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September 08, 2022

Mr. Arnaldo Arroyo  
**DISH WIRELESS, LLC**  
1 ADP Boulevard  
Roseland, NJ 07068

RE: Structural Analysis  
**NJJER01947B**  
430 Palisade Avenue  
Jersey City, NJ 07306  
FPA No. 14357.005.079

Dear Mr. Arroyo,

As per your request, French & Parrello Associates (FPA) has performed a structural analysis of the proposed Dish wireless facility located at 430 Palisade Avenue, Jersey City, NJ 07306.

The proposed facility will consist of equipment located on the proposed steel platform mounted on the rooftop and three antenna sectors (Alpha, Beta, and Gamma). The proposed Alpha, and Gamma sectors will be mounted on the penthouse façade and the Beta sector to the parapet wall.

FPA's structural analysis included an FPA site visit (06/10/22), a review of site photos (06/10/22), and FPA construction drawings (08/23/22). Dish Wireless proposes to install three antennas in each of the three proposed sectors. The final antenna configuration shall consist of (3) JMA MX08FRO665-21 antennas (72"x20"x8", 82.5 lbs.) for each sector. Dish Wireless also proposes to install (1) Raycap OVP box, (1) Fujitsu TA8025-B604, and (1) Fujitsu TA8025-B605 RRUs in each sector. Dish Wireless also proposes to install (1) Dish Wireless equipment cabinet on the proposed steel platform on the rooftop. (1) GPS unit, (1) Power protective cabinet, and (1) Dish Wireless Telco cabinet will be secured to Unistrut attached to the platform handrail.

**Based on our structural analysis, the proposed antenna support systems, the proposed steel platform, and the existing building components are capable of supporting the proposed antenna configuration and loads provided the installations are carried out according to the latest FPA construction drawings and manufacturer specifications. If conditions are found to be different than those depicted above, FPA should be notified immediately.**

It should be noted that the conclusion reached by FPA is expressly related to the antenna and platform supports and assumes that the building is in good condition and is being maintained and inspected at regular intervals in accordance with industry standards. FPA assumes no responsibility for any failure resulting from installations that do not conform to the design drawings or from hidden defects within the existing structural support systems resulting from aging or damaged components.

Should you have any questions or comments, please do not hesitate to contact us.

Very truly yours,

**FRENCH & PARRELLO ASSOCIATES**

John Bosco, PE, Senior Project Manager  
NJ Professional Engineer License # 29671



## Rooftop Antenna Support | Structural Analysis

### SITE INFORMATION

Address: 430 Palisade Avenue Jersey City, NJ 07306 FPA No. 14357.005.079	Condition: Fair
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### DESIGN CRITERIA

#### APPLICABLE CODES & STANDARDS

All design criteria and loads are in accordance with the International Building Code (IBC) 2018, New Jersey edition in conjunction with ASCE 7-16.

#### WIND LOAD

$V = 114 \text{ mph}$	$h = 65 \text{ ft}$	$\text{Exposure} = B$	$G = 0.85$
$K_{ZT} = 1.00$	$K_d = 0.85$	$K_Z = 0.87$	$q_z = 24.6 \text{ psf}$

#### SNOW LOAD

$\rho_g = 20 \text{ psf}$	$I = 1.0$
$C_e = 1.0$	$C_t = 1.0$
$\rho_f = 20 \text{ psf}$	

#### SEISMIC

The proposed antennas and their electrical and mechanical components are exempt from seismic requirements as per ASCE 7-16 Section 13.1.4 Exception 3. "Mechanical and electrical components in structures assigned to Seismic Design Category C provided the importance factor (IP) is equal to 1.0"

### REFERENCED DOCUMENTS

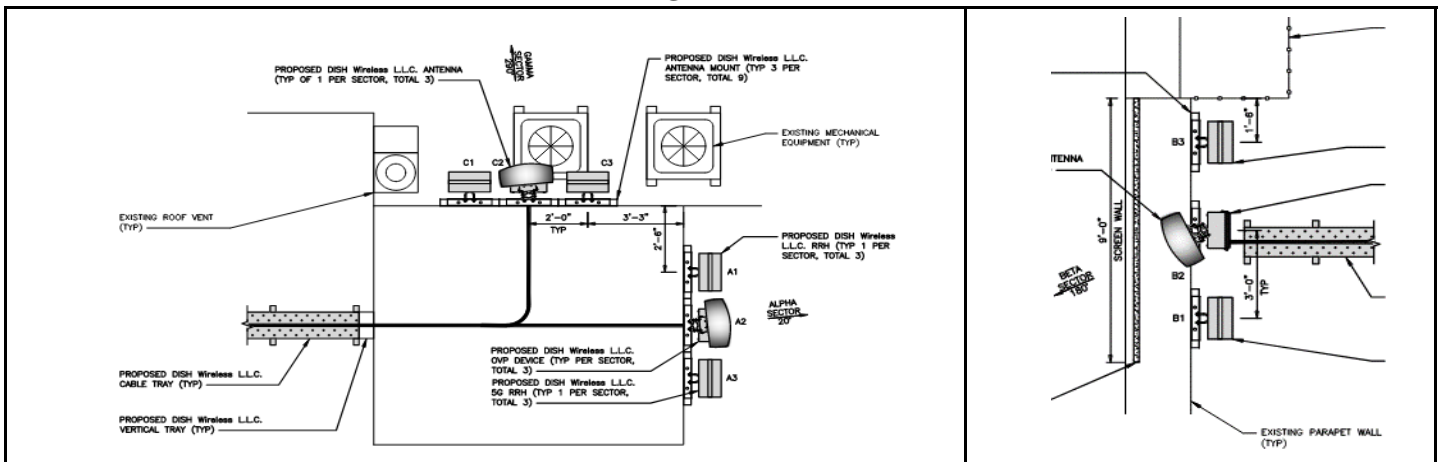
Item	Author/Provider	Date
Construction Drawings	FPA	8/23/2022
Site Audit Photographs	FPA	6/10/2022
Site Audit Report	--	--
Radio Frequency Data Sheet (RFDS)	--	--

