB+Mach)+1.0Pe3
SVW07a1	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe1+0.6WL_{hx}+0.6WL_{v}
SVW07a2	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe2+0.6WL_{hx}+0.6WL_{v}
SVW07a3	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe3+0.6WL_{hx}+0.6WL_{v}
SVW07b1	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe1-0.6WL_{hx}+0.6WL_{v}
SVW07b2	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe2-0.6WL_{hx}+0.6WL_{v}
SVW07b3	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe3-0.6WL_{hx}+0.6WL_{v}
SVW08a1	1.0(DL+SDL+SDLc+WALL)+0.75LLr+1.0(skyB+Mach)+1.0Pe1+0.45WL_{hx}+0.45WL_{v}
SVW08a2	1.0(DL+SDL+SDLc+WALL)+0.75LLr+1.0(skyB+Mach)+1.0Pe2+0.45WL_{hx}+0.45WL_{v}
SVW08a3	1.0(DL+SDL+SDLc+WALL)+0.75LLr+1.0(skyB+Mach)+1.0Pe3+0.45WL_{hx}+0.45WL_{v}
SVW08b1	1.0(DL+SDL+SDLc+WALL)+0.75LLr+1.0(skyB+Mach)+1.0Pe1-0.45WL_{hx}+0.45WL_{v}
SVW08b2	1.0(DL+SDL+SDLc+WALL)+0.75LLr+1.0(skyB+Mach)+1.0Pe2-0.45WL_{hx}+0.45WL_{v}
SVW08b3	1.0(DL+SDL+SDLc+WALL)+0.75LLr+1.0(skyB+Mach)+1.0Pe3-0.45WL_{hx}+0.45WL_{v}
SVW09a1	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe1+0.45WL_{hx}+0.45WL_{v}
SVW09a2	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe2+0.45WL_{hx}+0.45WL_{v}
SVW09a3	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe3+0.45WL_{hx}+0.45WL_{v}
SVW09b1	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe1-0.45WL_{hx}+0.45WL_{v}
SVW09b2	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe2-0.45WL_{hx}+0.45WL_{v}
SVW09b3	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe3-0.45WL_{hx}+0.45WL_{v}
SVE10a1	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe1+0.7Eq_{hx}+0.7Eq_{v}
SVE10a2	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe2+0.7Eq_{hx}+0.7Eq_{v}
SVE10a3	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe3+0.7Eq_{hx}+0.7Eq_{v}
SVE10b1	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe1-0.7Eq_{hx}+0.7Eq_{v}
SVE10b2	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe2-0.7Eq_{hx}+0.7Eq_{v}
SVE10b3	1.0(DL+SDL+SDLc+WALL)+1.0(skyB+Mach)+1.0Pe3-0.7Eq_{hx}+0.7Eq_{v}
SVE11a1	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe1+0.525Eq_{hx}+0.525Eq_{v}
SVE11a2	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe2+0.525Eq_{hx}+0.525Eq_{v}
SVE11a3	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe3+0.525Eq_{hx}+0.525Eq_{v}
SVE11b1	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe1-0.525Eq_{hx}+0.525Eq_{v}
SVE11b2	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe2-0.525Eq_{hx}+0.525Eq_{v}
SVE11b3	1.0(DL+SDL+SDLc+WALL)+0.75SL+1.0(skyB+Mach)+1.0Pe3-0.525Eq_{hx}+0.525Eq_{v}

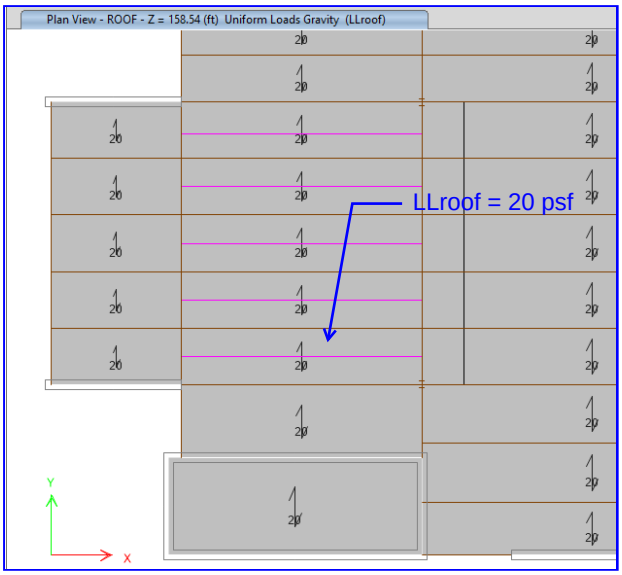
LOADINGS:

PRCTI20221788

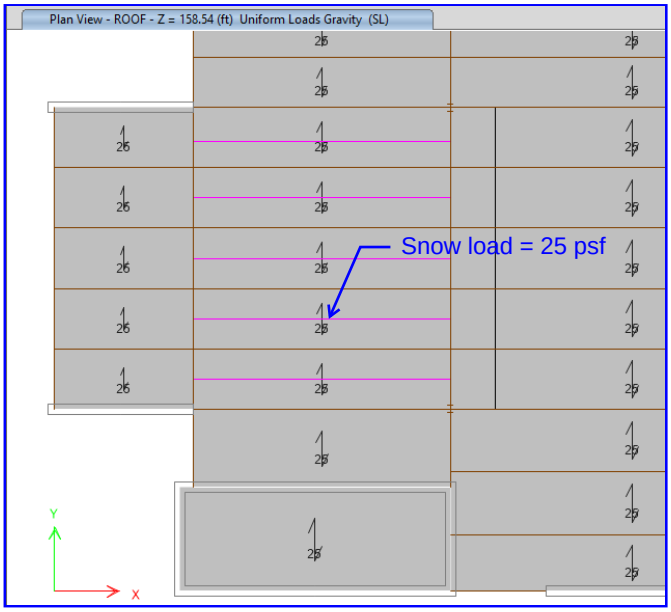
SDL:



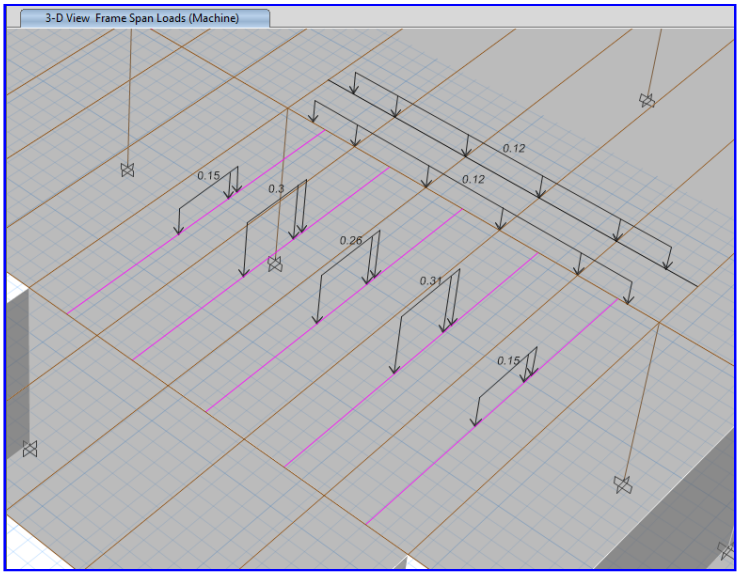
ROOF LL:



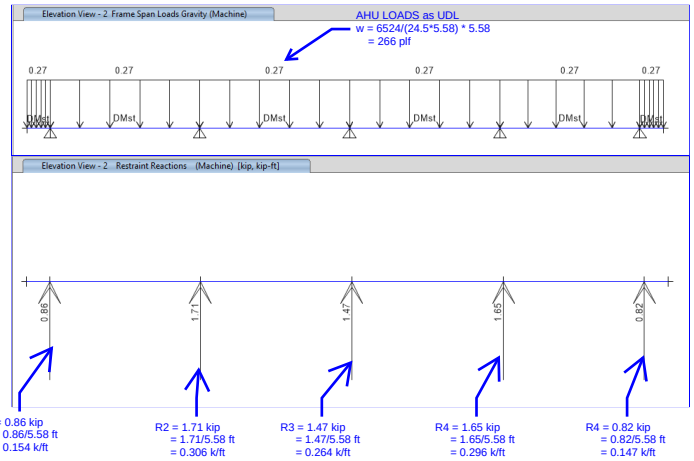
SNOW LOAD:



AHU LOADS: (For CALC REFER BELOW)

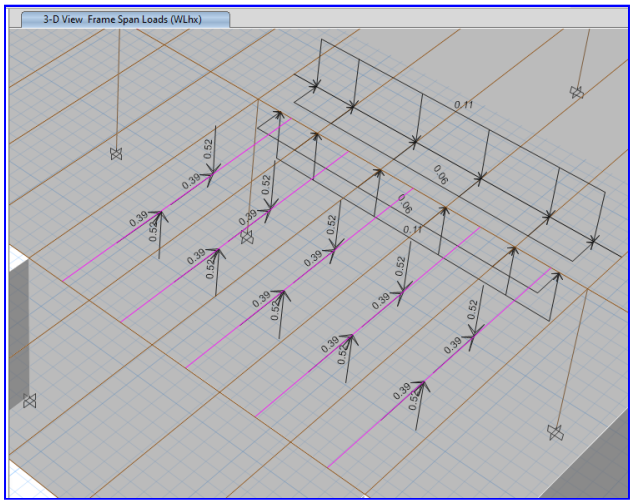


(N) AHU LOAD CALC:

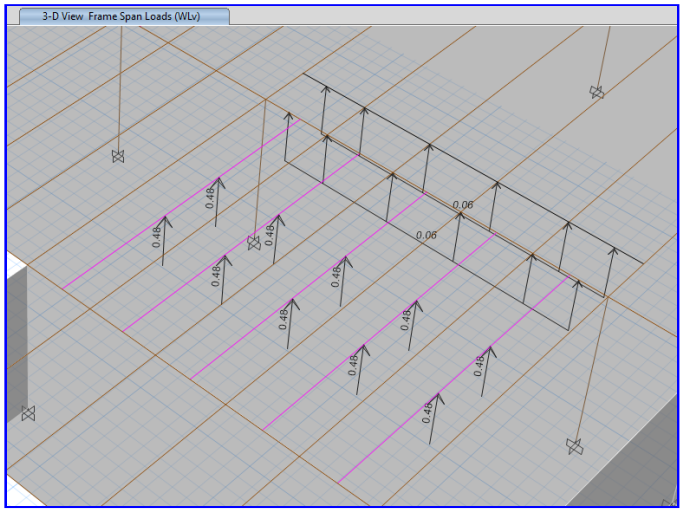


PRCTI20221788

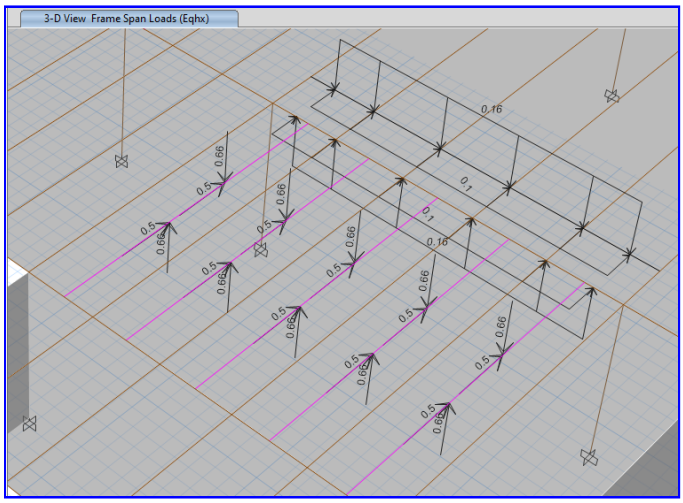
WIND LOADS ON AHU: (WLhx)



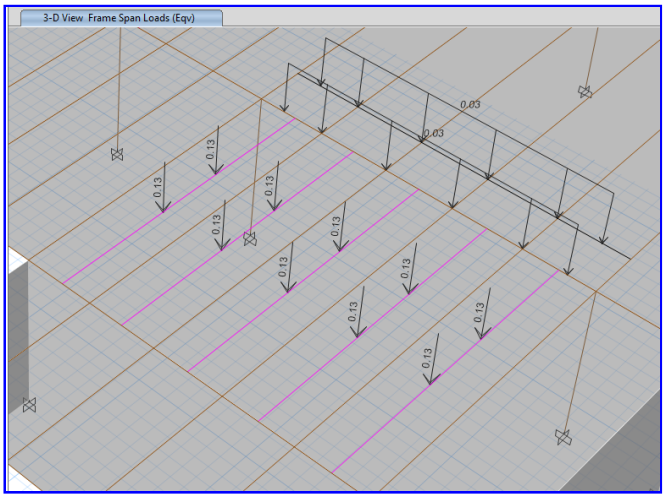
WIND LOADS ON AHU: UPLIFT (WLv)



SEISMIC LATERAL LOADS ON AHU: (Eqhx)



SEISMIC VERTICAL LOADS ON AHU: (Eqv)



FOR WIND LOADS AND SEISMIC LOADS CALC REFER NEXT 2 PAGES

PRCTI20221788

WIND LOAD CALC FOR NON STRUCTURAL COMPONENTS:

(N) AHU				
ASCE: cl 29.4.1	Roof Top structures and Equip for buildings:			
Resultant lateral force	Fh	=	qh (GCr) Af	
	Afx	=	103.2	s ft
	Bh	=	7370.593	s ft
	0.1Bh	=	737.0593	s ft
	GC_r	=	1.9	
ASCE: cl 26.10.2	qh	=	0.00256 kz kzt kd ke V^2	
	V	=	108	mph for Risk category IV
ASCE: cl 26.10.1	kz	=	0.78	Exposure B
ASCE: cl 26.8.2	kzt	=	1	
ASCE: cl 26.6	kd	=	0.85	
ASCE: cl 26.9	ke	=	1	
	qh	=	19.8	psf
	Fh	=	3882	lb
Hor load on Each beam (5Nos)		=	0.39	k
Ht of (N) AHU with Curb		=	5.58	ft
2/3*h		=	3.72	ft
Overtuning moment		=	14.4	k-ft
Width of (N) AHU		=	5.58	ft
Couple force (T & C)		=	2.59	k
Couple force @ each beam		=	0.52	k

