



G.F. CONSULTING ENGINEERS, Inc.

STRUCTURAL ENGINEERING • THRESHOLD & SPECIAL INSPECTION • SBCCI CERTIFIED PLANS EXAMINERS  
LICENSES: ALABAMA, COLORADO, FLORIDA, GEORGIA, NEW MEXICO, NORTH CAROLINA, SOUTH CAROLINA.

COA 9129

## **Structural Calculations** **for**



## **Casa at 63<sup>RD</sup> Avenue** Miami, FL

**-2023 Florida Building Code (8<sup>TH</sup> Edition)**



Fresnel E. Hernandez P.E./S.I./P.X.  
PE# 46618



### **NOTE:**

This set of calculations was prepared under my direct supervision, including the results of computer software generated results, to the extent indicated on this set of calculations.

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## Design Criteria

— FBC 2023, 8<sup>th</sup> Edition

— ASCE 7-20

- Wind Speed 175 mph (ultimate)

- Exp 'C'

- MRH

- Risk Category II

- $K_d = 0.85$

- $G_{Cpi} = 1/0.18$

- Flat Roof

— Roof Loads:

$LL = 30 \text{ psf}$   
 $ADL = 20 \text{ psf}$

— Floor loads:

$LL = 40 \text{ psf}$   
 $ADL = 30 \text{ psf} / 40 \text{ psf}$

— Soil  $V_{adm} = 3000 \text{ psf}$  per  
Geotech Report



## *Wind Loads & Design Criteria*



**Company**

Address  
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JOB TITLE CASA PA FERNANDZ

JOB NO.

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www.struware.com

**Code Search**

Code: ASCE 7 - 22

**Occupancy:**

Occupancy Group = R Residential

**Risk Category & Importance Factors:**

Risk Category = II

Wind Factor = 1.00

Snow Factor = 1.00

Seismic Importance factor = 1.00

**Type of Construction:****Fire Rating:**

Roof = 20.0 hr

Floor = 0.0 hr

**Building Geometry:**Roof angle ( $\theta$ ) 0.00 / 12 0.0 deg

Building length 110.0 ft

Least width 60.0 ft

Mean Roof Ht (h) 24.0 ft

Parapet ht above grd 27.0 ft

Minimum parapet ht 3.0 ft

hb for Elevated bldg 0.0 ft

**Live Loads:**

**Roof** 0 to 200 sf: 20 psf  
200 to 600 sf:  $24 - 0.02\text{Area}$ , but not less than 12 psf  
over 600 sf: 12 psf

Roofs used for roof gardens 100 psf

**Floor:**

Typical Floor 40 psf

Partitions 15 psf

All other residential areas except balk 40 psf

All other residential areas except balk 40 psf

60 psf

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DATEWind Loads - Other Structures:

ASCE 7- 22

Ultimate Wind Pressures

Wind Factor = 1.00  
 Gust Effect Factor (G) = 0.85 Ultimate Wind Speed = 175 mph  
 Kzt = 1.00 Exposure = C

A. Solid Freestanding Walls & Solid Signs (& open signs with less than 30% open)

|                                    |         |                          |          |                               |               |
|------------------------------------|---------|--------------------------|----------|-------------------------------|---------------|
| Dist to sign top (h)               | 6.0 ft  | s/h =                    | 1.00     | <u>Case A &amp; B</u>         |               |
| Height (s)                         | 6.0 ft  | B/s =                    | 4.83     | $C_f =$                       | 1.35          |
| Width (B)                          | 29.0 ft | Lr/s =                   | 0.00     | $F = K_d q_h G C_f A_s =$     | 65.1 As       |
| Wall Return (Lr) =                 | 0.0 ft  | Kz =                     | 0.851    | $A_s =$                       | 10.0 sf       |
| Directionality (Kd)                | 0.85    | Kd qh =                  | 56.7 psf | $F =$                         | 651 lbs       |
| Percent of open area to gross area | 0.0%    | Open reduction factor =  | 1.00     | <u>Case C</u>                 |               |
|                                    |         | Case C reduction factors |          | Horiz dist from windward edge |               |
|                                    |         | Factor if s/h > 0.8 =    | 0.80     | 0 to s                        | 2.45 118.3 As |
|                                    |         | Wall return factor       |          | s to 2s                       | 1.59 76.5 As  |
|                                    |         | for Cf at 0 to s =       | 1.00     | 2s to 3s                      | 1.14 55.0 As  |
|                                    |         |                          |          | 3s to 10s                     | 0.85 40.8 As  |

B. Open Signs & Single-Plane Open Frames (openings 30% or more of gross area)

|                                    |         |                           |          |
|------------------------------------|---------|---------------------------|----------|
| Height to centroid of Af (z)       | 15.0 ft | Kz =                      | 0.851    |
| Width (zero if round)              | 0.0 ft  | Base pressure (Kd qz) =   | 56.7 psf |
| Diameter (zero if rect)            | 2.0 ft  | $D(qz)^{.5} =$            | 15.08    |
| Percent of open area to gross area | 0.0%    | $I =$                     | 0        |
| Directionality (Kd)                | 0.85    | $C_f =$                   | 0.8      |
|                                    |         | $F = K_d q_z G C_f A_f =$ | 0.0 Af   |
|                                    |         | Solid Area: $A_f =$       | 10.0 sf  |
|                                    |         | $F =$                     | 0 lbs    |
|                                    |         | Design sign as solid sign |          |

C. Walls of Chimneys, Tanks, & Similar Structures

|                              |                                     |                                     |          |
|------------------------------|-------------------------------------|-------------------------------------|----------|
| Height to centroid of Af (z) | 15.0 ft                             | Kz =                                | 0.851    |
| Cross-Section                | Square                              | Base pressure (Kd qz) =             | 60.1 psf |
| Directionality (Kd)          | 0.90                                | h/D =                               | 15.00    |
| Height (h)                   | 15.0 ft                             |                                     |          |
| Width (D)                    | 1.0 ft                              |                                     |          |
| Type of Surface              | N/A                                 |                                     |          |
|                              | <u>Square (wind along diagonal)</u> | <u>Square (wind normal to face)</u> |          |
|                              | $C_f =$ 1.28                        | $C_f =$ 1.67                        |          |
|                              | $F = q_z G C_f A_f =$ 65.2 Af       | $F = K_d q_z G C_f A_f =$ 85.1 Af   |          |
|                              | $A_f =$ 10.0 sf                     | $A_f =$ 10.0 sf                     |          |
|                              | $F =$ 652 lbs                       | $F =$ 851 lbs                       |          |

D. Trussed Towers

|                              |                                           |                                     |          |
|------------------------------|-------------------------------------------|-------------------------------------|----------|
| Height to centroid of Af (z) | 15.0 ft                                   | Kz =                                | 0.851    |
| $e =$                        | 0.27                                      | Base pressure (Kd qz) =             | 56.7 psf |
| Tower Cross Section          | square                                    | Diagonal wind factor =              | 1.2      |
| Member Shape                 | flat                                      | Round member factor =               | 1.000    |
| Directionality (Kd)          | 0.85                                      |                                     |          |
|                              | <u>Square (wind along tower diagonal)</u> | <u>Square (wind normal to face)</u> |          |
|                              | $C_f =$ 3.24                              | $C_f =$ 2.70                        |          |
|                              | $F = K_d q_z G C_f A_f =$ 156.1 Af        | $F = K_d q_z G C_f A_f =$ 130.1 Af  |          |
|                              | Solid Area: $A_f =$ 10.0 sf               | Solid Area: $A_f =$ 10.0 sf         |          |
|                              | $F =$ 1561 lbs                            | $F =$ 1301 lbs                      |          |

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**Wind Loads :**

ASCE 7- 22

Ultimate Wind Speed 175 mph  
Nominal Wind Speed 135.6 mph  
Risk Category II  
Exposure Category C  
Enclosure Classif. Enclosed Building  
Internal pressure +/-0.18  
Bldg Directionality (Kd) 0.85  
Kh MWFRS<=60 0.937  
Kh all other 0.937  
Type of roof Monoslope

**Topographic Factor (Kzt)**

Topography Flat  
Hill Height (H) 0.0 ft  
Half Hill Length (Lh) 0.0 ft  
Actual H/Lh = 0.00  
Use H/Lh = 0.00  
Modified Lh = 0.0 ft  
From top of crest: x = 50.0 ft  
Bldg up/down wind? downwind

$$H/Lh = 0.00 \quad K_1 = 0.000$$

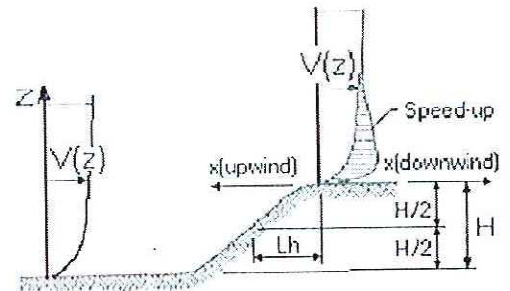
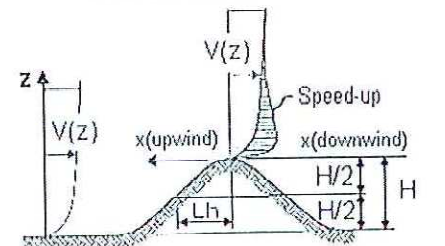
$$x/Lh = 0.00 \quad K_2 = 0.000$$

$$z/Lh = 0.00 \quad K_3 = 1.000$$

At Mean Roof Ht:

$$K_{zt} = (1 + K_1 K_2 K_3)^2 = 1.00$$

H < 15ft; exp C  
∴ Kzt=1.0

**ESCARPMENT****2D RIDGE or 3D AXISYMMETRICAL HILL****Gust Effect Factor**

h = 24.0 ft  
B = 60.0 ft  
/z (0.6h) = 15.0 ft

Flexible structure if natural frequency &lt; 1 Hz (T &gt; 1 second).

If building h/B &gt; 4 then may be flexible and should be investigated.

h/B = 0.40 Rigid structure (low rise bldg)

**G = 0.85** Using rigid structure default**Rigid Structure**

$\bar{e} = 0.20$   
 $\ell = 500$  ft  
 $z_{min} = 15$  ft  
 $c = 0.20$   
 $g_Q, g_v = 3.4$   
 $L_z = 427.1$  ft  
 $Q = 0.90$   
 $I_z = 0.23$   
 $G = 0.87$  use  $G = 0.85$

**Flexible or Dynamically Sensitive Structure**

Natural Frequency ( $\eta_1$ ) = 0.7 Hz  
Damping ratio ( $\beta$ ) = 0.01  
 $\beta/b = 0.660$   
 $\beta/\alpha = 0.156$   
 $V_z = 149.8$   
 $N_1 = 2.00$   
 $R_n = 0.089$   
 $R_h = 0.729$   $\eta = 0.516$  h = 24.0 ft  
 $R_B = 0.497$   $\eta = 1.290$   
 $R_L = 0.118$   $\eta = 7.918$   
 $g_R = 4.104$   
 $R = 1.377$   
 $G_f = 1.394$



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## Ultimate Wind Pressures

Wind Loads - Components & Cladding :  $h \leq 60'$ 

Base pressure ( $q_h$ ) = 66.7 psf  $K_h$  = 0.851 400.0 ft 30.0 ft  
 ( $K_d q_h$ ) = 56.7 psf  $h$  = 12.0 ft 0.2h = 2.4 ft 400.0 ft  
 Minimum parapet ht = 2.0 ft 0.6h = 7.2 ft 400.0 ft  
 Roof Angle ( $\theta$ ) = 0.0 deg  $GC_{pi}$  = +/-0.18  
 Type of roof = Monoslope  $K_d q_i = K_d q_h$  = 56.7 psf

## Roof

| Area               | GCp +/- GCpi |        |        |         | Surface Pressure (psf) |        |        |         |
|--------------------|--------------|--------|--------|---------|------------------------|--------|--------|---------|
|                    | 10 sf        | 100 sf | 500 sf | 1000 sf | 10 sf                  | 100 sf | 500 sf | 1000 sf |
| Negative Zone 1    | -1.88        | -1.47  | -1.18  | -1.18   | -106.6                 | -83.3  | -66.9  | -66.9   |
| Negative Zone 1'   | -1.08        | -1.08  | -0.73  | -0.58   | -61.3                  | -61.3  | -41.4  | -32.9   |
| Negative Zone 2    | -2.46        | -1.95  | -1.58  | -1.58   | 140.7                  | -110.6 | -89.6  | -89.6   |
| Negative Zone 3    | -3.38        | -2.32  | -1.58  | -1.58   | -191.7                 | -131.6 | -89.6  | -89.6   |
| Positive All Zones | 0.48         | 0.38   | 0.38   | 0.38    | 27.2                   | 21.6   | 21.6   | 21.6    |
| Overhang Zone 1&1' | -1.70        | -1.60  | -1.00  | -1.00   | -96.4                  | -90.8  | -56.7  | -56.7   |
| Overhang Zone 2    | -2.30        | -1.59  | -1.10  | -1.10   | -130.5                 | -90.4  | -62.4  | -62.4   |
| Overhang Zone 3    | -3.20        | -1.96  | -1.10  | -1.10   | -181.5                 | -111.4 | -62.4  | -62.4   |

Overhang pressures in the table above assume an internal pressure coefficient ( $GC_{pi}$ ) of 0.0  
 Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 10.2 psf)

| User input |        |
|------------|--------|
| 50 sf      | 200 sf |
| -90.3      | -76.2  |
| -61.3      | -52.7  |
| -119.7     | -101.6 |
| -149.7     | -113.5 |
| 23.3       | 21.6   |
| -92.5      | -76.1  |
| -102.5     | -78.3  |
| -132.5     | -90.3  |