### SECTOR PHOTOS

**ALPHA**

**GAMMA**

**BETA**



ALPHA / GAMMA SECTORS		
	<b>Proposed RRUS at P1</b>	<i>Fujitsu TA8025-B604</i>
	height: 14.9 in	width: 15.7 in      depth: 7.8 in
	area: 1.62 sq-ft	weight: 64 lbs
<b>Dimensions</b>		
h <sub>WL</sub> = <span style="border: 1px solid black; padding: 2px;">4.00 ft</span>		d = <span style="border: 1px solid black; padding: 2px;">48 in</span>
<b>Loads</b>		
Wind Load (WL) = 29 lbs		(C <sub>f</sub> = 1.4 )
Top Reaction (R <sub>top</sub> ) = 57 lbs	Bottom Reaction (R <sub>bot</sub> ) = 29 lbs	

PIPE MAST(S)			
Pipe Size: <span style="border: 1px solid black; padding: 2px;">2.5' STD</span>	M <sub>applied</sub> = 1.4 kip-in	<	M <sub>n</sub> /Ω = 28.7 kip-in → ✓ <b>0.05 :1.00</b>
F <sub>y</sub> = 35 ksi      Weight: 5.8 plf	V <sub>applied</sub> = 0.1 kip	<	V <sub>n</sub> /Ω = 10.0 kip → ✓ <b>0.01 :1.00</b>
I <sub>x-x</sub> = 1.45 in <sup>4</sup> S <sub>x-x</sub> = 1.01 in <sup>3</sup>	Δ <sub>total</sub> = 0.05 in	→ <b>L/ 1919</b>	<
L/180 = 0.53 in → ✓ <b>0.09 :1.00</b>			
<i>Therefore, the proposed pipe mast is structurally adequate.</i>			

CONNECTIONS			
U-Bolts		Anchor Bolts	
Bolt Size: <span style="border: 1px solid black; padding: 2px;">1/2" φ A307</span>	No of bolts: <span style="border: 1px solid black; padding: 2px;">2</span>	Anchor Size: <span style="border: 1px solid black; padding: 2px;">1/2" φ Hilti HY70</span>	No: <span style="border: 1px solid black; padding: 2px;">4</span>
T <sub>allow</sub> = 8.84 kip	>	T <sub>applied</sub> = 0.06 kip	✓ 1%
V <sub>allow</sub> = 4.72 kip	>	V <sub>applied</sub> = 0.11 kip	✓ 2%
$\sqrt{(T_{applied}/T_{allow})^2 + (V_{applied}/V_{allow})^2} = \mathbf{0.02 :1.0}$		$\sqrt{(T_{applied}/T_{allow})^2 + (V_{applied}/V_{allow})^2} = \mathbf{0.04 :1.0}$	
<i>Therefore, the proposed connections are structurally adequate.</i>			



**Therefore, the proposed antenna sectors are STRUCTURALLY ADEQUATE to support the proposed design loads in accordance with the local building codes.**

ALPHA / GAMMA SECTORS	
	<b>Proposed Antenna at P2</b> <span style="float: right; border: 1px solid black; padding: 2px;">JMA MX08FRO665-21</span> height: 72.0 in      width: 20.0 in      depth: 8.0 in area: 10.00 sq-ft      weight: 83 lbs
	<b>Dimensions</b> $h_{WL} = $ <span style="border: 1px solid black; padding: 2px;">4.00 ft</span> $d = $ <span style="border: 1px solid black; padding: 2px;">48 in</span>
	<b>Loads</b> Wind Load (WL) = 176 lbs      ( $C_f = 1.4$ ) Top Reaction ( $R_{top}$ ) = 351 lbs      Bottom Reaction ( $R_{bot}$ ) = 176 lbs

PIPE MAST(S)	
Pipe Size: <span style="border: 1px solid black; padding: 2px;">2.5' STD</span> $M_{applied} = 8.4 \text{ kip-in} < M_n/\Omega = 28.7 \text{ kip-in} \rightarrow \checkmark \text{ 0.29 :1.00}$ $F_y = 35 \text{ ksi}$ Weight: 5.8 plf $V_{applied} = 0.4 \text{ kip} < V_n/\Omega = 10.0 \text{ kip} \rightarrow \checkmark \text{ 0.04 :1.00}$ $I_{x-x} = 1.45 \text{ in}^4$ $S_{x-x} = 1.01 \text{ in}^3$ $\Delta_{total} = 0.31 \text{ in} \rightarrow \text{L/ 312} < \text{L/180} = 0.53 \text{ in} \rightarrow \checkmark \text{ 0.58 :1.00}$	
<i>Therefore, the proposed pipe mast is structurally adequate.</i>	