(N) AHU				
ASCE: cl 29.4.1	Roof Top structures and Equip for buildings:			
Vertical uplift force	Fv	=	qh (GCr) Ar	
	Ar	=	160.9	s ft
	BL	=	14963.6	s ft
	0.1BL	=	1496.36	s ft
	GC_r	=	1.5	
ASCE: cl 26.10.2	qh	=	0.00256 kz kzt kd ke V^2	
	V	=	108	mph for Risk category IV
ASCE: cl 26.10.1	kz	=	0.78	Exposure B
ASCE: cl 26.8.2	kzt	=	1	
ASCE: cl 26.6	kd	=	0.85	
ASCE: cl 26.9	ke	=	1	
	qh	=	19.8	psf
	Fv	=	4777	lb
Uplift load on Each beam (5Nos)		=	0.48	k

AHU-OR2				
ASCE: cl 29.4.1	Roof Top structures and Equip for buildings:			
Resultant lateral force	Fh	=	qh (GCr) Af	
	Afx	=	84.9	s ft
	Bh	=	7370.593	s ft
	0.1Bh	=	737.0593	s ft
	GC_r	=	1.9	
ASCE: cl 26.10.2	qh	=	0.00256 kz kzt kd ke V^2	
	V	=	108	mph for Risk category IV
ASCE: cl 26.10.1	kz	=	0.76	Exposure B
ASCE: cl 26.8.2	kzt	=	1	
ASCE: cl 26.6	kd	=	0.85	
ASCE: cl 26.9	ke	=	1	
	qh	=	19.3	psf
	Fh	=	3111	lb
Hor load on Each beam as UDL		=	0.064	k/ft
Ht of AHU-OR2 with Curb		=	5.5	ft
2/3*h		=	3.67	ft
Overtuning moment		=	11.4	k-ft
Width of (N) AHU		=	4.3	ft
Couple force (T & C) as UDL		=	0.11	k/ft

AHU-OR2				
ASCE: cl 29.4.1	Roof Top structures and Equip for buildings:			
Vertical uplift force	Fv	=	qh (GCr) Ar	
	Ar	=	105.0	s ft
	BL	=	14963.6	s ft
	0.1BL	=	1496.36	s ft
	GC_r	=	1.5	
ASCE: cl 26.10.2	qh	=	0.00256 kz kzt kd ke V^2	
	V	=	108	mph for Risk category IV
ASCE: cl 26.10.1	kz	=	0.76	Exposure B
ASCE: cl 26.8.2	kzt	=	1	
ASCE: cl 26.6	kd	=	0.85	
ASCE: cl 26.9	ke	=	1	
	qh	=	19.3	psf
	Fv	=	3038	lb
Uplift load on Each beam (2Nos) as UDL		=	0.063	k/ft

PRCTI20221788

SEISMIC LOAD CALC FOR NON STRUCTURAL COMPONENTS:

For (N) AHU :

ASCE: cl 13.3.1 **Seismic Dema** ...its

Horizontal seismic force:

$$F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)}\left(1 + 2\frac{z}{h}\right)$$

R_p	=	6.0	
a_p	=	2.5	
S_{DS}	=	1.019	From ATC Hazard
I_p	=	1.5	
W_p	=	6524	lb
z/h	=	1	
Max F_p	=	1.6 S_{DS} I_p W_p	
	=	15955	lb
Min F_p	=	0.3 S_{DS} I_p W_p	
	=	2992	lb
F_{ph}	=	4986	lb
Hor load on Each beam (5Nos)	=	0.50	k
Ht of (N) AHU with Curb	=	5.58	ft
2/3*h	=	3.72	ft
Overtuning moment	=	18.5	k-ft
Width of (N) AHU	=	5.58	ft
Couple force (T & C)	=	3.32	k
Couple force @ each beam	=	0.66	k

Vertical seismic force:

F_{pv}	=	0.2 S_{DS} W_p	
F_{pv}	=	1330	lb
Uplift load on Each beam (5Nos)	=	0.13	k

For AHU-OR2

ASCE: cl 13.3.1 **Seismic Demands on Non structural components**

Horizontal seismic force:

$$F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)}\left(1 + 2\frac{z}{h}\right)$$