## Parapet

Kd qp = 56.7 psf

| Solid Parapet Pressure | Surface Pressure (psf) |        |        |        |        |        |
|------------------------|------------------------|--------|--------|--------|--------|--------|
|                        | 10 sf                  | 20 sf  | 50 sf  | 100 sf | 200 sf | 500 sf |
| CASE A: Zone 2:        | 181.5                  | 169.7  | 154.2  | 142.4  | 130.7  | 115.1  |
| Zone 3:                | 232.6                  | 211.8  | 184.2  | 163.4  | 142.6  | 115.1  |
| CASE B: Interior zone: | -107.2                 | -101.8 | -94.6  | -89.2  | -83.7  | -76.6  |
| Corner zone:           | -122.5                 | -114.4 | -103.6 | -95.5  | -87.3  | -76.6  |

| User input |  |
|------------|--|
| 50 sf      |  |
| 154.2      |  |
| 184.2      |  |
| -94.6      |  |
| -103.6     |  |

## Walls

wall a = 3.0 ft

| Area                | GCp +/- GCpi |        |        |        | Surface Pressure at h |        |        |        |
|---------------------|--------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                     | 10 sf        | 100 sf | 200 sf | 500 sf | 10 sf                 | 100 sf | 200 sf | 500 sf |
| Negative Zone 4     | -1.17        | -1.01  | -0.96  | -0.90  | -66.4                 | -57.3  | -54.6  | -51.0  |
| Negative Zone 5     | -1.44        | -1.12  | -1.03  | -0.90  | -81.7                 | -63.6  | -58.2  | -51.0  |
| Positive Zone 4 & 5 | 1.08         | 0.92   | 0.87   | 0.81   | 61.3                  | 52.2   | 49.5   | 45.9   |

Note:  $GC_{pi}$  reduced by 10% due to roof angle  $\leq 10$  deg.

| User input |       |
|------------|-------|
| 20 sf      | 50 sf |
| -63.6      | -60.1 |
| -76.3      | -69.1 |
| 58.5       | 55.0  |

35.1  
-38.2  
-45.8

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### Ultimate Wind Pressures

### Wind Loads - Components & Cladding : $h \leq 60'$

Base pressure (qh) = 66.7 psf      Kh = 0.851  
(Kd qh) = 56.7 psf      h = 12.0 ft  
Minimum parapet ht = 2.0 ft      0.6h = 7.2 ft  
Roof Angle (θ) = 0.0 deg      GCpi = +/-0.18  
Type of roof = Monoslope      Kd qi - Kd qh = 56.7 psf

$$0.2h = 2.4 \text{ ft}$$

100.0 ft

30.0 ft

100.0 ft

100.0 ft

#### Roof

| Area                 | GCp +/- GCpi |        |        |         | Surface Pressure (psf) |        |        |         |
|----------------------|--------------|--------|--------|---------|------------------------|--------|--------|---------|
|                      | 10 sf        | 100 sf | 500 sf | 1000 sf | 10 sf                  | 100 sf | 500 sf | 1000 sf |
| Negative Zone 1      | -1.88        | -1.47  | -1.18  | -1.18   | -106.6                 | -83.3  | -66.9  | -66.9   |
| Negative Zone 1'     | -1.08        | -1.08  | -0.73  | -0.58   | -61.3                  | -61.3  | -41.4  | -32.9   |
| Negative Zone 2      | -2.48        | -1.95  | -1.58  | -1.58   | -140.7                 | -110.6 | -89.6  | -89.6   |
| Negative Zone 3      | -3.38        | -2.32  | -1.58  | -1.58   | -191.7                 | -131.6 | -89.6  | -89.6   |
| Positive All Zones   | 0.48         | 0.38   | 0.38   | 0.38    | 27.2                   | 21.6   | 21.6   | 21.6    |
| Overhang Zone 1 & 1' | -1.70        | -1.60  | -1.00  | -1.00   | -96.4                  | -90.8  | -56.7  | -56.7   |
| Overhang Zone 2      | -2.30        | -1.59  | -1.10  | -1.10   | -130.5                 | -90.4  | -62.4  | -62.4   |
| Overhang Zone 3      | -3.20        | -1.96  | -1.10  | -1.10   | -181.5                 | -111.4 | -62.4  | -62.4   |

Overhang pressures in the table above assume an internal pressure coefficient (GCpi) of 0.0  
Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 10.2 psf)

| User input |        |
|------------|--------|
| 50 sf      | 200 sf |
| -90.3      | -76.2  |
| -61.3      | -52.7  |
| -119.7     | -101.6 |
| -149.7     | -113.5 |
| 23.3       | 21.6   |
| -92.5      | -76.1  |
| -102.5     | -78.3  |
| -132.5     | -90.3  |

#### Parapet

Kd qp = 56.7 psf

| Solid Parapet Pressure  | Surface Pressure (psf) |        |        |        |        |        |
|-------------------------|------------------------|--------|--------|--------|--------|--------|
|                         | 10 sf                  | 20 sf  | 50 sf  | 100 sf | 200 sf | 500 sf |
| CASE A: Zone 2 :        | 181.5                  | 169.7  | 154.2  | 142.4  | 130.7  | 115.1  |
| Zone 3 :                | 232.6                  | 211.8  | 184.2  | 163.4  | 142.6  | 115.1  |
| CASE B: Interior zone : | -107.2                 | -101.8 | -94.6  | -89.2  | -83.7  | -76.6  |
| Corner zone :           | -122.5                 | -114.4 | -103.6 | -95.5  | -87.3  | -76.6  |

| User input |  |
|------------|--|
| 50 sf      |  |
| 154.2      |  |
| 184.2      |  |
| -94.6      |  |
| -103.6     |  |

wall a = 3.0 ft

#### Walls

| Area                | GCp +/- GCpi |        |        |        | Surface Pressure at h |        |        |        |
|---------------------|--------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                     | 10 sf        | 100 sf | 200 sf | 500 sf | 10 sf                 | 100 sf | 200 sf | 500 sf |
| Negative Zone 4     | -1.17        | -1.01  | -0.96  | -0.90  | -66.4                 | -57.3  | -54.6  | -51.0  |
| Negative Zone 5     | -1.44        | -1.12  | -1.03  | -0.90  | -81.7                 | -63.6  | -58.2  | -51.0  |
| Positive Zone 4 & 5 | 1.08         | 0.92   | 0.87   | 0.81   | 61.3                  | 52.2   | 49.5   | 45.9   |

Note: GCp reduced by 10% due to roof angle <= 10 deg.

| User input |       |
|------------|-------|
| 20 sf      | 50 sf |
| -63.6      | -60.1 |
| -76.3      | -69.1 |
| 58.5       | 55.0  |

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DATE

**Ultimate Wind Pressures**
**Wind Loads - Components & Cladding :  $h \leq 60'$** 

Base pressure ( $q_h$ ) = 73.4 psf  $K_h = 0.937$   
( $K_d q_h$ ) = **62.4 psf**  $h = 24.0$  ft  $0.2h = 4.8$  ft  
Minimum parapet ht = 2.0 ft  $0.6h = 14.4$  ft  
Roof Angle ( $\theta$ ) = 0.0 deg  $GC_{pi} = +/-0.18$   
Type of roof = Monoslope  $K_d q_i = K_d q_h = 62.4$  psf

100.0 ft  
100.0 ft  
100.0 ft

30.0 ft

**Roof**

| Area               | GCp +/- GCpi |        |        |         | Surface Pressure (psf) |        |        |         |
|--------------------|--------------|--------|--------|---------|------------------------|--------|--------|---------|
|                    | 10 sf        | 100 sf | 500 sf | 1000 sf | 10 sf                  | 100 sf | 500 sf | 1000 sf |
| Negative Zone 1    | -1.88        | -1.47  | -1.18  | -1.18   | -117.4                 | -91.6  | -73.7  | -73.7   |
| Negative Zone 1'   | -1.08        | -1.08  | -0.73  | -0.58   | -67.4                  | -67.4  | -45.6  | -36.2   |
| Negative Zone 2    | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Negative Zone 3    | -3.38        | -2.32  | -1.58  | -1.58   | -211.0                 | -144.9 | -98.6  | -98.6   |
| Positive All Zones | 0.48         | 0.38   | 0.38   | 0.38    | 30.0                   | 23.7   | 23.7   | 23.7    |
| Overhang Zone 1&1' | -1.70        | -1.60  | -1.00  | -1.00   | -106.1                 | -99.9  | -62.4  | -62.4   |
| Overhang Zone 2    | -2.30        | -1.59  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |
| Overhang Zone 3    | -3.20        | -1.96  | -1.10  | -1.10   | -199.8                 | -122.6 | -68.7  | -68.7   |

Overhang pressures in the table above assume an internal pressure coefficient ( $GC_{pi}$ ) of 0.0  
Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 11.2 psf)

| User input |        |
|------------|--------|
| 50 sf      | 200 sf |
| -99.4      | -83.9  |
| -67.4      | -58.0  |
| -131.7     | -111.8 |
| -164.8     | -125.0 |
| 25.6       | 23.7   |
| -101.8     | -83.8  |
| -112.8     | -86.2  |
| -145.8     | -99.4  |

**Parapet**

$K_d q_p = 63.9$  psf

| Solid Parapet Pressure | Surface Pressure (psf) |        |        |        |        |        |
|------------------------|------------------------|--------|--------|--------|--------|--------|
|                        | 10 sf                  | 20 sf  | 50 sf  | 100 sf | 200 sf | 500 sf |
| CASE A: Zone 2:        | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
| Zone 3:                | 262.2                  | 238.7  | 207.7  | 184.3  | 160.8  | 129.8  |
| CASE B: Interior zone: | -120.9                 | -114.7 | -106.7 | -100.5 | -94.4  | -86.3  |
| Corner zone:           | -138.1                 | -129.0 | -116.8 | -107.6 | -98.5  | -86.3  |

| User input |  |
|------------|--|
| 50 sf      |  |
| 173.9      |  |
| 207.7      |  |
| -106.7     |  |
| -116.8     |  |

wall  $a = 6.0$  ft

**Walls**

| Area                | GCp +/- GCpi |        |        |        | Surface Pressure at h |        |        |        |
|---------------------|--------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                     | 10 sf        | 100 sf | 200 sf | 500 sf | 10 sf                 | 100 sf | 200 sf | 500 sf |
| Negative Zone 4     | -1.17        | -1.01  | -0.96  | -0.90  | -73.0                 | -63.1  | -60.1  | -56.2  |
| Negative Zone 5     | -1.44        | -1.12  | -1.03  | -0.90  | -89.9                 | -70.1  | -64.1  | -56.2  |
| Positive Zone 4 & 5 | 1.08         | 0.92   | 0.87   | 0.81   | 67.4                  | 57.5   | 54.5   | 50.6   |

Note:  $GC_{pi}$  reduced by 10% due to roof angle  $\leq 10$  deg.

| User input |       |
|------------|-------|
| 20 sf      | 50 sf |
| -70.1      | -66.1 |
| -83.9      | -76.0 |
| 64.4       | 60.5  |



**Company**

Address  
City, State  
Phone

JOB TITLE CASA PA FERNANDZ

JOB NO.  
CALCULATED BY FEH  
CHECKED BY FEH

SHEET NO.  
DATE  
DATE

**Ultimate Wind Pressures**
**Wind Loads - Components & Cladding :  $h \leq 60'$** 

Base pressure ( $q_h$ ) = 73.4 psf       $K_h$  = 0.937      100.0 ft      30.0 ft  
( $K_d q_h$ ) = 62.4 psf       $h$  = 24.0 ft       $0.2h = 4.8$  ft      100.0 ft  
Minimum parapet ht = 2.0 ft       $0.6h$  = 14.4 ft      100.0 ft  
Roof Angle ( $\theta$ ) = 0.0 deg       $G C_{pi}$  = +/- 0.18  
Type of roof = Monoslope       $K_d q_i = K_d q_h$  = 62.4 psf

**Roof**

| Area               | GCp +/- GCpi |        |        |         | Surface Pressure (psf) |        |        |         |
|--------------------|--------------|--------|--------|---------|------------------------|--------|--------|---------|
|                    | 10 sf        | 100 sf | 500 sf | 1000 sf | 10 sf                  | 100 sf | 500 sf | 1000 sf |
| Negative Zone 1    | -1.88        | -1.47  | -1.18  | -1.18   | -117.4                 | -91.6  | -73.7  | -73.7   |
| Negative Zone 1'   | -1.08        | -1.08  | -0.73  | -0.58   | -67.4                  | -67.4  | -45.6  | -36.2   |
| Negative Zone 2    | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Negative Zone 3    | -3.38        | -2.32  | -1.58  | -1.58   | -211.0                 | -144.9 | -98.6  | -98.6   |
| Positive All Zones | 0.48         | 0.38   | 0.38   | 0.38    | 30.0                   | 23.7   | 23.7   | 23.7    |
| Overhang Zone 1&1' | -1.70        | -1.60  | -1.00  | -1.00   | -106.1                 | -99.9  | -62.4  | -62.4   |
| Overhang Zone 2    | -2.30        | -1.59  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |
| Overhang Zone 3    | -3.20        | -1.96  | -1.10  | -1.10   | -199.8                 | -122.6 | -68.7  | -68.7   |

**User**

| 50 sf  |
|--------|
| -99.4  |
| -67.4  |
| -131.7 |
| -164.8 |
| 25.6   |
| -101.8 |
| -112.8 |
| -145.8 |

Overhang pressures in the table above assume an internal pressure coefficient ( $G C_{pi}$ ) of 0.0  
Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 11.2 psf)

**Parapet**

$K_d q_p$  = 63.9 psf

|                         |               | Surface Pressure (psf) |        |        |        |        |        |
|-------------------------|---------------|------------------------|--------|--------|--------|--------|--------|
|                         |               | 10 sf                  | 20 sf  | 50 sf  | 100 sf | 200 sf | 500 sf |
| Solid Parapet Pressure  |               |                        |        |        |        |        |        |
| CASE A:                 | Zone 2 :      | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
|                         | Zone 3 :      | 262.2                  | 238.7  | 207.7  | 184.3  | 160.8  | 129.8  |
| CASE B: Interior zone : |               | -120.9                 | -114.7 | -106.7 | -100.5 | -94.4  | -86.3  |
|                         | Corner zone : | -138.1                 | -129.0 | -116.8 | -107.6 | -98.5  | -86.3  |

wall  $a$  = 6.0 ft

**Walls**

| Area                | GCp +/- GCpi |        |        |        | Surface Pressure at h |        |        |        |
|---------------------|--------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                     | 10 sf        | 100 sf | 200 sf | 500 sf | 10 sf                 | 100 sf | 200 sf | 500 sf |
| Negative Zone 4     | -1.17        | -1.01  | -0.96  | -0.90  | -73.0                 | -63.1  | -60.1  | -56.2  |
| Negative Zone 5     | -1.44        | -1.12  | -1.03  | -0.90  | -89.9                 | -70.1  | -64.1  | -56.2  |
| Positive Zone 4 & 5 | 1.08         | 0.92   | 0.87   | 0.81   | 67.4                  | 57.5   | 54.5   | 50.6   |