CONNECTIONS	
U-Bolts	Anchor Bolts
Bolt Size: <span style="border: 1px solid black; padding: 2px;">1/2" φ A307</span> No of bolts: <span style="border: 1px solid black; padding: 2px;">2</span> $T_{allow} = 8.84 \text{ kip} > T_{applied} = 0.35 \text{ kip} \checkmark \text{ 4\%}$ $V_{allow} = 4.72 \text{ kip} > V_{applied} = 0.13 \text{ kip} \checkmark \text{ 3\%}$ $\sqrt{(T_{applied}/T_{allow})^2 + (V_{applied}/V_{allow})^2} = \text{0.05 :1.0}$	Anchor Size: <span style="border: 1px solid black; padding: 2px;">1/2" φ Hilti HY70</span> No: <span style="border: 1px solid black; padding: 2px;">4</span> $T_{allow} = 3.0 \text{ kip} < T_{applied} = 0.4 \text{ kip} \checkmark \text{ 12\%}$ $V_{allow} = 3.7 \text{ kip} < V_{applied} = 0.1 \text{ kip} \checkmark \text{ 3\%}$ $\sqrt{(T_{applied}/T_{allow})^2 + (V_{applied}/V_{allow})^2} = \text{0.12 :1.0}$
<i>Therefore, the proposed connections are structurally adequate.</i>	



**Therefore, the proposed antenna sectors are STRUCTURALLY ADEQUATE to support the proposed design loads in accordance with the local building codes.**

**ALPHA / GAMMA SECTORS**

	<b>Proposed Antenna at P3</b> <span style="float: right;"><i>Fujitsu TA8025-B605</i></span>
	height: 14.9 in      width: 15.7 in      depth: 9.0 in area: 1.62 sq-ft      weight: 75 lbs
	<b>Dimensions</b> $h_{WL} = 4.00 \text{ ft}$ $d = 48 \text{ in}$
<b>Loads</b> Wind Load (WL) = 29 lbs      ( $C_f = 1.4$ ) Top Reaction ( $R_{top}$ ) = 57 lbs      Bottom Reaction ( $R_{bot}$ ) = 29 lbs	

**PIPE MAST(S)**

Pipe Size: <i>2.5" STD</i> $F_y = 35 \text{ ksi}$ Weight: 5.8 plf $I_{x-x} = 1.45 \text{ in}^4$ $S_{x-x} = 1.01 \text{ in}^3$	$M_{applied} = 1.4 \text{ kip-in} < M_n/\Omega = 28.7 \text{ kip-in} \rightarrow \checkmark \text{ 0.05 :1.00}$ $V_{applied} = 0.1 \text{ kip} < V_n/\Omega = 10.0 \text{ kip} \rightarrow \checkmark \text{ 0.01 :1.00}$ $\Delta_{total} = 0.05 \text{ in} \rightarrow \text{L/ 1919} < L/180 = 0.53 \text{ in} \rightarrow \checkmark \text{ 0.09 :1.00}$
<i>Therefore, the proposed pipe mast is structurally adequate.</i>	

**CONNECTIONS**

U-Bolts		Anchor Bolts	
Bolt Size: <i>1/2" φ A307</i> $T_{allow} = 8.84 \text{ kip} > T_{applied} = 0.06 \text{ kip} \checkmark \text{ 1\%}$ $V_{allow} = 4.72 \text{ kip} > V_{applied} = 0.12 \text{ kip} \checkmark \text{ 3\%}$	No of bolts: <i>2</i>	Anchor Size: <i>1/2" φ Hilti HY70</i> $T_{allow} = 3.0 \text{ kip} < T_{applied} = 0.1 \text{ kip} \checkmark \text{ 2\%}$ $V_{allow} = 3.7 \text{ kip} < V_{applied} = 0.1 \text{ kip} \checkmark \text{ 3\%}$	No: <i>4</i>
$\sqrt{(T_{applied}/T_{allow})^2 + (V_{applied}/V_{allow})^2} = \text{0.03 :1.0}$		$\sqrt{(T_{applied}/T_{allow})^2 + (V_{applied}/V_{allow})^2} = \text{0.04 :1.0}$	
<i>Therefore, the proposed connections are structurally adequate.</i>			



**Therefore, the proposed antenna sectors are STRUCTURALLY ADEQUATE to support the proposed design loads in accordance with the local building codes.**