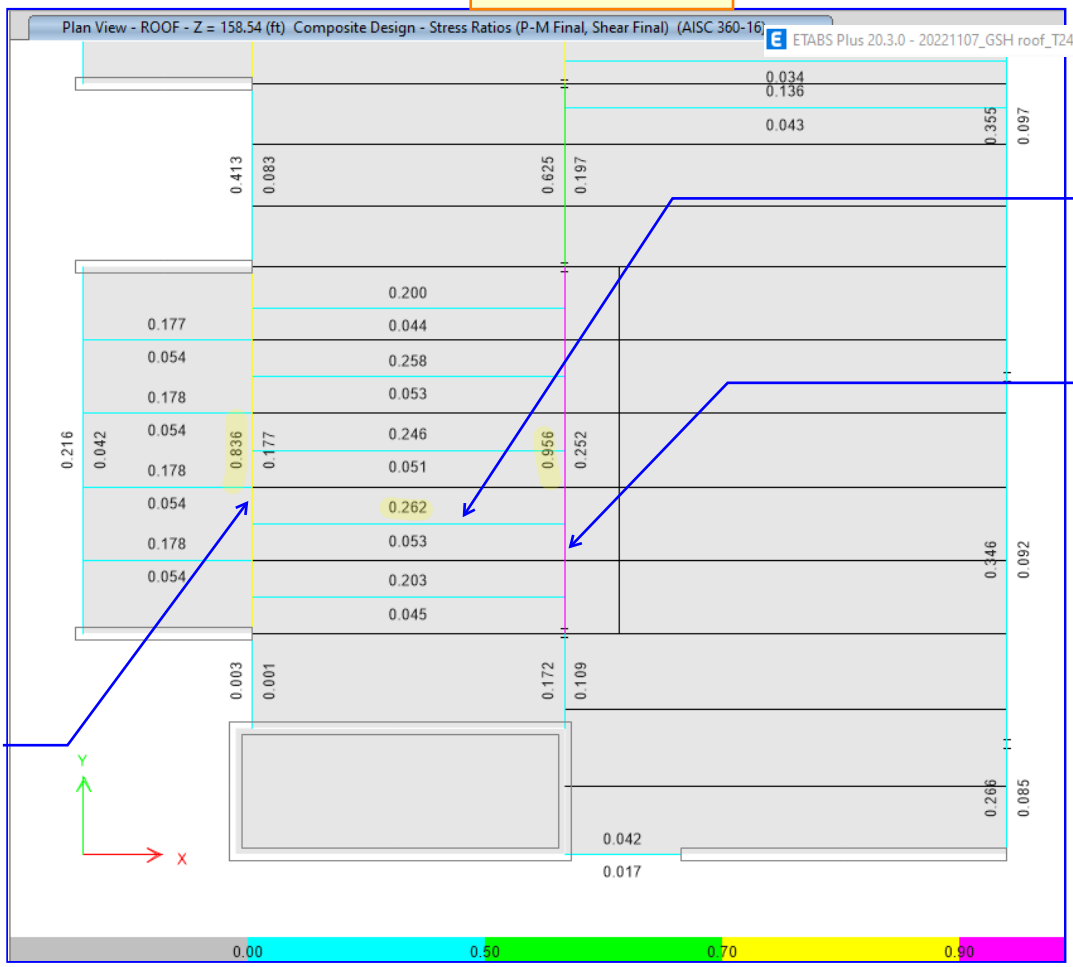
R_p	=	6.0	
a_p	=	2.5	
S_{DS}	=	1.019	From ATC Hazard
I_p	=	1.5	
W_p	=	6000	lb
z/h	=	1	
Max F_p	=	1.6 S_{DS} I_p W_p	
	=	14674	lb
Min F_p	=	0.3 S_{DS} I_p W_p	
	=	2751	lb
F_{ph}	=	4586	lb
Hor load on Each beam as UDL	=	0.095	k/ft
Ht of AHU-OR2 with Curb	=	5.5	ft
2/3*h	=	3.67	ft
Overtuning moment	=	16.8	k-ft
Width of (N) AHU	=	4.3	ft
Couple force (T & C) as UDL	=	0.16	k/ft

Vertical seismic force:

F_{pv}	=	0.2 S_{DS} W_p	
F_{pv}	=	1223	lb
Uplift load on Each beam (2Nos) as UDL	=	0.025	k/ft

STEEL BM DESIGN RESULTS :