Note:  $G C_p$  reduced by 10% due to roof angle  $\leq 10$  deg.

| Use   |
|-------|
| 30 sf |
| -68.3 |
| -80.4 |
| 62.7  |

+ 37.1  
25 = 48.  
24 = 41

**Company**

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JOB TITLE CASA PA FERNANDZ

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SHEET NO.  
DATE  
DATE

**Ultimate Wind Pressures**
**Wind Loads - Components & Cladding :  $h \leq 60'$** 

Base pressure (qh) = 73.4 psf      Kh = 0.937      100.0-ft      30.0-ft  
(Kd qh) = 62.4 psf      h = 24.0 ft      0.2h = 4.8 ft      100.0 ft  
Minimum parapet ht = 2.0 ft      0.6h = 14.4 ft      100.0 ft  
Roof Angle ( $\theta$ ) = 0.0 deg      GCpi = +/-0.18  
Type of roof = Monoslope      Kd qi = Kd qh = 62.4 psf

**Roof**

| Area               | GCp +/- GCpi |        |        |         | Surface Pressure (psf) |        |        |         |
|--------------------|--------------|--------|--------|---------|------------------------|--------|--------|---------|
|                    | 10 sf        | 100 sf | 500 sf | 1000 sf | 10 sf                  | 100 sf | 500 sf | 1000 sf |
| Negative Zone 1    | -1.88        | -1.47  | -1.18  | -1.18   | -117.4                 | -91.6  | -73.7  | -73.7   |
| Negative Zone 1'   | -1.08        | -1.08  | -0.73  | -0.58   | -67.4                  | -67.4  | -45.6  | -36.2   |
| Negative Zone 2    | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Negative Zone 3    | -3.38        | -2.32  | -1.58  | -1.58   | -211.0                 | -144.9 | -98.6  | -98.6   |
| Positive All Zones | 0.48         | 0.38   | 0.38   | 0.38    | 30.0                   | 23.7   | 23.7   | 23.7    |
| Overhang Zone 1&1' | -1.70        | -1.60  | -1.00  | -1.00   | -106.1                 | -99.9  | -62.4  | -62.4   |
| Overhang Zone 2    | -2.30        | -1.59  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |
| Overhang Zone 3    | -3.20        | -1.96  | -1.10  | -1.10   | -199.8                 | -122.6 | -68.7  | -68.7   |

Overhang pressures in the table above assume an internal pressure coefficient (GCpi) of 0.0  
Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 11.2 psf)

| User input |        |
|------------|--------|
| 50 sf      | 200 sf |
| -99.4      | -83.9  |
| -67.4      | -58.0  |
| -131.7     | -111.8 |
| -164.8     | -125.0 |
| 25.6       | 23.7   |
| -101.8     | -83.8  |
| -112.8     | -86.2  |
| -145.8     | -99.4  |

**Parapet**

Kd qp = 63.9 psf

|                         |          | Surface Pressure (psf) |        |        |        |        |        |
|-------------------------|----------|------------------------|--------|--------|--------|--------|--------|
| Solid Parapet Pressure  |          | 10 sf                  | 20 sf  | 50 sf  | 100 sf | 200 sf | 500 sf |
| CASE A:                 | Zone 2 : | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
|                         | Zone 3 : | 262.2                  | 238.7  | 207.7  | 184.3  | 160.8  | 129.8  |
| CASE B: Interior zone : |          | -120.9                 | -114.7 | -106.7 | -100.5 | -94.4  | -86.3  |
| Corner zone :           |          | -138.1                 | -129.0 | -116.8 | -107.6 | -98.5  | -86.3  |

| User input |  |
|------------|--|
| 50 sf      |  |
| 173.9      |  |
| 207.7      |  |
| -106.7     |  |
| -116.8     |  |

wall a = 6.0 ft

**Walls**

| Area                | GCp +/- GCpi |        |        |        | Surface Pressure at h |        |        |        |
|---------------------|--------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                     | 10 sf        | 100 sf | 200 sf | 500 sf | 10 sf                 | 100 sf | 200 sf | 500 sf |
| Negative Zone 4     | -1.17        | -1.01  | -0.96  | -0.90  | -73.0                 | -63.1  | -60.1  | -56.2  |
| Negative Zone 5     | -1.44        | -1.12  | -1.03  | -0.90  | -89.9                 | -70.1  | -64.1  | -56.2  |
| Positive Zone 4 & 5 | 1.08         | 0.92   | 0.87   | 0.81   | 67.4                  | 57.5   | 54.5   | 50.6   |

Note: GCp reduced by 10% due to roof angle  $\leq 10$  deg.

| User input |       |
|------------|-------|
| 20 sf      | 50 sf |
| -70.1      | -66.1 |
| -83.9      | -76.0 |
| 64.4       | 60.5  |

**Company**

Address  
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JOB TITLE CASA PA FERNANDZ

JOB NO.  
CALCULATED BY FEH  
CHECKED BY FEH

SHEET NO.

DATE

DATE

**Ultimate Wind Pressures**

**Wind Loads - Components & Cladding :  $h \leq 60'$**

Base pressure ( $q_h$ ) = 73.4 psf

$K_h$  = 0.937

400.0 ft

30.0 ft

( $K_d q_h$ ) = 62.4 psf

$h$  = 24.0 ft

0.2h = 4.8 ft

100.0 ft

Minimum parapet ht = 3.0 ft

0.6h = 14.4 ft

100.0 ft

Roof Angle ( $\theta$ ) = 1.2 deg

$G C_{pi}$  =  $\pm 0.18$

Type of roof = Monoslope

$K_d q_i = K_d q_h$  = 62.4 psf

92.88 92.88

**Roof**

| Area                 | GCP +/- GCpi |        |        |         | Surface Pressure (psf) |        |        |         |
|----------------------|--------------|--------|--------|---------|------------------------|--------|--------|---------|
|                      | 10 sf        | 100 sf | 500 sf | 1000 sf | 10 sf                  | 100 sf | 500 sf | 1000 sf |
| Negative Zone 1      | -1.88        | -1.47  | -1.18  | -1.18   | -117.4                 | -91.6  | -73.7  | -73.7   |
| Negative Zone 1'     | -1.08        | -1.08  | -0.73  | -0.58   | -67.4                  | -67.4  | -45.6  | -36.2   |
| Negative Zone 2      | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Negative Zone 3      | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Positive Zone 1 & 1' | 0.48         | 0.38   | 0.38   | 0.38    | 30.0                   | 23.7   | 23.7   | 23.7    |
| Positive Zones 2 & 3 | 1.08         | 0.92   | 0.81   | 0.81    | 67.4                   | 57.5   | 50.6   | 50.6    |
| Overhang Zone 1 & 1' | -1.70        | -1.60  | -1.00  | -1.00   | -106.1                 | -99.9  | -62.4  | -62.4   |
| Overhang Zone 2      | -2.30        | -1.59  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |
| Overhang Zone 3      | -2.30        | -1.59  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |

Negative zone 3 = zone 2, since parapet  $\geq$  3ft.

Overhang pressures in the table above assume an internal pressure coefficient ( $G C_{pi}$ ) of 0.0

Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 11.2 psf)

| User input |        |
|------------|--------|
| 50 sf      | 200 sf |
| -99.4      | -83.9  |
| -67.4      | -58.0  |
| -131.7     | -111.8 |
| -131.7     | -111.8 |
| 25.6       | 23.7   |
| 60.5       | 54.5   |
| -101.8     | -83.8  |
| -112.8     | -86.2  |
| -112.8     | -86.2  |

**Parapet**

$K_d q_p$  = 63.9 psf

| Solid Parapet Pressure | Surface Pressure (psf) |        |        |        |        |        |
|------------------------|------------------------|--------|--------|--------|--------|--------|
|                        | 10 sf                  | 20 sf  | 50 sf  | 100 sf | 200 sf | 500 sf |
| CASE A: Zone 2:        | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
| Zone 3:                | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
| CASE B: Interior zone: | -120.9                 | -114.7 | -106.7 | -100.5 | -94.4  | -86.3  |
| Corner zone:           | -138.1                 | -129.0 | -116.8 | -107.6 | -98.5  | -86.3  |

123 115 psf

| User input |  |
|------------|--|
| 50 sf      |  |
| 173.9      |  |
| 173.9      |  |
| -106.7     |  |
| -116.8     |  |

**Walls**

wall a = 6.0 ft

| Area                | GCP +/- GCpi |        |        |        | Surface Pressure at h |        |        |        |
|---------------------|--------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                     | 10 sf        | 100 sf | 200 sf | 500 sf | 10 sf                 | 100 sf | 200 sf | 500 sf |
| Negative Zone 4     | -1.17        | -1.01  | -0.96  | -0.90  | -73.0                 | -63.1  | -60.1  | -56.2  |
| Negative Zone 5     | -1.44        | -1.12  | -1.03  | -0.90  | -89.9                 | -70.1  | -64.1  | -56.2  |
| Positive Zone 4 & 5 | 1.08         | 0.92   | 0.87   | 0.81   | 67.4                  | 57.5   | 54.5   | 50.6   |

Note:  $G C_{pi}$  reduced by 10% due to roof angle  $\leq$  10 deg.

| User input |       |
|------------|-------|
| 20 sf      | 50 sf |
| -70.1      | -68.1 |
| -83.9      | -76.0 |
| 64.4       | 60.5  |

$0.6h$   
 $0.6 \times 12$   
 $7.2$   
 $0.2h$   
 $0.2 \times 12 = 2.4$   
 $3.0$

$40.4$   
 $25$   
 $24$   
 $-53.9$   
 $-43.8$

$12$   
 $50.3$   
 $38$   
 $-70.1$   
 $-83.9$   
 $64.4$   
 $-68.1$   
 $-76.0$   
 $60.5$   
 $29.6$   
 $45.6$   
 $36.3$



Company

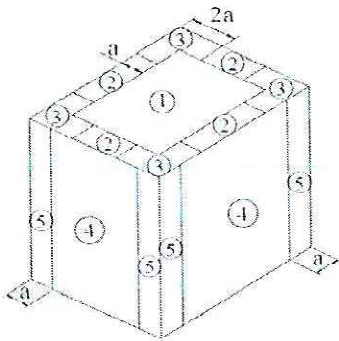
Address  
City, State  
Phone

JOB TITLE CASA PA FERNANDZ

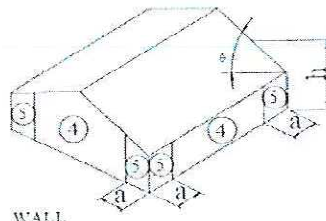
JOB NO.  
CALCULATED BY FEH  
CHECKED BY FEH

SHEET NO.  
DATE  
DATE

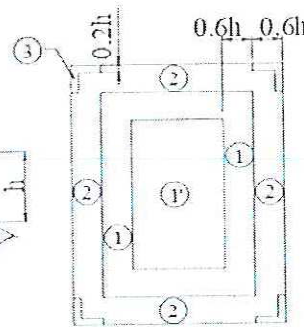
# Location of C&C Wind Pressure Zones - ASCE 7-22



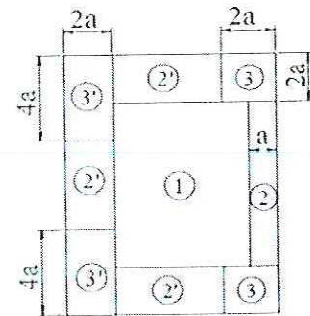
Roofs w/  $0 \leq \theta \leq 10^\circ$   
and all walls  
 $h > 60'$



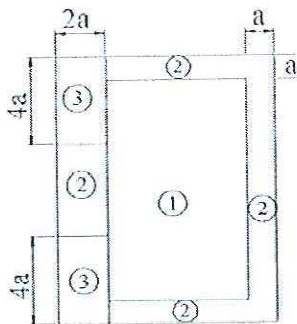
Walls  $h \leq 60'$   
& alt design  $h < 90'$



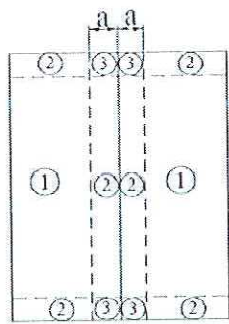
Multispan Gable & Sawtooth  $\leq 10^\circ$   
& Gable  $\theta \leq 7$  degrees &  
Monoslope  $\leq 3$  degrees  
 $h \leq 60'$  & alt design  $h < 90'$



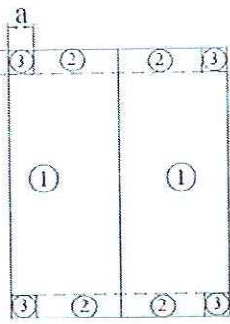
Monoslope roofs  
 $3^\circ < \theta \leq 10^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



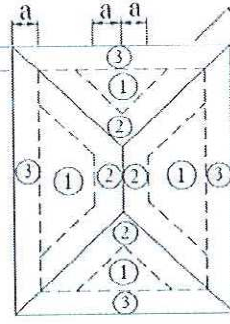
Monoslope roofs  
 $10^\circ < \theta \leq 30^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



Gable  $7^\circ < \theta \leq 27^\circ$



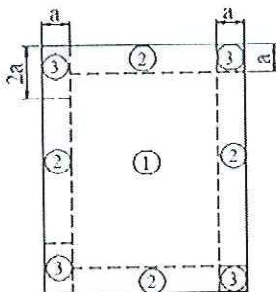
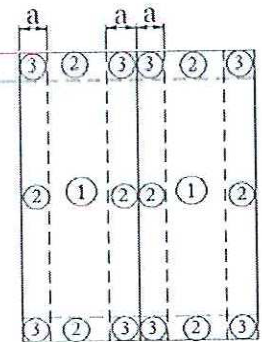
Gable  $27^\circ < \theta \leq 45^\circ$



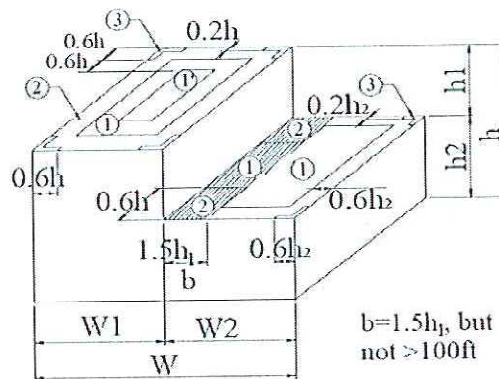
Hip  $7^\circ < \theta \leq 45^\circ$



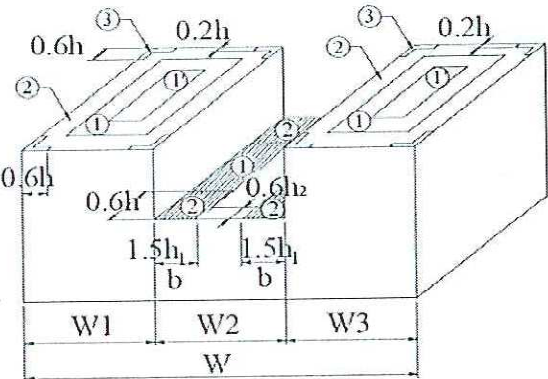
Multispan gable  $10^\circ < \theta \leq 45^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



Sawtooth  $10^\circ < \theta \leq 45^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



Stepped roofs  $\theta \leq 3^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



Note: The hatched area indicates where roof positive pressures are equal to the adjacent wall positive pressure.