BETA SECTOR			
	<b>Antenna at P1</b>	Fujitsu TA8025-B604	
	height: 14.9 in area: 1.62 sq-ft	width: 15.7 in weight: 64 lbs	depth: 7.8 in Wind Load: 29 lbs
	<b>Antenna at P2</b>	JMA MX08FR0665-21	
height: 72.0 in area: 10.00 sq-ft	width: 20.0 in weight: 83 lbs	depth: 8.0 in Wind Load: 176 lbs	
<b>Antenna at P3</b>	Fujitsu TA8025-B605		
height: 14.9 in area: 1.62 sq-ft	width: 15.7 in weight: 75 lbs	depth: 9.0 in Wind Load: 29 lbs	
$d_1 = 36 \text{ in}$ $h_{WL} = 4.00 \text{ ft}$	$R_{top} = 129 \text{ lbs}$ $d_2 = 36 \text{ in}$	Total Wind Load: $A_L$ 233 lbs      Wind load per pipe mast: 116 lbs	
FLUSH MOUNT PIPE			
Pipe Size: <span style="border: 1px solid blue; padding: 2px;">2.5' STD</span>	$M_{applied} = 0.3 \text{ kip-in}$	$M_n/\Omega = 28.7 \text{ kip-in}$	$\rightarrow \checkmark \text{ 0.01 :1.00}$
$F_y = 35 \text{ ksi}$ Weight: 5.8 plf	$V_{applied} = 0.0 \text{ kip}$	$V_n/\Omega = 10.0 \text{ kip}$	$\rightarrow \checkmark \text{ 0.00 :1.00}$
$I_{x-x} = 1.45 \text{ in}^4$ $S_{x-x} = 1.01 \text{ in}^3$	$\Delta_{total} = 0.001 \text{ in}$	$\rightarrow L/54580$	$< L/240 = 0.15 \text{ in} \rightarrow \checkmark \text{ 0.00 :1.00}$
<i>Therefore, the proposed flush mount pipe is structurally adequate.</i>			
PIPE MAST(S)			
Pipe Size: <span style="border: 1px solid blue; padding: 2px;">3.0' STD</span>	$M_{applied} = 5.6 \text{ kip-in}$	$M_n/\Omega = 45.9 \text{ kip-in}$	$\rightarrow \checkmark \text{ 0.12 :1.00}$
$F_y = 35 \text{ ksi}$ Weight: 7.6 plf	$V_{applied} = 0.1 \text{ kip}$	$V_n/\Omega = 13.1 \text{ kip}$	$\rightarrow \checkmark \text{ 0.01 :1.00}$
$I_{x-x} = 2.85 \text{ in}^4$ $S_{x-x} = 1.63 \text{ in}^3$	$\Delta_{total} = 0.09 \text{ in}$	$\rightarrow L/925$	$< L/240 = 0.35 \text{ in} \rightarrow \checkmark \text{ 0.26 :1.00}$
<i>Therefore, the proposed pipe mast is structurally adequate.</i>			
CONNECTIONS			
<b>U-Bolts</b>		<b>Anchor Bolts</b>	
Bolt Size: <span style="border: 1px solid blue; padding: 2px;">1/2" <math>\phi</math> A307</span>	No of bolts: <span style="border: 1px solid blue; padding: 2px;">2</span>	Anchor Size: <span style="border: 1px solid blue; padding: 2px;">1/2" <math>\phi</math> Hilti HY70</span>	No: <span style="border: 1px solid blue; padding: 2px;">2</span>
$T_{allow} = 8.84 \text{ kip}$	$T_{applied} = 0.13 \text{ kip}$ $\checkmark \text{ 1\%}$	$T_{allow} = 1.5 \text{ kip}$	$T_{applied} = 0.13 \text{ kip}$ $\checkmark \text{ 9\%}$
$V_{allow} = 4.72 \text{ kip}$	$V_{applied} = 0.27 \text{ kip}$ $\checkmark \text{ 6\%}$	$V_{allow} = 1.9 \text{ kip}$	$V_{applied} = 0.27 \text{ kip}$ $\checkmark \text{ 15\%}$
$\sqrt{(T_{applied}/T_{allow})^2 + (V_{applied}/V_{allow})^2} = \text{0.06 :1.0}$		$\sqrt{(T_{applied}/T_{allow})^2 + (V_{applied}/V_{allow})^2} = \text{0.17 :1.0}$	
<i>Therefore, the proposed connections are structurally adequate.</i>			
<b>Therefore, the proposed sector is <u>STRUCTURALLY ADEQUATE</u> to support the proposed design loads in accordance with the local building codes.</b>			