PRCTI20221788



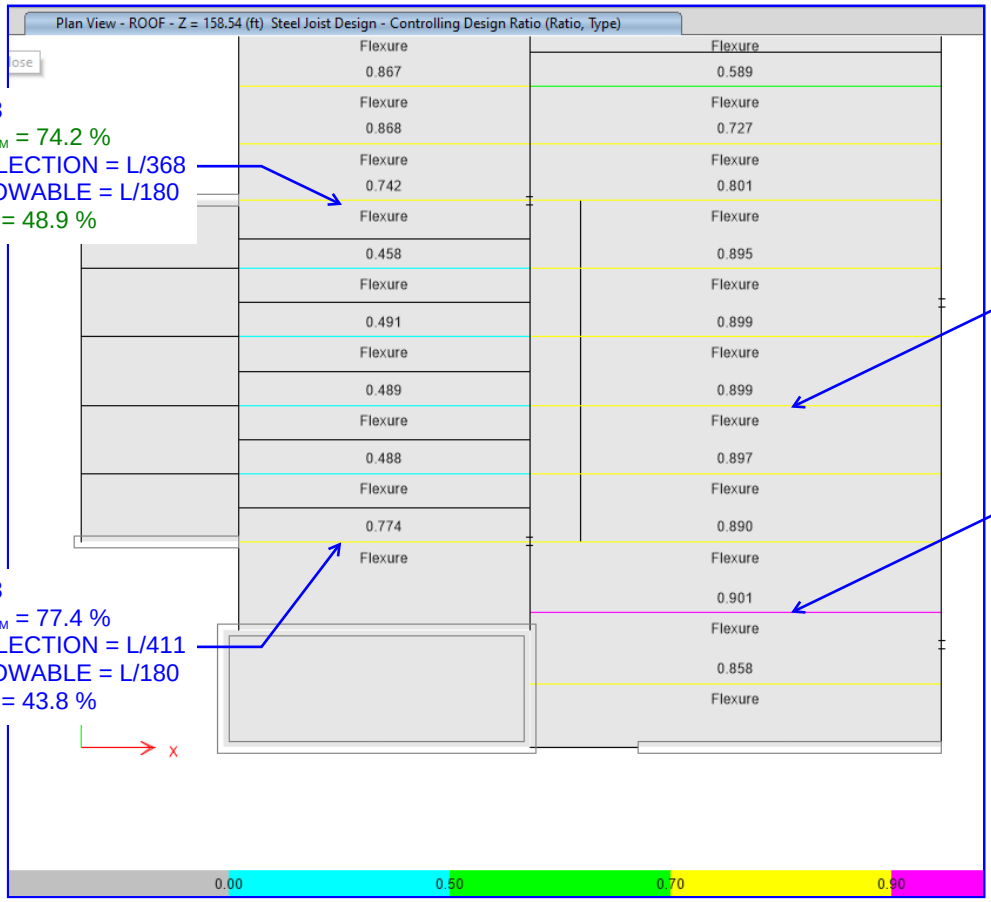
B100:
W14x22_50ksi
DCR_M = 26.2 %
DLR = 32.3 %

B3:
W21x44 W/ 3/8" BOT COVER PLT_36ksi
DCR_M = 95.6 %
DLR = 69.2 %

BEAM BOT. COVER PL IS EXISTING. REF. 2003 RETROFIT DRAWINGS

W18x40_36ksi
DCR_M = 83.6 %
DLR = 73.7 %

STEEL JOIST DESIGN RESULTS :



18K3
DCR_M = 74.2 %
DEFLECTION = L/368
ALLOWABLE = L/180
DLR = 48.9 %

B68:
24K7
DCR_M = 89.9 %
DEFLECTION = L/220
ALLOWABLE = L/180
DLR = 81.8 %

B84:
24K7
DCR_M = 90.1 %
DEFLECTION = L/220
ALLOWABLE = L/180
DLR = 81.8 %

20K3
DCR_M = 77.4 %
DEFLECTION = L/411
ALLOWABLE = L/180
DLR = 43.8 %

THEREFORE THE EXISTING BEAMS ARE WORKING FINE WHEN ADDING NEW AHU UNIT LOADS (Note: VIBRATION RESULT IGNORED)

BEAM B100 DESIGN RESULTS

ETABS 20.3.0 | AISC 360-16 Composite Beam Details | License #

Story ROOF | **Beam B100** | Length: 24.5592 ft Trib. Area: 70.85 ft²

Location: X= 25.5504 ft Y= 26.05 ft | No shear studs

A992Fy50 | **W14x22_50ksi** | No camber

Composite Deck Properties

	Deck	Cover (in)	w_c (pcf)	f'_c (ksi)	Ribs	b_{eff} (in)	E_c(S) (ksi)	E_c(D) (ksi)	E_c(V) (ksi)
At Left	1.5"Deck(F)	0.25	1E-03	1E-03	⊥	17.465	1E-03	1E-03	1.35E-03
At Right	1.5"Deck(F)	0.25	1E-03	1E-03	⊥	17.155	1E-03	1E-03	1.35E-03

Loading (ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1 combo)