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CHECKED BY FEH

SHEET NO.  
DATE  
DATE

**Ultimate Wind Pressures**
**Wind Loads - Components & Cladding :  $h \leq 60'$** 

Base pressure ( $q_h$ ) = 73.4 psf       $K_h$  = 0.937      100.0 ft      30.0 ft  
( $K_d q_h$ ) = 62.4 psf       $h$  = 24.0 ft      0.2h = 4.8 ft      100.0 ft  
Minimum parapet ht = 3.0 ft      0.6h = 14.4 ft      100.0 ft  
Roof Angle ( $\theta$ ) = 1.2 deg       $G C_{pi}$  = +/-0.18  
Type of roof = Monoslope       $K_d q_i = K_d q_h$  = 62.4 psf

**Roof**

| Area                 | GCp +/- GCpi |        |        |         | Surface Pressure (psf) |        |        |         |
|----------------------|--------------|--------|--------|---------|------------------------|--------|--------|---------|
|                      | 10 sf        | 100 sf | 500 sf | 1000 sf | 10 sf                  | 100 sf | 500 sf | 1000 sf |
| Negative Zone 1      | -1.88        | -1.47  | -1.18  | -1.18   | -117.4                 | -91.6  | -73.7  | -73.7   |
| Negative Zone 1'     | -1.08        | -1.08  | -0.73  | -0.58   | -67.4                  | -67.4  | -45.6  | -36.2   |
| Negative Zone 2      | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Negative Zone 3      | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Positive Zone 1 & 1' | 0.48         | 0.38   | 0.38   | 0.38    | 30.0                   | 23.7   | 23.7   | 23.7    |
| Positive Zones 2 & 3 | 1.08         | 0.92   | 0.81   | 0.81    | 67.4                   | 57.5   | 50.6   | 50.6    |
| Overhang Zone 1 & 1' | -1.70        | -1.60  | -1.00  | -1.00   | -106.1                 | -99.9  | -62.4  | -62.4   |
| Overhang Zone 2      | -2.30        | -1.59  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |
| Overhang Zone 3      | -2.30        | -1.59  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |

Negative zone 3 = zone 2, since parapet  $\geq 3$  ft.

Overhang pressures in the table above assume an internal pressure coefficient ( $G_{ci}$ ) of 0.0

Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 11.2 psf)

| User input |        |
|------------|--------|
| 50 sf      | 200 sf |
| -99.4      | -83.9  |
| -67.4      | -58.0  |
| -131.7     | -111.8 |
| -131.7     | -111.8 |
| 25.6       | 23.7   |
| 60.5       | 54.5   |
| -101.8     | -83.8  |
| -112.8     | -86.2  |
| -112.8     | -86.2  |

**Parapet**

$K_d q_p$  = 63.9 psf

| Solid Parapet Pressure  | Surface Pressure (psf) |        |        |        |        |        |
|-------------------------|------------------------|--------|--------|--------|--------|--------|
|                         | 10 sf                  | 20 sf  | 50 sf  | 100 sf | 200 sf | 500 sf |
| CASE A: Zone 2 :        | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
| Zone 3 :                | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
| CASE B: Interior zone : | -120.9                 | -114.7 | -106.7 | -100.5 | -94.4  | -86.3  |
| Corner zone :           | -138.1                 | -129.0 | -116.8 | -107.6 | -98.5  | -86.3  |

| User Input |  |
|------------|--|
| 50 sf      |  |
| 173.9      |  |
| 173.9      |  |
| -106.7     |  |
| -116.8     |  |

wall  $a$  = 6.0 ft

**Walls**

| Area                | GCp +/- GCpi |        |        |        | Surface Pressure at h |        |        |        |
|---------------------|--------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                     | 10 sf        | 100 sf | 200 sf | 500 sf | 10 sf                 | 100 sf | 200 sf | 500 sf |
| Negative Zone 4     | -1.17        | -1.01  | -0.98  | -0.90  | -73.0                 | -63.1  | -60.1  | -56.2  |
| Negative Zone 5     | -1.44        | -1.12  | -1.03  | -0.90  | -89.9                 | -70.1  | -64.1  | -56.2  |
| Positive Zone 4 & 5 | 1.08         | 0.92   | 0.87   | 0.81   | 67.4                  | 57.5   | 54.5   | 50.6   |

Note:  $G C_p$  reduced by 10% due to roof angle  $\leq 10$  deg.

| User input |       |
|------------|-------|
| 20 sf      | 50 sf |
| -70.1      | -66.1 |
| -83.9      | -76.0 |
| 64.4       | 60.5  |

**Company**

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JOB TITLE CASA PA FERNANDZ

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**Ground Elevation Factor (Ke)**

Grd level above sea level = 0 ft  
 Constant = 0.00256  
 $0.00256K_e = 0.00256$

Ke = 1.0000

**Enclosure Classification****Test for Enclosed Building:**  $A_o < 0.01A_g$  or 4 sf, whichever is smaller**Test for Open Building:** All walls are at least 80% open.  
 $A_o \geq 0.8A_g$ **Test for Partially Enclosed Building:** Predominately open on one side only

| Input |            | Test                           |     |
|-------|------------|--------------------------------|-----|
| Ao    | 500.0 sf   | $A_o \geq 1.1A_{oi}$           | NO  |
| Ag    | 600.0 sf   | $A_o > 4\text{sf or } 0.01A_g$ | YES |
| Aoi   | 1000.0 sf  | $A_{oi} / A_{gi} \leq 0.20$    | YES |
| Agi   | 10000.0 sf |                                |     |

Building is NOT  
Partially Enclosed

Conditions to qualify as Partially Enclosed Building. Must satisfy all of the following:

 $A_o \geq 1.1A_{oi}$  $A_o > \text{smaller of } 4\text{sf or } 0.01 A_g$  $A_{oi} / A_{gi} \leq 0.20$ 

Where:

Ao = the total area of openings in a wall that receives positive external pressure.

Ag = the gross area of that wall in which Ao is identified.

Aoi = the sum of the areas of openings in the building envelope (walls and roof) not including Ao.

Agi = the sum of the gross surface areas of the building envelope (walls and roof) not including Ag.

**Test for Partially Open Building:** A building that does not qualify as open, enclosed or partially enclosed.  
(This type building will have same wind pressures as an enclosed building.)**Reduction Factor for large volume partially enclosed buildings (Ri) :**

If the partially enclosed building contains a single room that is unpartitioned, the internal pressure coefficient may be multiplied by the reduction factor Ri.

Total area of all wall &amp; roof openings (Aog):

- SF

Unpartitioned internal volume (Vi) :

- CF

Ri = 1.00



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Wind Loads - MWFRS all h (Except for Open Buildings)

Base pressure ( $q_h$ ) = 73.4 psf  
( $K_d q_h$ ) = 62.4 psf  
Roof Angle ( $\theta$ ) = 0.0 deg  
Roof tributary area:  
Wind normal to ridge  $= (h/2) \cdot L$ : 1320 sf  
Wind parallel to ridge  $= (h/2) \cdot L$ : 720 sf

$K_h$  = 0.937  
Bldg dim parallel to ridge = 110.0 ft  
Bldg dim normal to ridge = 60.0 ft  
 $h$  = 24.0 ft  
ridge ht = 24.0 ft

$GC_{pi}$  = +/-0.18  
 $G$  = 0.85  
 $q_i = q_h$

Ultimate Wind Surface Pressures (psf)

| Surface                      | Wind Normal to Ridge |       |                 |           | Wind Parallel to Ridge |                           |            |                 |           |
|------------------------------|----------------------|-------|-----------------|-----------|------------------------|---------------------------|------------|-----------------|-----------|
|                              | L/B = 0.55           |       | h/L = 0.40      |           | L/B = 1.83             |                           | h/L = 0.22 |                 |           |
|                              | Cp                   | qhGCp | w/+qhGCpi       | w/-qhGCpi | Dist.*                 | Cp                        | qhGCp      | w/+qhGCpi       | w/-qhGCpi |
| Windward Wall (WW)           | 0.80                 | 42.5  | see table below |           |                        | 0.80                      | 42.5       | see table below |           |
| Leeward Wall (LW)            | -0.50                | -26.5 | -37.8           | -15.3     |                        | -0.33                     | -11.7      | -28.9           | -6.5      |
| Side Wall (SW)               | -0.70                | -37.1 | -48.4           | -25.9     |                        | -0.70                     | -37.1      | -48.4           | -25.9     |
| Leeward Roof (LR)            | **                   |       |                 |           |                        | Included in windward roof |            |                 |           |
| Neg Windward Roof: 0 to h/2* | -0.90                | -47.8 | -59.0           | -36.5     | 0 to h/2*              | -0.90                     | -47.8      | -59.0           | -36.5     |
| h/2 to h*                    | -0.90                | -47.8 | -59.0           | -36.5     | h/2 to h*              | -0.90                     | -47.8      | -59.0           | -36.5     |
| h to 2h*                     | -0.50                | -26.5 | -37.8           | -15.3     | h to 2h*               | -0.50                     | -26.5      | -37.8           | -15.3     |
| > 2h*                        | -0.30                | -15.9 | -27.2           | -4.7      | > 2h*                  | -0.30                     | -15.9      | -27.2           | -4.7      |
| Pos/min windward roof press. | -0.18                | -9.6  | -20.8           | 1.7       | Min press.             | -0.18                     | -9.6       | -20.8           | 1.7       |

\*Horizontal distance from windward edge

\*\*Roof angle < 10 degrees. Therefore, leeward roof is included in windward roof pressure zones.

For monoslope roofs, entire roof surface is either windward or leeward surface.

Windward roof overhangs : 42.5 psf (upward : add to  $q_h GC_p$  windward roof pressure)

Parapet

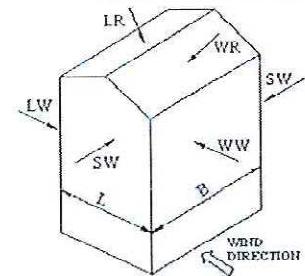
| z       | $K_z$ | $K_{zt}$ | $K_{dqp}$ (psf) |
|---------|-------|----------|-----------------|
| 27.0 ft | 0.960 | 1.00     | 63.9            |

Windward parapet: 95.9 psf ( $GC_{pn} = +1.5$ )

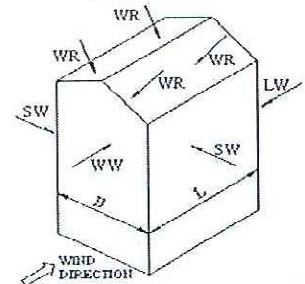
Leeward parapet: -63.9 psf ( $GC_{pn} = -1.0$ )

Windward Wall Pressures at "z" (psf)

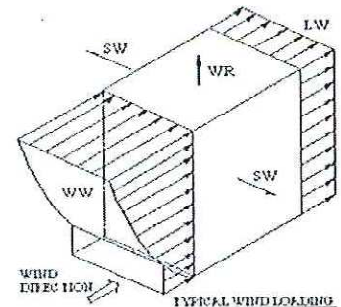
| z           | $K_z$ | $K_{zt}$ | Windward Wall |                  |                  | Combined WW + LW     |                        |
|-------------|-------|----------|---------------|------------------|------------------|----------------------|------------------------|
|             |       |          | $q_h GC_p$    | $w/+q_h GC_{pi}$ | $w/-q_h GC_{pi}$ | Wind Normal to Ridge | Wind Parallel to Ridge |
| 0 to 15'    | 0.85  | 1.00     | 38.6          | 27.3             | 49.8             | 65.1                 | 56.3                   |
| 20.0 ft     | 0.90  | 1.00     | 40.9          | 29.7             | 52.1             | 67.4                 | 58.6                   |
| h = 24.0 ft | 0.94  | 1.00     | 42.5          | 31.2             | 53.7             | 69.0                 | 60.1                   |