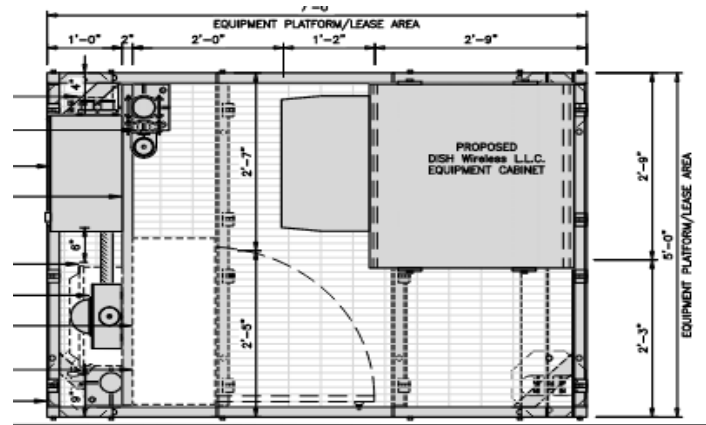
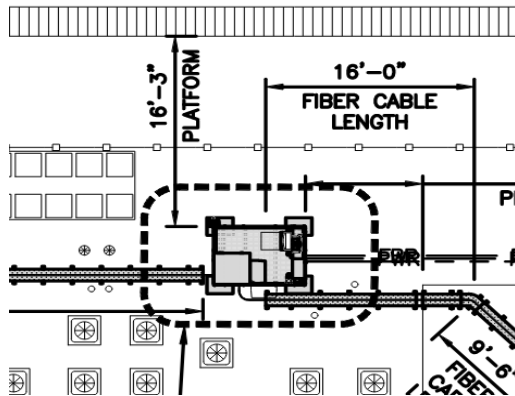
<b>BETA SECTOR</b>		
<b>Antenna at P1</b> <i>Fujitsu TA8025-B604</i> height: 14.9 in      width: 15.7 in      depth: 7.8 in area: 1.62 sq-ft      weight: 64 lbs <b>Dimensions</b> $h_{ant} = 65 \text{ ft}$ (to grade) $d = 36 \text{ in}$ <b>Loads</b> Wind Load (WL) = 29 lbs      ( $C_f = 1.4$ )		Assume full windload is transferred into the (2) proposed L4x4x1/4" kickers resulting in minimal load/reactions in existing pipe-mast and base connections.
<b>Antenna at P2</b> <i>JMA MX08FR0665-21</i> height: 72.0 in      width: 20.0 in      depth: 8.0 in area: 10.00 sq-ft      weight: 83 lbs <b>Dimensions</b> $h_{ant} = 65 \text{ ft}$ (to grade) $d = 36 \text{ in}$ <b>Loads</b> Wind Load (WL) = 176 lbs      ( $C_f = 1.4$ )		
<b>Antenna at P3</b> <i>Fujitsu TA8025-B605</i> height: 14.9 in      width: 15.7 in      depth: 9.0 in area: 1.62 sq-ft      weight: 75 lbs <b>Dimensions</b> $h_{ant} = 65 \text{ ft}$ (to grade) $d = 36 \text{ in}$ <b>Loads</b> Wind Load (WL) = 29 lbs      ( $C_f = 1.4$ )		<b>KICKERS</b> T/C = 165 lbs Unbraced Length: ± 7'-0" <i>L4X4X1/4" (Fy = 36 ksi)</i> $C_{ALL} = 27.70 \text{ kips} \gg 165 \text{ lbs}$ <b>0.6%</b> <i>Therefore, the proposed kickers are structurally adequate to support the proposed loads.</i>
<b>TOTAL WIND LOAD</b>		<b>CONNECTION</b>
29 lbs      +      176 lbs      +      29 lbs      =      233 lbs		Bolt Size: <i>1/2" φ A307</i> $T_{all} = 4.42 \text{ kip}$ $T_{app} = 0.16 \text{ kip}$ $V_{all} = 2.36 \text{ kip}$ $V_{app} = 0.16 \text{ kip}$ $\sqrt{(T_{app}/T_{all})^2 + (V_{app}/V_{all})^2} = 0.08 : 1.0$ Bolt Size: <i>5/8" φ A325</i> $T_{all} = 6.90 \text{ kip}$ $T_{app} = 0.00 \text{ kip}$ $V_{all} = 3.68 \text{ kip}$ $V_{app} = 0.33 \text{ kip}$ $\sqrt{(T_{app}/T_{all})^2 + (V_{app}/V_{all})^2} = 0.09 : 1.0$
<p><b>Therefore, the proposed sector is <u>STRUCTURALLY ADEQUATE</u> to support the proposed design loads in accordance with the local building codes.</b></p>		

Site ID: NJJER01947B

Dish Wireless Project

September 8, 2022

**PROPOSED PLATFORM**



<b>PROPOSED STRUCTURE</b>		
Frame Area: 35 sq-ft	Total Weight: 1000 lbs	Dist. Load: 28.6 psf
<div style="border: 1px solid black; padding: 5px; margin: 0 auto; width: 80%;"> <p><b>The increase in roof distributed loads is minimal. Therefore, the existing structure is structurally adequate.</b></p> </div>		
<div style="border: 1px solid black; padding: 5px; margin: 0 auto; width: 80%;"> <p><b>See concrete slab calculations (attached).</b></p> </div>		
<p><b>Therefore, the proposed structure is structurally adequate to support the proposed design loads in accordance with the local building codes.</b></p>		

**ASSUMPTIONS:**

It is assumed that the entire platform and equipment weight is transferred to the existing 4" concrete slab through 4 supports, each 250 lbs.