	Constr.	Dead	SDL	Live NR	Snow	Factored
Line Load (kip/ft) 0 ft→9.9612 ft	0.00	0.03→0.00	0.07→0.00	0.00	0.07→0.00	0.24→0.00
Line Load (kip/ft) 9.9612 ft→15.541 ft	0.00	0.03→0.00	0.07→0.00	0.31→0.00	0.07→0.00	0.73→0.00
Line Load (kip/ft) 15.541 ft→24.5592 ft	0.00	0.03	0.07	0.00	0.07	0.24

End Reactions

	Top Cope	Bot. Cope	Constr.	Dead	SDL	Live NR	Snow	Combo	Factored
I end (kip)	0.775 in	0 in	0.000	0.346	0.886	0.821	0.886	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	4.208
J end (kip)	0.7 in	0 in	0.000	0.346	0.886	0.886	0.886	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	4.313

Strength Checks

	Combo	Loc.	Factored	Design	Ratio	Pass
Shear at Ends (kip)	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	24.5592 ft	4.313	80.730	0.053	✓
Construction Bending (kip-ft)	DCmpC1	12.2796 ft	3.0	124.4	0.024	✓
Positive Bending (kip-ft)	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	12.5199 ft	32.6	124.4	0.262	✓

Constructability and Serviceability Checks

	Combo	I (in⁴)	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (in)	SV18: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	198.62	0.0398	No Limit	N/A	N/A
Post-concrete Defl. (in)	SV09: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	198.62	0.336	1.228	0.274	✓
Live Load Defl. (in)	SV09: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	198.62	0.2341	0.8186	0.286	✓
Total Defl. (in)	SV18: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	198.62	0.3961	1.228	0.323	✓

Section Properties

	PNA (in)	Area (in²)	S_{bot} (in³)	I (in⁴)	ΦM_n (kip-ft)
Steel fully braced	6.85	6.51	29	198.62	124.4
Vibrations Check (E_c = 1.35E-03)	6.85	6.51	N/A	198.62	N/A

BEAM B3 DESIGN RESULTS

ETABS 20.3.0 | AISC 360-16 Composite Beam Details | License #

Story ROOF | **Beam B3** | Length: 28.83 ft Trib. Area: 717.74 ft²

Location: X= 37.83 ft Y= 31.835 ft | No shear studs

A36 | **W21x44BU** | No camber

Composite Deck Properties

	Deck	Cover (in)	w_c (pcf)	f'_c (ksi)	Ribs	b_{eff} (in)	E_c (S) (ksi)	E_c (D) (ksi)	E_c (V) (ksi)
At Left, at Right	1.5"Deck(F)	0.25	1E-03	1E-03	ll	43.245	1E-03	1E-03	1.35E-03

Loading (ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1 combo)

	Constr.	Dead	SDL	Live NR	Snow	Factored
Line Load (kip/ft) 0 ft→1.6079 ft	0.00	0.05	0.00	0.00	0.00	0.06
Line Load (kip/ft) 1.6079 ft→2.88 ft	0.00	0.05→0.00	0.00	-0.03→0.00	0.00	0.02→0.00
Line Load (kip/ft) 2.88 ft→25.57 ft	0.00	0.05→0.00	0.00	0.12→0.00	0.00	0.26→0.00
Line Load (kip/ft) 25.57 ft→27.0321 ft	0.00	0.05	0.00	0.16→0.02	0.00	0.32→0.09
Line Load (kip/ft) 27.0321 ft→28.83 ft	0.00	0.05	0.00	0.00	0.00	0.06
Point Load (kip) @ 2.88 ft	0.000	0.346	0.886	0.446	0.886	3.609
Point Load (kip) @ 5.7708 ft	0.000	0.540	3.393	0.581	3.393	11.078
Point Load (kip) @ 8.63 ft	0.000	0.346	0.886	0.886	0.886	4.313
Point Load (kip) @ 11.5408 ft	0.000	0.541	3.396	0.626	3.396	11.159
Point Load (kip) @ 14.4 ft	0.000	0.346	0.886	0.765	0.886	4.119
Point Load (kip) @ 17.3108 ft	0.000	0.541	3.399	0.626	3.399	11.168
Point Load (kip) @ 20.19 ft	0.000	0.346	0.886	0.858	0.886	4.267
Point Load (kip) @ 23.0808 ft	0.000	0.535	3.331	0.580	3.331	10.898
Point Load (kip) @ 25.57 ft	0.000	0.346	0.882	0.426	0.882	3.567

End Reactions

	Top Cope	Bot. Cope	Constr.	Dead	SDL	Live NR	Snow	Combo	Factored
I end (kip)	0 in	0 in	0.000	2.657	8.999	4.434	8.999	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	35.480
J end (kip)	0 in	0 in	0.000	2.646	8.944	4.393	8.944	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	35.248