WIND NORMAL TO RIDGE



WIND PARALLEL TO RIDGE



TYPICAL WIND LOADING

**Company**

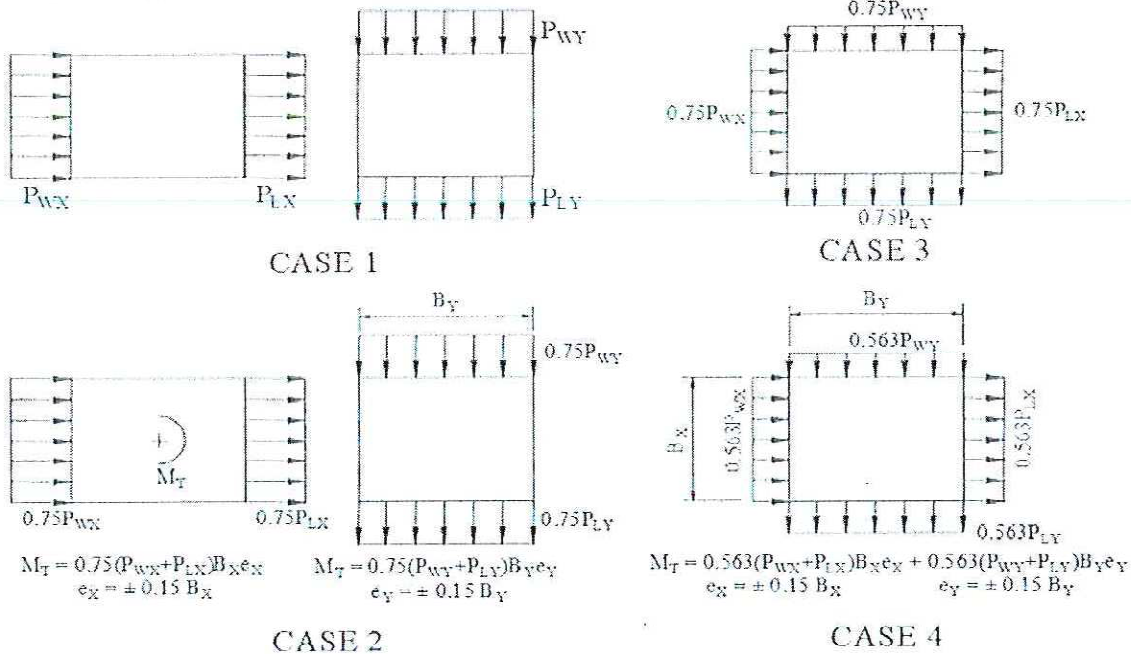
Address  
City, State  
Phone

JOB TITLE CASA PA FERNANDZ

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DATE \_\_\_\_\_

NOTE: ASCE 7 requires the application of full and partial loading of the wind pressures per the 4 cases below


**Wind Forces at Floors**

Total Floors above grade = 2  
T/Fdn (dist below grade) = 2.0 ft

Building dimension (parallel with ridge) = 110.0 ft  
Building dimension (normal to ridge) = 60.0 ft  
L is the building dimension parallel to the wind direction

e = 16.50 ft  
e = 9.00 ft

| Level      | Elevation Above Grade (ft) | Height of Centroid to Fdn (ft) | Wind Normal to Ridge              |       |           |                   |                 | Wind Parallel to Ridge  |         |                   |                 |                         |
|------------|----------------------------|--------------------------------|-----------------------------------|-------|-----------|-------------------|-----------------|-------------------------|---------|-------------------|-----------------|-------------------------|
|            |                            |                                | L                                 | B     | Area (sf) | Applied Force (k) | Story Shear (k) | Overturning Moment ('k) | Area    | Applied Force (k) | Story Shear (k) | Overturning Moment ('k) |
| Equip, etc | 66.00                      | 68.00                          | wind on equip, screenwalls, etc = |       |           |                   | 2               |                         |         | 0                 |                 |                         |
| Parapet    | 27.00                      | 0.00                           |                                   |       |           | 0.0               |                 |                         |         | 0.0               |                 |                         |
| T/Ridge    | 67.20                      | 66.60                          | 60.0                              | 110.0 | 572.0     | 0.0               |                 |                         | 156.0   | 10.9              |                 |                         |
| Roof       | 62.00                      | 64.00                          | 60.0                              | 110.0 | 1,210.0   | 94.5              | 96.5            | 8.0                     | 660.0   | 45.7              | 56.6            | 28.4 Roof               |
| 2          | 40.00                      | 42.00                          | 60.0                              | 110.0 | 2,310.0   | 170.1             | 266.6           | 2,129.9                 | 1,260.0 | 81.7              | 138.3           | 1,273.9 2               |
| 1          | 20.00                      | 22.00                          | 60.0                              | 110.0 | 2,200.0   | 148.4             | 414.9           | 7,461.6                 | 1,200.0 | 70.3              | 208.6           | 4,039.3 1               |
| GRD        |                            | 2.00                           |                                   |       |           |                   |                 | 15,760.5                |         |                   |                 | 8,210.8 GRD             |
| FDN        |                            | 0.00                           |                                   |       |           |                   |                 | 16,590.4                |         |                   |                 | 8,628.0 FDN             |

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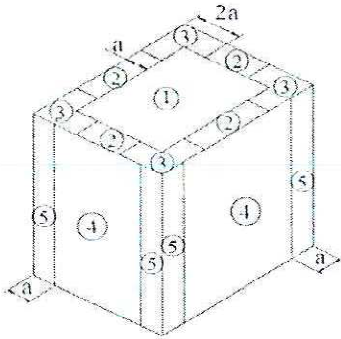
CALCULATED BY FEH

DATE

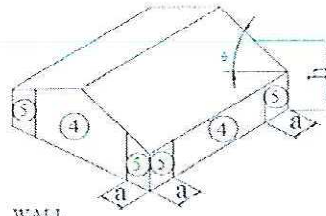
CHECKED BY FEH

DATE

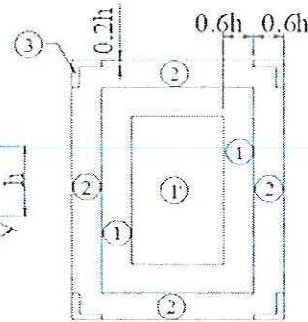
## Location of C&C Wind Pressure Zones - ASCE 7-22



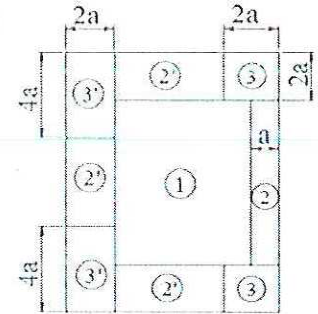
Roofs w/  $0 \leq \theta \leq 10^\circ$   
and all walls  
 $h > 60'$



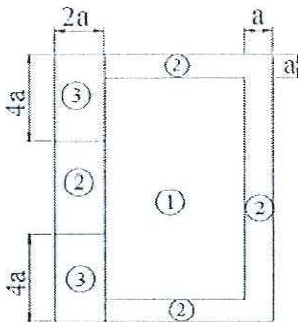
Walls  $h \leq 60'$   
& alt design  $h < 90'$



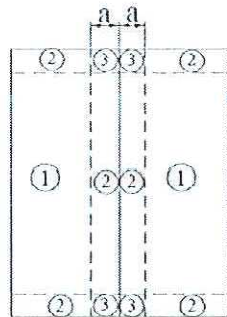
Multispan Gable & Sawtooth  $\leq 10^\circ$   
& Gable  $\theta \leq 7$  degrees &  
Monoslope  $\leq 3$  degrees  
 $h \leq 60'$  & alt design  $h < 90'$



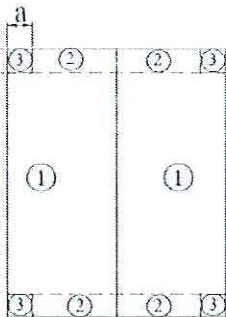
Monoslope roofs  
 $3^\circ < \theta \leq 10^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



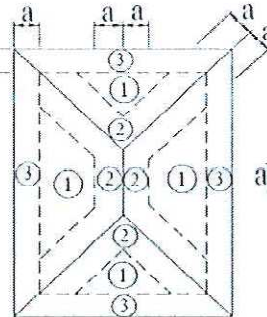
Monoslope roofs  
 $10^\circ < \theta \leq 30^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



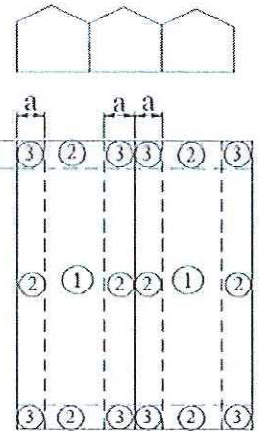
Gable  $7^\circ < \theta \leq 27^\circ$



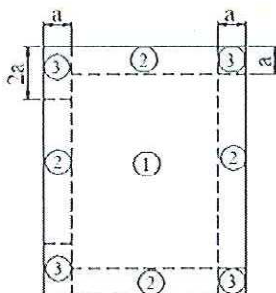
Gable  $27^\circ < \theta \leq 45^\circ$



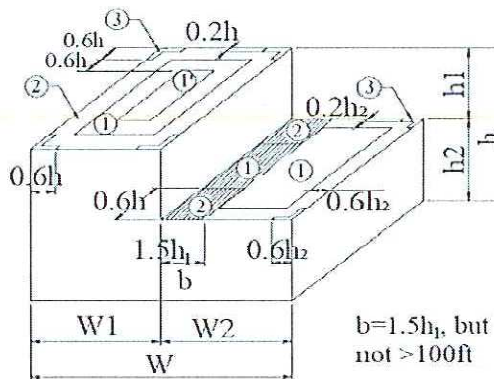
Hip  $7^\circ < \theta \leq 45^\circ$



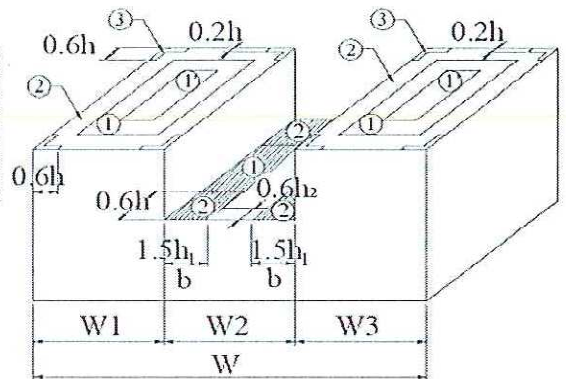
Multispan gable  $10^\circ < \theta \leq 45^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



Sawtooth  $10^\circ < \theta \leq 45^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



Stepped roofs  $0 \leq \theta \leq 3^\circ$   
 $h \leq 60'$  & alt design  $h < 90'$



Note: The hatched area indicates where roof positive pressures are equal to the adjacent wall positive pressure.



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**Ultimate Wind Pressures**
**Wind Loads - Components & Cladding :  $h \leq 60'$** 

Base pressure ( $q_h$ ) = 73.4 psf       $K_h$  = 0.937      100.0 ft      30.0 ft  
( $K_d q_h$ ) = 62.4 psf       $h$  = 24.0 ft       $0.2h = 4.8$  ft      100.0 ft  
Minimum parapet ht = 3.0 ft       $0.6h$  = 14.4 ft      100.0 ft  
Roof Angle ( $\theta$ ) = 0.0 deg       $GC_{pi}$  = +/-0.18  
Type of roof = Monoslope       $K_d q_i = K_d q_h$  = 62.4 psf

**Roof**

| Area                 | GCp +/- GCpi |        |        |         | Surface Pressure (psf) |        |        |         |
|----------------------|--------------|--------|--------|---------|------------------------|--------|--------|---------|
|                      | 10 sf        | 100 sf | 500 sf | 1000 sf | 10 sf                  | 100 sf | 500 sf | 1000 sf |
| Negative Zone 1      | -1.88        | -1.47  | -1.18  | -1.18   | -117.4                 | -91.6  | -73.7  | -73.7   |
| Negative Zone 1'     | -1.08        | -1.08  | -0.73  | -0.58   | -67.4                  | -67.4  | -45.6  | -36.2   |
| Negative Zone 2      | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Negative Zone 3      | -2.48        | -1.95  | -1.58  | -1.58   | -154.8                 | -121.8 | -98.6  | -98.6   |
| Positive Zone 1 & 1' | 0.48         | 0.38   | 0.38   | 0.38    | 30.0                   | 23.7   | 23.7   | 23.7    |
| Positive Zones 2 & 3 | 1.08         | 0.92   | 0.81   | 0.81    | 67.4                   | 57.5   | 50.6   | 50.6    |
| Overhang Zone 1 & 1' | -1.70        | -1.60  | -1.00  | -1.00   | -106.1                 | -99.9  | -62.4  | -62.4   |
| Overhang Zone 2      | -2.30        | -1.69  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |
| Overhang Zone 3      | -2.30        | -1.69  | -1.10  | -1.10   | -143.6                 | -99.5  | -68.7  | -68.7   |

| User input |        |
|------------|--------|
| 50 sf      | 200 sf |
| -99.4      | -83.9  |
| -67.4      | -58.0  |
| -131.7     | -111.8 |
| -131.7     | -111.8 |
| 25.6       | 23.7   |
| 60.5       | 54.5   |
| -101.8     | -83.8  |
| -112.8     | -86.2  |
| -112.8     | -86.2  |

Negative zone 3 = zone 2, since parapet  $\geq 3$  ft.