## Concrete Beam

Lic. #: KW-06001575

DESCRIPTION: 4" CONCRETE SLAB

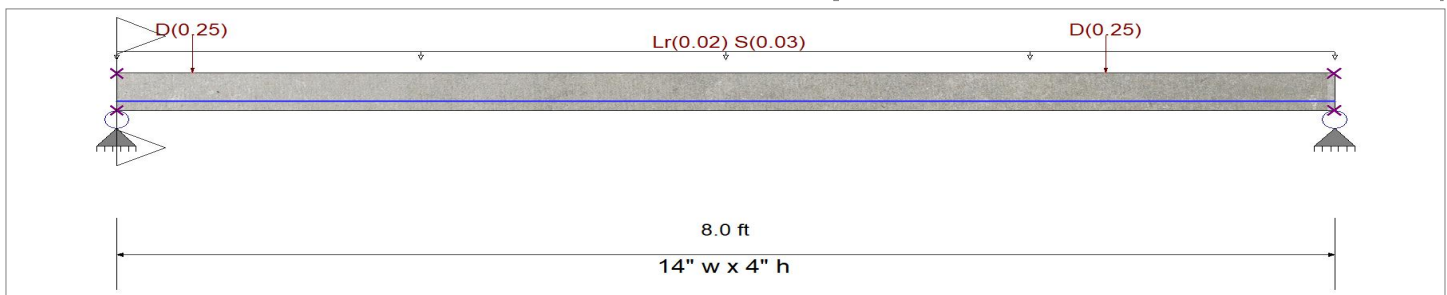
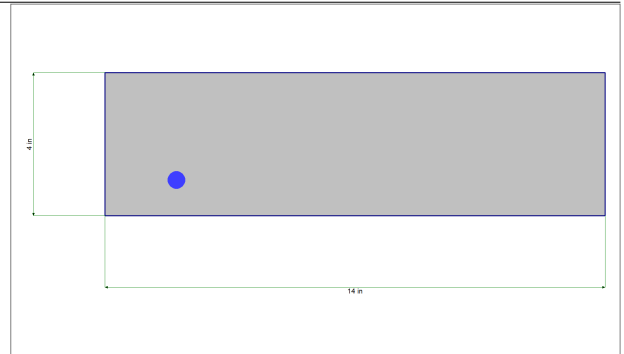
### CODE REFERENCES

Calculations per ACI 318-14, IBC 2015, CBC 2016, ASCE 7-10

Load Combination Set : ASCE 7-05

### Material Properties

$f'_c$	=	3.0 ksi	$\phi$ Phi Values	Flexure :	0.90
$f_r = f'_c^{1/2} * 7.50$	=	410.792 psi		Shear :	0.750
$\psi$ Density	=	145.0 pcf	$\beta_1$	=	0.850
$\lambda$ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	$F_y$ - Stirrups	=	40.0 ksi
$f_y$ - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	3
			Number of Resisting Legs Per Stirrup =	=	2



### Cross Section & Reinforcing Details

Rectangular Section, Width = 14.0 in, Height = 4.0 in

Span #1 Reinforcing....

1-#4 at 1.0 in from Bottom, from 0.0 to 8.0 ft in this span

Beam self weight calculated and added to loads

Load for Span Number 1

Uniform Load :  $L_r = 0.020$ ,  $S = 0.030$  k/ft, Tributary Width = 1.0 ft, (General Loads)

Point Load :  $D = 0.250$  k @ 0.50 ft

Point Load :  $D = 0.250$  k @ 6.50 ft, (Platform Point Load)

### DESIGN SUMMARY

**Design OK**

Maximum Bending Stress Ratio =	<b>0.483</b> : 1	Maximum Deflection	
Section used for this span	<b>Typical Section</b>	Max Downward Transient Deflection	0.012 in Ratio = 8096 >=360.
Mu : Applied	1.231 k-ft	Max Upward Transient Deflection	0.000 in Ratio = 0 <360.0
Mn * Phi : Allowable	2.549 k-ft	Max Downward Total Deflection	0.048 in Ratio = 1982 >=180.
Location of maximum on span	4.328 ft	Max Upward Total Deflection	0.000 in Ratio = 0 <180.0
Span # where maximum occurs	Span # 1		

### Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	0.627	0.564
Overall MINimum	0.080	0.080
D Only	0.507	0.444
+D+L+H	0.507	0.444
+D+Lr+H	0.587	0.524
+D+S+H	0.627	0.564
+D+0.750Lr+0.750L+H	0.567	0.504
+D+0.750L+0.750S+H	0.597	0.534
+D+W+H	0.507	0.444
+D+0.70E+H	0.507	0.444

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

Printed: 8 SEP 2022, 12:31PM

**Concrete Beam**

File: CALCS.ec6  
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24  
**FRENCH & PARRELLO ASSOCIATES**

Lic. # : KW-06001575

DESCRIPTION: 4" CONCRETE SLAB

**Vertical Reactions**

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+0.750Lr+0.750L+0.750W+H	0.567	0.504
+D+0.750L+0.750S+0.750W+H	0.597	0.534
+D+0.750Lr+0.750L+0.5250E+H	0.567	0.504
+D+0.750L+0.750S+0.5250E+H	0.597	0.534
+0.60D+W+H	0.304	0.267
+0.60D+0.70E+H	0.304	0.267
D Only	0.507	0.444
Lr Only	0.080	0.080
S Only	0.120	0.120
H Only		