Strength Checks

	Combo	Loc.	Factored	Design	Ratio	Pass
Shear at Ends (kip)	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	0.3358 ft	35.480	140.843	0.252	✓
Construction Bending (kip-ft)	DCmpC1	14.4 ft	28.3	297.4	0.095	✓
Positive Bending (kip-ft)	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	14.4 ft	284.3	297.4	0.956	✓

Constructability and Serviceability Checks

	Combo	I (in⁴)	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (in)	SV18: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	990.12	0.1002	No Limit	N/A	N/A
Post-concrete Defl. (in)	SV09: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	990.12	0.8255	1.4415	0.573	✓
Live Load Defl. (in)	SV09: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	990.12	0.4653	0.961	0.484	✓
Total Defl. (in)	SV18: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	990.12	0.9977	1.4415	0.692	✓

Section Properties

	PNA (in)	Area (in²)	S_{bot} (in³)	I (in⁴)	ΦM_n (kip-ft)
Steel (L_b = 2.8592 ft C_b = 1.013)	9.0331	14.78	84.87	990.12	297.4
Steel fully braced	9.0331	14.78	84.87	990.12	297.4
Vibrations Check (E_c = 1.35E-03)	10.35	14.78	N/A	990.12	N/A

PRCTI20221788

BEAM B11 DESIGN RESULTS

ETABS 20.3.0 | AISC 360-16 Composite Beam Details | License #

Story ROOF | **Beam B11** | Length: 28.83 ft Trib. Area: 469.4 ft²

Location: X= 13.2708 ft Y= 31.835 ft | No shear studs

A36 | **W18X40** | No camber

Composite Deck Properties

	Deck	Cover (in)	w_c (pcf)	f'_c (ksi)	Ribs	b_{eff} (in)	E_c (S) (ksi)	E_c (D) (ksi)	E_c (V) (ksi)
At Left, at Right	1.5"Deck(F)	0.25	1E-03	1E-03	ǁ	43.245	1E-03	1E-03	1.35E-03

Loading (ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1 combo)

	Constr.	Dead	SDL	Live NR	Snow	Factored
Line Load (kip/ft) 0 ft→28.83 ft	0.00	0.04	0.00	0.00	0.00	0.05
Point Load (kip) @ 2.88 ft	0.000	0.346	0.886	0.413	0.886	3.556
Point Load (kip) @ 5.7708 ft	0.000	0.341	1.840	0.000	1.840	5.561
Point Load (kip) @ 8.63 ft	0.000	0.346	0.886	0.821	0.886	4.208
Point Load (kip) @ 11.5408 ft	0.000	0.341	1.843	0.000	1.843	5.570
Point Load (kip) @ 14.4 ft	0.000	0.346	0.886	0.708	0.886	4.028
Point Load (kip) @ 17.3108 ft	0.000	0.342	1.846	0.000	1.846	5.579
Point Load (kip) @ 20.19 ft	0.000	0.346	0.886	0.794	0.886	4.166
Point Load (kip) @ 23.0808 ft	0.000	0.336	1.781	0.000	1.781	5.391
Point Load (kip) @ 25.57 ft	0.000	0.346	0.882	0.394	0.882	3.517

End Reactions

	Top Cope	Bot. Cope	Constr.	Dead	SDL	Live NR	Snow	Combo	Factored
I end (kip)	0 in	0 in	0.000	2.130	5.896	1.584	5.896	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	21.599
J end (kip)	0 in	0 in	0.000	2.118	5.839	1.547	5.839	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	21.366

Strength Checks

	Combo	Loc.	Factored	Design	Ratio	Pass
Shear at Ends (kip)	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	0 ft	21.599	121.792	0.177	✓
Construction Bending (kip-ft)	DCmpC1	14.4 ft	23.2	211.7	0.110	✓
Positive Bending (kip-ft)	ST11: 1.2(DL+SDL+SDLc+WALL)+1.6SL+1.6Skyb+1.6Mach+1.6Pe1	14.4 ft	176.9	211.7	0.836	✓

Constructability and Serviceability Checks

	Combo	I (in⁴)	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (in)	SV18: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	612	0.1391	No Limit	N/A	N/A
Post-concrete Defl. (in)	SV09: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	612	0.842	1.4415	0.584	✓
Live Load Defl. (in)	SV09: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	612	0.4347	0.961	0.452	✓
Total Defl. (in)	SV18: 1.0(DL+SDL+SDLc+WALL)+1.0LLr+1.0Skyb+1.0Mach+1.0Pe9	612	1.0626	1.4415	0.737	✓

Section Properties

	PNA (in)	Area (in²)	S_{bot} (in³)	I (in⁴)	ΦM_n (kip-ft)
Steel (L_b = 2.9108 ft C_b = 1.015)	8.95	11.8	68.38	612	211.7
Steel fully braced	8.95	11.8	68.38	612	211.7
Vibrations Check (E_c = 1.35E-03)	8.95	11.8	N/A	612	N/A