Overhang pressures in the table above assume an internal pressure coefficient ( $GC_{pi}$ ) of 0.0

Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 11.2 psf)

**Parapet**

$K_d q_p$  = 63.9 psf

| Solid Parapet Pressure  | Surface Pressure (psf) |        |        |        |        |        |
|-------------------------|------------------------|--------|--------|--------|--------|--------|
|                         | 10 sf                  | 20 sf  | 50 sf  | 100 sf | 200 sf | 500 sf |
| CASE A: Zone 2 :        | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
| Zone 3 :                | 204.6                  | 191.4  | 173.9  | 160.6  | 147.3  | 129.8  |
| CASE B: Interior zone : | -120.9                 | -114.7 | -106.7 | -100.5 | -94.4  | -86.3  |
| Corner zone :           | -138.1                 | -129.0 | -116.8 | -107.6 | -98.5  | -86.3  |

| User input |  |
|------------|--|
| 50 sf      |  |
| 173.9      |  |
| 173.9      |  |
| -106.7     |  |
| -116.8     |  |

wall  $a$  = 6.0 ft

**Walls**

| Area                | GCp +/- GCpi |        |        |        | Surface Pressure at h |        |        |        |
|---------------------|--------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                     | 10 sf        | 100 sf | 200 sf | 500 sf | 10 sf                 | 100 sf | 200 sf | 500 sf |
| Negative Zone 4     | -1.17        | -1.01  | -0.96  | -0.90  | -73.0                 | -63.1  | -60.1  | -56.2  |
| Negative Zone 5     | -1.44        | -1.12  | -1.03  | -0.90  | -89.9                 | -70.1  | -64.1  | -56.2  |
| Positive Zone 4 & 5 | 1.08         | 0.92   | 0.87   | 0.81   | 67.4                  | 57.5   | 54.5   | 50.6   |

Note:  $GC_{pi}$  reduced by 10% due to roof angle  $\leq 10$  deg.

| User input |       |
|------------|-------|
| 20 sf      | 50 sf |
| -70.1      | -66.1 |
| -83.9      | -76.0 |
| 64.4       | 60.5  |

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**Wind Loads - Other Structures:**

ASCE 7- 22

Ultimate Wind Pressures

Wind Factor = 1.00  
Gust Effect Factor (G) = 0.85 Ultimate Wind Speed = 115 mph  
Kzt = 1.00 Exposure = C

for 6' fence

**A. Solid Freestanding Walls & Solid Signs (& open signs with less than 30% open)**

|                                    |         |                                |          |                                             |                                                           |
|------------------------------------|---------|--------------------------------|----------|---------------------------------------------|-----------------------------------------------------------|
| Dist to sign top (h)               | 6.0 ft  | s/h =                          | 1.00     | Case A & B                                  |                                                           |
| Height (s)                         | 6.0 ft  | B/s =                          | 4.83     | C <sub>f</sub> =                            | 1.35                                                      |
| Width (B)                          | 29.0 ft | Lr/s =                         | 0.00     | F = Kd qh G C <sub>f</sub> A <sub>s</sub> = | 28.1 As                                                   |
| Wall Return (Lr) =                 | 0.0 ft  | Kz =                           | 0.851    | A <sub>s</sub> =                            | 10.0 sf                                                   |
| Directionality (Kd)                | 0.85    | Kd qh =                        | 24.5 psf | F =                                         | 281 lbs                                                   |
| Percent of open area to gross area | 0.0%    | Open reduction factor =        | 1.00     | Case C                                      |                                                           |
|                                    |         | Case C reduction factors       |          | Horiz dist from windward edge               | C <sub>f</sub> F=KdqhGC <sub>f</sub> A <sub>s</sub> (psf) |
|                                    |         | Factor if s/h>0.8 =            | 0.80     | 0 to s                                      | 2.45 51.1 As                                              |
|                                    |         | Wall return factor             |          | s to 2s                                     | 1.59 33.0 As                                              |
|                                    |         | for C <sub>f</sub> at 0 to s = | 1.00     | 2s to 3s                                    | 1.14 23.7 As                                              |
|                                    |         |                                |          | 3s to 10s                                   | 0.85 17.6 As                                              |

**B. Open Signs & Single-Plane Open Frames (openings 30% or more of gross area)**

|                                          |         |                                            |          |
|------------------------------------------|---------|--------------------------------------------|----------|
| Height to centroid of A <sub>f</sub> (z) | 15.0 ft | Kz =                                       | 0.851    |
| Width (zero if round)                    | 0.0 ft  | Base pressure (Kd qz) =                    | 24.5 psf |
| Diameter (zero if rect)                  | 2.0 ft  | F = Kdqz G C <sub>f</sub> A <sub>f</sub> = | 0.0 Af   |
| Percent of open area to gross area       | 0.0%    | Solid Area: A <sub>f</sub> =               | 10.0 sf  |
| Directionality (Kd)                      | 0.85    | F =                                        | 0 lbs    |
|                                          |         | Design sign as solid sign                  |          |

**C. Walls of Chimneys, Tanks, & Similar Structures**

|                                          |                                                  |                                                    |          |
|------------------------------------------|--------------------------------------------------|----------------------------------------------------|----------|
| Height to centroid of A <sub>f</sub> (z) | 15.0 ft                                          | Kz =                                               | 0.851    |
| Cross-Section                            | Square                                           | Base pressure (Kd qz) =                            | 25.9 psf |
| Directionality (Kd)                      | 0.90                                             | h/D =                                              | 15.00    |
| Height (h)                               | 15.0 ft                                          |                                                    |          |
| Width (D)                                | 1.0 ft                                           |                                                    |          |
| Type of Surface                          | N/A                                              |                                                    |          |
|                                          | Square (wind along diagonal)                     | Square (wind normal to face)                       |          |
|                                          | C <sub>f</sub> = 1.28                            | C <sub>f</sub> = 1.67                              |          |
|                                          | F = qz G C <sub>f</sub> A <sub>f</sub> = 28.2 Af | F = Kdqz G C <sub>f</sub> A <sub>f</sub> = 36.7 Af |          |
|                                          | A <sub>f</sub> = 10.0 sf                         | A <sub>f</sub> = 10.0 sf                           |          |
|                                          | F = 282 lbs                                      | F = 367 lbs                                        |          |

**D. Trussed Towers**

|                                          |                                                    |                                                    |          |
|------------------------------------------|----------------------------------------------------|----------------------------------------------------|----------|
| Height to centroid of A <sub>f</sub> (z) | 15.0 ft                                            | Kz =                                               | 0.851    |
| ε =                                      | 0.27                                               | Base pressure (Kd qz) =                            | 24.5 psf |
| Tower Cross Section                      | square                                             | Diagonal wind factor =                             | 1.2      |
| Member Shape                             | flat                                               | Round member factor =                              | 1.000    |
| Directionality (Kd)                      | 0.85                                               |                                                    |          |
|                                          | Square (wind along tower diagonal)                 | Square (wind normal to face)                       |          |
|                                          | C <sub>f</sub> = 3.24                              | C <sub>f</sub> = 2.70                              |          |
|                                          | F = Kdqz G C <sub>f</sub> A <sub>f</sub> = 67.4 Af | F = Kdqz G C <sub>f</sub> A <sub>f</sub> = 56.2 Af |          |
|                                          | Solid Area: A <sub>f</sub> = 10.0 sf               | Solid Area: A <sub>f</sub> = 10.0 sf               |          |
|                                          | F = 674 lbs                                        | F = 562 lbs                                        |          |

**TABLE 1609.7(1)  
NOMINAL (ASD) GARAGE DOOR AND ROLLING DOOR WIND LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT  
OF 30 FEET LOCATED IN EXPOSURE B (PSF)<sup>1, 2, 3, 4, 5</sup>**

| ULTIMATE DESIGN WIND SPEED ( $V_{ult}$ ) DETERMINED IN ACCORDANCE WITH SECTION 1609.3 (MPH - 3 SECOND GUST) |                |         |         |         |         |         |         |         |         |         |         |      |      |      |      |      |      |      |
|-------------------------------------------------------------------------------------------------------------|----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|------|------|------|------|------|------|
| Width<br>(ft)                                                                                               | Height<br>(ft) | 100 MPH | 110 MPH | 120 MPH | 130 MPH | 140 MPH | 150 MPH | 160 MPH | 170 MPH | 180 MPH | 190 MPH |      |      |      |      |      |      |      |
| Roof Angle 0 - 10 degrees                                                                                   |                |         |         |         |         |         |         |         |         |         |         |      |      |      |      |      |      |      |
| 8                                                                                                           | 8              | ±       | ±       | -       | ±       | -       | ±       | -       | ±       | -       | ±       | -    |      |      |      |      |      |      |
|                                                                                                             |                | 10.0    | 10.0    | 10.5    | 11.9    | 12.5    | 14.2    | 14.7    | 16.6    | 17.1    | 19.3    | 19.6 | 22.2 | 22.3 | 25.2 | 25.1 | 23.5 | 23.2 |
| 10                                                                                                          | 10             | ±       | -       | ±       | -       | ±       | -       | ±       | -       | ±       | -       | ±    |      |      |      |      |      |      |
|                                                                                                             |                | 10.0    | 10.0    | 10.2    | 11.4    | 12.1    | 13.6    | 14.2    | 16.0    | 16.5    | 18.5    | 18.9 | 21.2 | 21.5 | 24.2 | 24.3 | 27.3 | 27.3 |
| 14                                                                                                          | 14             | ±       | -       | ±       | -       | ±       | -       | ±       | -       | ±       | -       | ±    |      |      |      |      |      |      |
|                                                                                                             |                | 10.0    | 10.0    | 10.0    | 10.8    | 11.5    | 12.8    | 13.6    | 15.0    | 15.7    | 17.4    | 18.0 | 20.0 | 20.5 | 22.8 | 23.1 | 25.7 | 25.9 |
| Roof Angle > 10 degrees                                                                                     |                |         |         |         |         |         |         |         |         |         |         |      |      |      |      |      |      |      |
| 9                                                                                                           | 7              | +10.0   | -       | ±       | -       | ±       | -       | ±       | -       | ±       | -       | ±    |      |      |      |      |      |      |
|                                                                                                             |                | 10.9    | 11.4    | 12.9    | 13.7    | 15.6    | 16.1    | 18.2    | 18.5    | 20.9    | 21.3    | 24.1 | 24.3 | 27.5 | 27.6 | 31.2 | 30.6 | 34.6 |
| 16                                                                                                          | 7              | +10.0   | -       | ±       | -       | ±       | -       | ±       | -       | ±       | -       | ±    |      |      |      |      |      |      |
|                                                                                                             |                | 10.3    | 10.9    | 12.2    | 13.1    | 14.6    | 15.5    | 17.2    | 17.7    | 19.7    | 20.4    | 22.7 | 23.3 | 26.0 | 26.4 | 29.4 | 29.3 | 32.6 |
|                                                                                                             |                | 78 MPH  | 85 MPH  | 93 MPH  | 101 MPH | 108 MPH | 116 MPH | 124 MPH | 132 MPH | 139 MPH | 147 MPH |      |      |      |      |      |      |      |

For SI: 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 psf = 47.88 N/m<sup>2</sup>.

Nominal Design Wind Speed ( $V_{nd}$ ) converted from Ultimate Design Wind Speed per Section 1609.3.1

1. For door sizes or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the lower door size.
2. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 1609.7.2. Minimum positive wind load shall be 10 psf and minimum negative wind load shall be 10 psf.
3. Plus and minus signs signify pressures acting toward and away from the building surfaces.
4. Negative pressures assume door has 2 feet of width in building's end zone.
5. Table values include the 0.6 load reduction factor.



TABLE 1609.7(1)

**NOMINAL (ASD) GARAGE DOOR AND ROLLING DOOR WIND LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT  
OF 30 FEET LOCATED IN EXPOSURE B (PSF)<sup>1, 2, 3, 4, 5</sup>**

| ULTIMATE DESIGN WIND SPEED ( $V_{ult}$ ) DETERMINED IN ACCORDANCE WITH SECTION 1609.3 (MPH - 3 SECOND GUST) |                |         |         |         |         |         |         |         |         |         |         |       |       |      |      |      |      |      |
|-------------------------------------------------------------------------------------------------------------|----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------|-------|------|------|------|------|------|
| Width<br>(ft)                                                                                               | Height<br>(ft) | 100 MPH | 110 MPH | 120 MPH | 130 MPH | 140 MPH | 150 MPH | 160 MPH | 170 MPH | 180 MPH | 190 MPH | 190 M | 190 N |      |      |      |      |      |
| Roof Angle 0 – 10 degrees                                                                                   |                |         |         |         |         |         |         |         |         |         |         |       |       |      |      |      |      |      |
| 8                                                                                                           | 8              | +       | +       | –       | +       | –       | +       | –       | +       | –       | +       | –     | –     |      |      |      |      |      |
|                                                                                                             | 10.0           | 10.0    | 10.5    | 11.9    | 14.2    | 14.7    | 16.6    | 17.1    | 19.3    | 19.6    | 22.2    | 22.3  | 25.2  | 25.1 | 28.5 | 28.2 | 31.9 | 31.4 |
| 10                                                                                                          | 10             | +       | +       | –       | +       | –       | –       | –       | –       | –       | –       | –     | –     | –    | –    | –    | –    | –    |
|                                                                                                             | 10.0           | 10.0    | 10.2    | 11.4    | 12.1    | 13.6    | 14.2    | 16.0    | 16.5    | 18.6    | 21.2    | 21.5  | 24.2  | 24.3 | 27.3 | 27.3 | 30.6 | 30.4 |
| 14                                                                                                          | 14             | +       | +       | –       | +       | –       | –       | –       | +       | –       | –       | –     | –     | –    | –    | +    | –    | +    |
|                                                                                                             | 10.0           | 10.0    | 10.0    | 10.6    | 11.6    | 12.8    | 13.6    | 15.0    | 15.7    | 17.4    | 18.0    | 20.0  | 20.6  | 22.8 | 23.1 | 25.7 | 25.9 | 28.8 |
| Roof Angle > 10 degrees                                                                                     |                |         |         |         |         |         |         |         |         |         |         |       |       |      |      |      |      |      |
| 9                                                                                                           | 7              | –       | +       | –       | +       | –       | +       | –       | +       | –       | –       | –     | –     | –    | –    | +    | –    | +    |
|                                                                                                             | +10.0          | 10.9    | 11.4    | 12.9    | 13.7    | 15.6    | 16.1    | 18.2    | 18.5    | 20.9    | 21.3    | 24.1  | 24.3  | 27.6 | 27.6 | 31.2 | 30.6 | 34.6 |
| 16                                                                                                          | 7              | –       | +       | –       | +       | –       | +       | –       | +       | –       | –       | –     | –     | –    | –    | +    | –    | +    |
|                                                                                                             | +10.0          | 10.3    | 10.9    | 12.2    | 13.1    | 14.5    | 15.5    | 17.2    | 17.7    | 19.7    | 20.4    | 22.7  | 23.3  | 26.0 | 25.4 | 29.4 | 29.3 | 32.6 |
|                                                                                                             | 78 MPH         | 85 MPH  | 93 MPH  | 101 MPH | 108 MPH | 116 MPH | 124 MPH | 132 MPH | 139 MPH | 147 N   |         |       |       |      |      |      |      |      |

For SI: 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 psf = 47.88 N/m<sup>2</sup>.