**Detailed Shear Information**

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)		Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in)	
				Actual	Design							Req'd	Suggest
+1.20D+1.60S+0.80W	1	0.00	3.00	0.80	0.80	0.00	1.00	3.65	Vu < PhiVc/2	lot Reqd 9.6.	3.7	0.0	0.0
+1.20D+1.60S+0.80W	1	0.09	3.00	0.79	0.79	0.07	1.00	3.65	Vu < PhiVc/2	lot Reqd 9.6.	3.7	0.0	0.0
+1.20D+1.60S+0.80W	1	0.17	3.00	0.78	0.78	0.14	1.00	3.65	Vu < PhiVc/2	lot Reqd 9.6.	3.7	0.0	0.0
+1.20D+1.60S+0.80W	1	0.26	3.00	0.77	0.77	0.21	0.93	3.63	Vu < PhiVc/2	lot Reqd 9.6.	3.6	0.0	0.0
+1.20D+1.60S+0.80W	1	0.35	3.00	0.76	0.76	0.27	0.70	3.54	Vu < PhiVc/2	lot Reqd 9.6.	3.5	0.0	0.0
+1.20D+1.60S+0.80W	1	0.44	3.00	0.75	0.75	0.34	0.55	3.49	Vu < PhiVc/2	lot Reqd 9.6.	3.5	0.0	0.0
+1.20D+1.60S+0.80W	1	0.52	3.00	0.44	0.44	0.40	0.28	3.38	Vu < PhiVc/2	lot Reqd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	0.61	3.00	0.43	0.43	0.43	0.25	3.37	Vu < PhiVc/2	lot Reqd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	0.70	3.00	0.42	0.42	0.47	0.22	3.36	Vu < PhiVc/2	lot Reqd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	0.79	3.00	0.41	0.41	0.51	0.20	3.35	Vu < PhiVc/2	lot Reqd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	0.87	3.00	0.40	0.40	0.54	0.18	3.35	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	0.96	3.00	0.39	0.39	0.58	0.17	3.34	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.05	3.00	0.38	0.38	0.61	0.15	3.34	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.14	3.00	0.37	0.37	0.64	0.14	3.33	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.22	3.00	0.36	0.36	0.68	0.13	3.33	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.31	3.00	0.35	0.35	0.71	0.12	3.32	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.40	3.00	0.34	0.34	0.74	0.11	3.32	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.49	3.00	0.33	0.33	0.77	0.11	3.32	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.57	3.00	0.32	0.32	0.79	0.10	3.32	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.66	3.00	0.31	0.31	0.82	0.09	3.31	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.75	3.00	0.30	0.30	0.85	0.09	3.31	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.84	3.00	0.29	0.29	0.87	0.08	3.31	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	1.92	3.00	0.28	0.28	0.90	0.08	3.31	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.01	3.00	0.27	0.27	0.92	0.07	3.31	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.10	3.00	0.26	0.26	0.94	0.07	3.30	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.19	3.00	0.25	0.25	0.97	0.06	3.30	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.27	3.00	0.24	0.24	0.99	0.06	3.30	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.36	3.00	0.23	0.23	1.01	0.06	3.30	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.45	3.00	0.22	0.22	1.03	0.05	3.30	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.54	3.00	0.21	0.21	1.05	0.05	3.30	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.62	3.00	0.20	0.20	1.06	0.05	3.30	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.71	3.00	0.19	0.19	1.08	0.04	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.80	3.00	0.18	0.18	1.10	0.04	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.89	3.00	0.17	0.17	1.11	0.04	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	2.97	3.00	0.16	0.16	1.13	0.03	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	3.06	3.00	0.15	0.15	1.14	0.03	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	3.15	3.00	0.14	0.14	1.15	0.03	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	3.23	3.00	0.13	0.13	1.16	0.03	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	3.32	3.00	0.12	0.12	1.17	0.02	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	3.41	3.00	0.11	0.11	1.18	0.02	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	3.50	3.00	0.10	0.10	1.19	0.02	3.29	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	3.58	3.00	0.09	0.09	1.20	0.02	3.28	Vu < PhiVc/2	lot Reqd 9.6.	3.3	0.0	0.0

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

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DESCRIPTION: 4" CONCRETE SLAB