Nominal Design Wind Speed ( $V_{ult}$ ) converted from Ultimate Design Wind Speed per Section 1609.3.1

1. For door sizes or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the lower door size.

2. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 1609.7(2). Minimum positive wind load shall be 10 psf and minimum negative wind load shall be 10 psf.

3. Plus and minus signs signify pressures acting toward and away from the building surfaces.

4. Negative pressures assume door has 2 feet of width in building's end zone.

5. Table values include the 0.6 load reduction factor.

TABLE 1609.7(1)

# NOMINAL (ASD) GARAGE DOOR AND ROLLING DOOR WIND LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (PSF)<sup>1, 2, 3, 4, 5</sup>

| ULTIMATE DESIGN WIND SPEED ( $V_{ult}$ ) DETERMINED IN ACCORDANCE WITH SECTION 1609.3 (MPH = 3 SECOND GUST) |                |         |         |         |         |         |         |         |         |         |         |       |
|-------------------------------------------------------------------------------------------------------------|----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------|
| Width<br>(ft)                                                                                               | Height<br>(ft) | 100 MPH | 110 MPH | 120 MPH | 130 MPH | 140 MPH | 150 MPH | 160 MPH | 170 MPH | 180 MPH | 190 MPH | 190 N |
| 8                                                                                                           | 8              | +       | +       | +       | +       | +       | +       | +       | +       | +       | +       | +     |
|                                                                                                             |                | 10.0    | 10.0    | 10.5    | 11.9    | 12.5    | 14.2    | 14.7    | 16.6    | 17.1    | 19.3    | 19.3  |
| 10                                                                                                          | 10             | +       | +       | +       | +       | +       | +       | +       | +       | +       | +       | +     |
|                                                                                                             |                | 10.0    | 10.0    | 10.2    | 11.4    | 12.1    | 13.6    | 14.2    | 16.0    | 16.5    | 18.9    | 21.2  |
| 14                                                                                                          | 14             | +       | +       | +       | +       | +       | +       | +       | +       | +       | +       | +     |
|                                                                                                             |                | 10.0    | 10.0    | 10.0    | 10.8    | 11.5    | 12.8    | 13.6    | 15.0    | 15.7    | 17.4    | 18.0  |
| Roof Angle 0 - 10 degrees                                                                                   |                |         |         |         |         |         |         |         |         |         |         |       |
| Roof Angle > 10 degrees                                                                                     |                |         |         |         |         |         |         |         |         |         |         |       |
| 9                                                                                                           | 7              | +       | +       | +       | +       | +       | +       | +       | +       | +       | +       | +     |
|                                                                                                             |                | 10.9    | 11.4    | 12.9    | 13.7    | 15.5    | 16.1    | 18.2    | 18.5    | 20.9    | 21.3    | 24.1  |
| 16                                                                                                          | 7              | +       | +       | +       | +       | +       | +       | +       | +       | +       | +       | +     |
|                                                                                                             |                | 10.3    | 10.9    | 12.2    | 13.1    | 14.6    | 15.5    | 17.2    | 17.7    | 19.7    | 20.4    | 22.7  |
|                                                                                                             |                | 78 MPH  | 85 MPH  | 93 MPH  | 101 MPH | 108 MPH | 116 MPH | 124 MPH | 132 MPH | 139 MPH | 147 N   |       |

For SI: 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 psf = 47.88 N/m<sup>2</sup>.

Nominal Design Wind Speed ( $V_{nd}$ ) converted from Ultimate Design Wind Speed per Section 1609.3.1

1. For door sizes or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the lower door size.

2. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 1609.7(2). Minimum positive wind load shall be 10 psf and minimum negative wind load shall be 10 psf.

3. Plus and minus signs signify pressures acting toward and away from the building surfaces.

4. Negative pressures assume door has 2 feet of width in buildings and zone.

5. Table values include the 0.6 load reduction factor.

$$P = +26.7 \times 1.34 = 35.7 \text{ psf}$$

$$S = -30.2 \times 1.34 = 40.5 \text{ psf}$$

7(1)

NOMINAL (ASD) GARAGE DOOR AND ROLLING DOOR WIND LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN  
EXPOSURE B (PSF)<sup>1, 2, 3, 4, 5</sup>

| ULTIMATE DESIGN WIND SPEED ( $V_{ult}$ ) DETERMINED IN ACCORDANCE WITH SECTION 1609.3 (MPH - 3 SECOND GUST) |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |
|-------------------------------------------------------------------------------------------------------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Width(ft<br>)                                                                                               | Height(ft<br>) | 100 MPH   |           | 110 MPH   |           | 120 MPH   |           | 130 MPH   |           | 140 MPH   |           | 150 MPH   |           | 160 MPH   |           | 170 MPH   |           | 180 MPH   |           | 190 MPH   |           | 200 MPH   |           |
| Roof Angle 0 – 10 degrees                                                                                   |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |
| 8                                                                                                           | 8              | +<br>10.0 | –<br>10.0 | +<br>10.5 | –<br>11.9 | +<br>12.5 | –<br>14.2 | +<br>14.7 | –<br>16.6 | +<br>17.1 | –<br>19.3 | +<br>19.6 | –<br>22.2 | +<br>22.3 | –<br>25.2 | +<br>25.1 | –<br>28.5 | +<br>28.2 | –<br>31.9 | +<br>31.4 | –<br>35.5 | +<br>34.8 | –<br>39.4 |
| 10                                                                                                          | 10             | +<br>10.0 | –<br>10.0 | +<br>10.2 | –<br>11.4 | +<br>12.1 | –<br>13.6 | +<br>14.2 | –<br>16.0 | +<br>16.5 | –<br>18.5 | +<br>18.9 | –<br>21.2 | +<br>21.5 | –<br>24.2 | +<br>24.3 | –<br>27.3 | +<br>27.3 | –<br>30.6 | +<br>30.4 | –<br>34.1 | +<br>33.7 | –<br>37.8 |
| 14                                                                                                          | 14             | +<br>10.0 | –<br>10.0 | +<br>10.0 | –<br>10.8 | +<br>11.5 | –<br>12.8 | +<br>13.5 | –<br>15.0 | +<br>15.7 | –<br>17.4 | +<br>18.0 | –<br>20.0 | +<br>20.5 | –<br>22.8 | +<br>23.1 | –<br>25.7 | +<br>25.9 | –<br>28.8 | +<br>28.9 | –<br>32.1 | +<br>32.0 | –<br>35.6 |
| Roof Angle > 10 degrees                                                                                     |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |
| 9                                                                                                           | 7              | +10.0     | –<br>10.9 | +<br>11.4 | –<br>12.9 | +<br>13.7 | –<br>15.5 | +<br>16.1 | –<br>18.2 | +<br>18.5 | –<br>20.9 | +<br>21.3 | –<br>24.1 | +<br>24.3 | –<br>27.5 | +<br>27.6 | –<br>31.2 | +<br>30.6 | –<br>34.6 | +<br>34.2 | –<br>38.6 | +<br>38.0 | –<br>43.0 |
| 16                                                                                                          | 7              | +10.0     | –<br>10.3 | +<br>10.9 | –<br>12.2 | +<br>13.1 | –<br>14.6 | +<br>15.5 | –<br>17.2 | +<br>17.7 | –<br>19.7 | +<br>20.4 | –<br>22.7 | +<br>23.3 | –<br>26.0 | +<br>26.4 | –<br>29.4 | +<br>29.3 | –<br>32.6 | +<br>32.7 | –<br>36.5 | +<br>36.4 | –<br>40.6 |



|  |  |        |        |        |         |         |         |         |         |         |         |         |
|--|--|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|
|  |  | 78 MPH | 85 MPH | 93 MPH | 101 MPH | 108 MPH | 116 MPH | 124 MPH | 132 MPH | 139 MPH | 147 MPH | 155 MPH |
|--|--|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|

For SI: 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 psf = 47.88 N/m².  
Nominal Design Wind Speed ( $V_w$ ) converted from Ultimate Design Wind Speed per Section 1609.3.1.  
1. 1.For door sizes or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the lower door size.  
2. 2.Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 1609.7(2). Minimum positive wind load shall be 10 psf and minimum negative wind load shall be 10 psf.  
3. 3.Plus and minus signs signify pressures acting toward and away from the building surfaces.  
4. 4.Negative pressures assume door has 2 feet of width in building's end zone.  
5. 5.Table values include the 0.6 load reduction factor.

TABLE 1609.7(2)  
ADJUSTMENT FACTOR FOR BUILDING HEIGHT AND EXPOSURE, ( $\lambda$ )

| MEAN ROOF HEIGHT (feet) | EXPOSURE |      |      |
|-------------------------|----------|------|------|
|                         | B        | C    | D    |
| 15                      | 0.82     | 1.21 | 1.47 |
| 20                      | 0.89     | 1.29 | 1.55 |
| 25                      | 0.94     | 1.35 | 1.61 |
| 30                      | 1.00     | 1.40 | 1.66 |
| 35                      | 1.05     | 1.45 | 1.70 |
| 40                      | 1.06     | 1.49 | 1.74 |
| 45                      | 1.10     | 1.53 | 1.78 |
| 50                      | 1.13     | 1.56 | 1.81 |
| 55                      | 1.16     | 1.59 | 1.84 |
| 60                      | 1.19     | 1.62 | 1.87 |

**SD) GARAGE DOOR AND ROLLING DOOR WIND LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (PSF)<sup>1, 2, 3, 4, 5</sup>**

| ULTIMATE DESIGN WIND SPEED ( $V_{ult}$ ) DETERMINED IN ACCORDANCE WITH SECTION 1609.3 (MPH - 3 SECOND GUST) |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |
|-------------------------------------------------------------------------------------------------------------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|
| 100 MPH                                                                                                     |      | 110 MPH |      | 120 MPH |      | 130 MPH |      | 140 MPH |      | 150 MPH |      | 160 MPH |      | 170 MPH |      | 180 MPH |      | 190 MPH |      | 200 MPH |      |
| Roof Angle 0 – 10 degrees                                                                                   |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |
| +                                                                                                           | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    |
| 10.0                                                                                                        | 10.0 | 10.5    | 11.9 | 12.5    | 14.2 | 14.7    | 16.6 | 17.1    | 19.3 | 19.6    | 22.2 | 22.3    | 25.2 | 25.1    | 28.5 | 28.2    | 31.9 | 31.4    | 35.5 | 34.8    | 39.4 |
| +                                                                                                           | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    |
| 10.0                                                                                                        | 10.0 | 10.2    | 11.4 | 12.1    | 13.6 | 14.2    | 16.0 | 16.5    | 18.5 | 18.9    | 21.2 | 21.5    | 24.2 | 24.3    | 27.3 | 27.3    | 30.6 | 30.4    | 34.1 | 33.7    | 37.8 |
| +                                                                                                           | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    |
| 10.0                                                                                                        | 10.0 | 10.0    | 10.8 | 11.5    | 12.8 | 13.5    | 15.0 | 15.7    | 17.4 | 18.0    | 20.0 | 20.5    | 22.8 | 23.1    | 25.7 | 25.9    | 28.8 | 28.9    | 32.1 | 32.0    | 35.6 |
| Roof Angle > 10 degrees                                                                                     |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |         |      |
| +10.0                                                                                                       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    |
|                                                                                                             | 10.9 | 11.4    | 12.9 | 13.7    | 15.5 | 16.1    | 18.2 | 18.5    | 20.9 | 21.3    | 24.1 | 24.3    | 27.5 | 27.6    | 31.2 | 30.6    | 34.6 | 34.2    | 38.6 | 38.0    | 43.0 |
| +10.0                                                                                                       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    | +       | –    |
|                                                                                                             | 10.3 | 10.9    | 12.2 | 13.1    | 14.6 | 15.5    | 17.2 | 17.7    | 19.7 | 20.4    | 22.7 | 23.3    | 26.0 | 26.4    | 29.4 | 29.3    | 32.6 | 32.7    | 36.5 | 36.4    | 40.6 |
| 78 MPH                                                                                                      |      | 85 MPH  |      | 93 MPH  |      | 101 MPH |      | 108 MPH |      | 116 MPH |      | 124 MPH |      | 132 MPH |      | 139 MPH |      | 147 MPH |      | 155 MPH |      |

3 mm, 1 mile per hour = 1.609 km/h, 1 psf = 47.88 N/m<sup>2</sup>.

d Speed ( $V_{asd}$ ) converted from Ultimate Design Wind Speed per Section 1609.3.1.

izes or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the lower door size.

ies shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 1609.7(2). Minimum positive wind load shall be 10 psf and negative wind load shall be 10 psf.

minus signs signify pressures acting toward and away from the building surfaces.

ressures assume door has 2 feet of width in building's end zone.

es include the 0.6 load reduction factor.