**Detailed Shear Information**

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd Suggest	
+1.20D+1.60S+0.80W	1	3.67	3.00	0.08	0.08	1.21	0.02	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	3.76	3.00	0.07	0.07	1.21	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.40D	1	3.85	3.00	0.06	0.06	0.97	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.40D	1	3.93	3.00	0.05	0.05	0.98	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.40D	1	4.02	3.00	0.04	0.04	0.98	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.40D	1	4.11	3.00	0.04	0.04	0.99	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.40D	1	4.20	3.00	0.03	0.03	0.99	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.40D	1	4.28	3.00	0.02	0.02	0.99	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.40D	1	4.37	3.00	0.01	0.01	0.99	0.00	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	4.46	3.00	-0.02	0.02	1.23	0.00	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	4.55	3.00	-0.03	0.03	1.23	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	4.63	3.00	-0.04	0.04	1.23	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	4.72	3.00	-0.05	0.05	1.22	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	4.81	3.00	-0.06	0.06	1.22	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	4.90	3.00	-0.07	0.07	1.21	0.01	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	4.98	3.00	-0.08	0.08	1.21	0.02	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.07	3.00	-0.09	0.09	1.20	0.02	3.28	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.16	3.00	-0.10	0.10	1.19	0.02	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.25	3.00	-0.11	0.11	1.18	0.02	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.33	3.00	-0.12	0.12	1.17	0.02	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.42	3.00	-0.13	0.13	1.16	0.03	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.51	3.00	-0.14	0.14	1.15	0.03	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.60	3.00	-0.15	0.15	1.14	0.03	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.68	3.00	-0.16	0.16	1.12	0.03	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.77	3.00	-0.17	0.17	1.11	0.04	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.86	3.00	-0.18	0.18	1.10	0.04	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	5.95	3.00	-0.19	0.19	1.08	0.04	3.29	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.03	3.00	-0.20	0.20	1.06	0.05	3.30	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.12	3.00	-0.21	0.21	1.04	0.05	3.30	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.21	3.00	-0.22	0.22	1.03	0.05	3.30	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.30	3.00	-0.23	0.23	1.01	0.06	3.30	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.38	3.00	-0.24	0.24	0.99	0.06	3.30	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.47	3.00	-0.25	0.25	0.97	0.06	3.30	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.56	3.00	-0.56	0.56	0.93	0.15	3.33	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.64	3.00	-0.57	0.57	0.88	0.16	3.34	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.73	3.00	-0.58	0.58	0.83	0.18	3.34	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.82	3.00	-0.59	0.59	0.78	0.19	3.35	Vu < PhiVc/2	lot Req'd 9.6.	3.3	0.0	0.0
+1.20D+1.60S+0.80W	1	6.91	3.00	-0.60	0.60	0.72	0.21	3.36	Vu < PhiVc/2	lot Req'd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	6.99	3.00	-0.61	0.61	0.67	0.23	3.36	Vu < PhiVc/2	lot Req'd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	7.08	3.00	-0.62	0.62	0.62	0.25	3.37	Vu < PhiVc/2	lot Req'd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	7.17	3.00	-0.63	0.63	0.56	0.28	3.38	Vu < PhiVc/2	lot Req'd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	7.26	3.00	-0.64	0.64	0.51	0.32	3.40	Vu < PhiVc/2	lot Req'd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	7.34	3.00	-0.65	0.65	0.45	0.36	3.41	Vu < PhiVc/2	lot Req'd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	7.43	3.00	-0.66	0.66	0.39	0.42	3.44	Vu < PhiVc/2	lot Req'd 9.6.	3.4	0.0	0.0
+1.20D+1.60S+0.80W	1	7.52	3.00	-0.67	0.67	0.34	0.50	3.47	Vu < PhiVc/2	lot Req'd 9.6.	3.5	0.0	0.0
+1.20D+1.60S+0.80W	1	7.61	3.00	-0.68	0.68	0.28	0.61	3.51	Vu < PhiVc/2	lot Req'd 9.6.	3.5	0.0	0.0
+1.20D+1.60S+0.80W	1	7.69	3.00	-0.69	0.69	0.22	0.80	3.58	Vu < PhiVc/2	lot Req'd 9.6.	3.6	0.0	0.0
+1.20D+1.60S+0.80W	1	7.78	3.00	-0.70	0.70	0.16	1.00	3.65	Vu < PhiVc/2	lot Req'd 9.6.	3.7	0.0	0.0
+1.20D+1.60S+0.80W	1	7.87	3.00	-0.71	0.71	0.09	1.00	3.65	Vu < PhiVc/2	lot Req'd 9.6.	3.7	0.0	0.0
+1.20D+1.60S+0.80W	1	7.96	3.00	-0.72	0.72	0.03	1.00	3.65	Vu < PhiVc/2	lot Req'd 9.6.	3.7	0.0	0.0

**Maximum Forces & Stresses for Load Combinations**

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
			Mu : Max	Phi*Mnx	Stress Ratio

MAXIMUM BENDING Envelope

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

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**Concrete Beam**

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**DESCRIPTION: 4" CONCRETE SLAB**

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
			Mu : Max	Phi*Mnx	Stress Ratio
Span # 1	1	8.000	1.23	2.55	0.48
+1.40D	Span # 1	8.000	0.99	2.55	0.39
+1.20D+0.50Lr+1.60L+1.60H	Span # 1	8.000	0.93	2.55	0.37
+1.20D+1.60L+0.50S+1.60H	Span # 1	8.000	0.97	2.55	0.38
+1.20D+1.60Lr+0.50L	Span # 1	8.000	1.10	2.55	0.43
+1.20D+1.60Lr+0.80W	Span # 1	8.000	1.10	2.55	0.43
+1.20D+0.50L+1.60S	Span # 1	8.000	1.23	2.55	0.48
+1.20D+1.60S+0.80W	Span # 1	8.000	1.23	2.55	0.48
+1.20D+0.50Lr+0.50L+1.60W	Span # 1	8.000	0.93	2.55	0.37
+1.20D+0.50L+0.50S+1.60W	Span # 1	8.000	0.97	2.55	0.38
+1.20D+0.50L+0.20S+E	Span # 1	8.000	0.90	2.55	0.35
+0.90D+1.60W+1.60H	Span # 1	8.000	0.64	2.55	0.25
+0.90D+E+1.60H	Span # 1	8.000	0.64	2.55	0.25

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+S+H	1	0.0484	4.131		0.0000	0.000