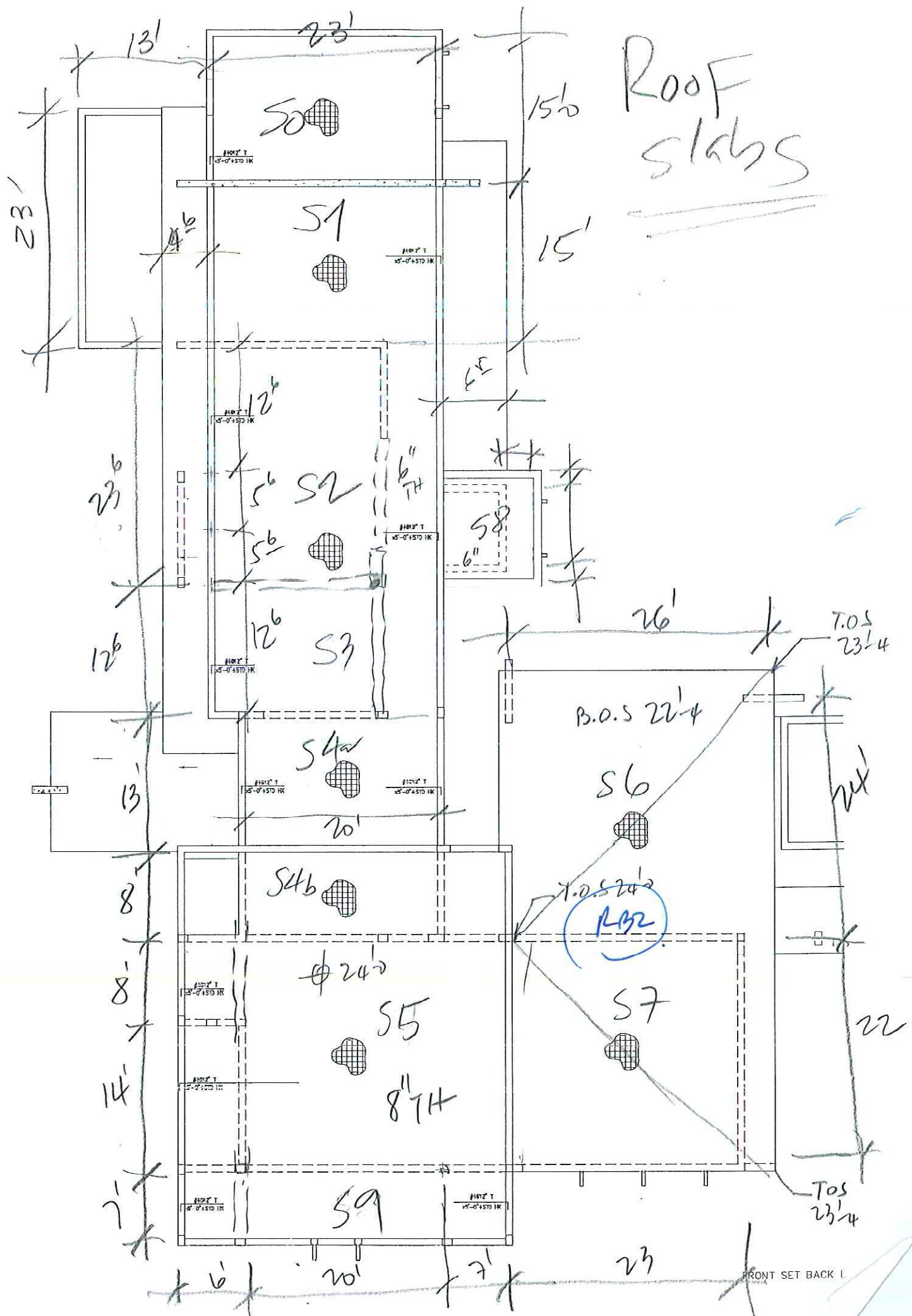
**TABLE 1609.7(2) ADJUSTMENT FACTOR FOR BUILDING HEIGHT AND EXPOSURE, ( $\lambda$ )**

| MEAN ROOF HEIGHT (feet) | EXPOSURE |      |      |
|-------------------------|----------|------|------|
|                         | B        | C    | D    |
| 15                      | 0.82     | 1.21 | 1.47 |
| 20                      | 0.89     | 1.29 | 1.55 |
| 25                      | 0.94     | 1.35 | 1.61 |
| 30                      | 1.00     | 1.40 | 1.66 |
| 35                      | 1.05     | 1.45 | 1.70 |
| 40                      | 1.06     | 1.49 | 1.74 |
| 45                      | 1.10     | 1.53 | 1.78 |
| 50                      | 1.13     | 1.56 | 1.81 |
| 55                      | 1.16     | 1.59 | 1.84 |
| 60                      | 1.19     | 1.62 | 1.87 |

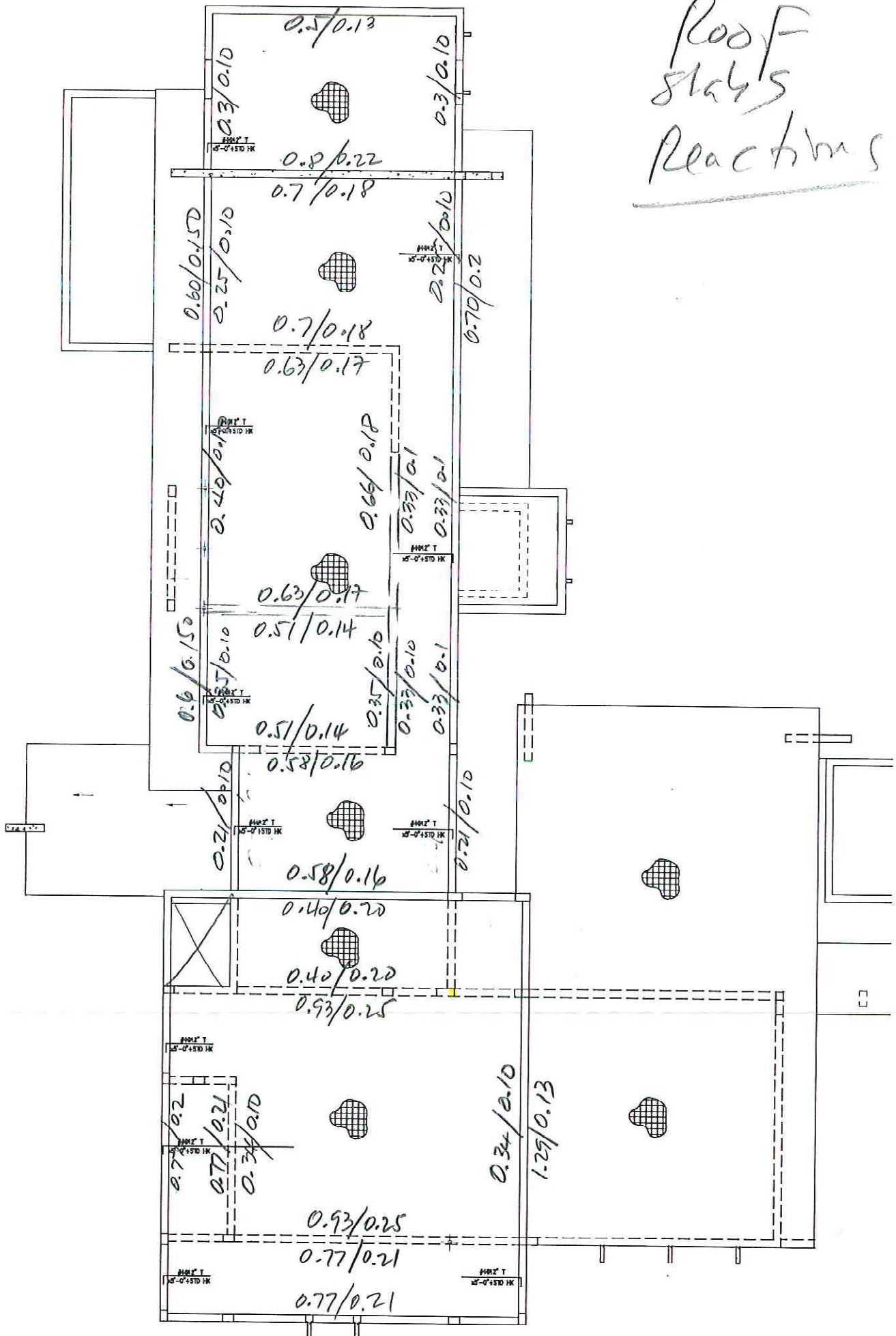




## *Roof Slabs*



# Roof slabs Reactions



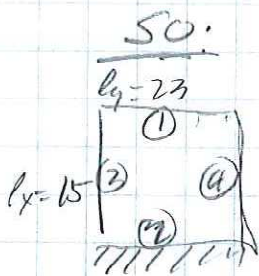


[illegible]

FRONT SET BACK L

# Main House (Hand Verification)

## Slabs



$$h = \frac{23 \times 1.1}{36 + \sqrt{\frac{23}{15}}} = 0.58 \rightarrow 7"$$

$$E = \frac{l_x}{l_y} = 0.65$$

$$M^e = -0.1126 \times 40.5 = 4.6 \text{ k/F}$$

$$M_x = 0.0512 \times 40.5 = 2.07 \text{ k/F}$$

$$M_y = 0.0127 \times 40.5 = 0.5 \text{ k/F}$$

$$DL = 89 \text{ psf}$$

$$ASL = 20 \text{ psf}$$

$$LL = 30 \text{ psf}$$

$$UTL = 180 \text{ psf}$$

$$\frac{qL^2}{4} = 180 \times 15^2 = 40.5$$

$$R_{11}^D = 0.279 \times 38 \div 23 = 0.5 \text{ kLF}$$

$$R_{11}^L = 0.279 \times 10.4 \div 23 = 0.13 \text{ kLF}$$

$$R_{22}^D = 0.483 \times 38 \div 23 = 0.8 \text{ kLF}$$

$$R_{22}^L = 0.483 \times 10.4 \div 23 = 0.22 \text{ kLF}$$

$$R_{34}^D = 0.119 \times 38 \div 15 = 0.30 \text{ kLF}$$

$$R_{34}^L = 0.119 \times 10.4 \div 15 = 0.10 \text{ kLF}$$

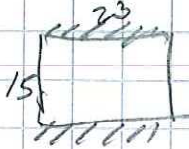
$$D = 110 \times 15 \times 23 = 38 \text{ k}$$

$$L = 30 \times 15 \times 23 = 10.4 \text{ k}$$

$$A_s = \frac{4.6}{4 \times 5} = 0.23 \text{ in}^2/\text{F} \rightarrow \#4 @ 8" T$$

S1

$$E = \frac{15}{23} = 0.65$$



$$M^e = 0.0828 \times 40.5 = 3.4 \text{ k/F}$$

$$M_x = 0.0371 \times 40.5 = 1.6 \text{ k/F}$$

$$M_y = 0.0058 \times 40.5 = 0.2 \text{ k/F}$$

$$\frac{qL^2}{4} = 40.5$$

$$D = 38.0 \text{ k}$$

$$L = 10.4 \text{ k}$$

$$\Delta M = 4.6 - 3.4 = 1.2 \text{ k} \rightarrow M_{s0}^x = 2.07 + \frac{1.2}{2} = 2.67 \text{ k/F}$$

$$R_{12}^D = 0.406 \times 38 \div 23 = 0.67 \text{ kLF}$$

$$R_{34}^D = 0.094 \times 38 \div 15 = 0.24 \text{ kLF}$$

$$R_{12}^L = 0.406 \times 10.4 \div 23 = 0.18 \text{ kLF}$$

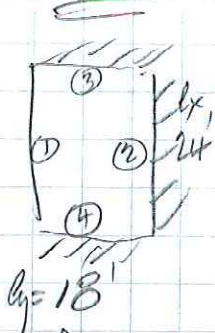
$$R_{34}^L = 0.094 \times 10.4 \div 15 = 0.07 \text{ kLF}$$

$$A_s = \frac{3.4}{4 \times 5} = 0.17 \text{ in}^2/\text{F} \rightarrow \#4 @ 12"$$



## Main House Roof (Hand Verification) cont.

S2



$$\frac{l_y}{l_x} = 0.75$$

$$M_x^e = 0.0727 \times 0.180 \times 18 \times 24 = 4.24 \text{ k}$$

$$M_y^e = 0.0837 \times 58.32 = 4.89 \text{ k} \rightarrow \#4 @ 10" T$$

$$M_x = 0.0214 \times 58.32 = 1.25 \text{ k}$$

$$M_y = 0.0327 \times 58.32 = 1.91 \text{ k}$$

#4 @ 12" EW  
BOT

$$R_{10}^D = 0.192 \times 110 \times 18 \times \frac{24}{24} = 0.38 \text{ klf}$$

$$R_{10}^L = 0.192 \times 80 \times 18 \times \frac{24}{24} = 0.104 \text{ klf}$$

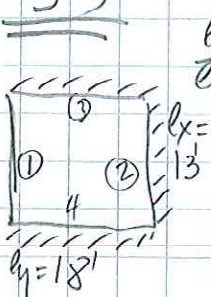
$$R_{10}^D = 0.334 \times 47.5 \div 24 = 0.66 \text{ klf}$$

$$R_{10}^L = 0.334 \times 13 \div 24 = 0.18 \text{ klf}$$

$$R_{34}^D = 0.237 \times 47.5 \div 18 = 0.63 \text{ klf}$$

$$R_{34}^L = 0.237 \times 13 \div 18 = 0.17 \text{ klf}$$

S3



$$\frac{l_x}{l_y} = \frac{13}{18} = 0.72$$

$$M_x^e = 0.0764 \times 30.4 = 2.32 \text{ k}$$

$$M_y^e = 0.0572 \times 30.4 = 1.74 \text{ k}$$

$$M_x = 0.0343 \times 30.4 = 1.04 \text{ k}$$

$$M_y = 0.010 \times 30.4 = 0.30 \text{ k}$$

$$g_c = 30.4$$

#4 @ 12" T

#4 @ 12" B/EW

$$R_1^D = 0.103 \times \frac{25.7}{13} = 0.20 \text{ klf}$$

$$R_1^L = 0.103 \times \frac{7.02}{13} = 0.06 \text{ klf}$$

$$R_2^D = 0.179 \times \frac{25.7}{13} = 0.35 \text{ klf}$$

$$R_2^L = 0.179 \times \frac{7.02}{13} = 0.10 \text{ klf}$$

$$R_{34}^D = 0.359 \times \frac{25.7}{18} = 0.51 \text{ klf}$$

$$R_{34}^L = 0.359 \times \frac{7.02}{18} = 0.14 \text{ klf}$$

$$D = 110 \times 13 \times 18 = 25.7 \text{ k}$$

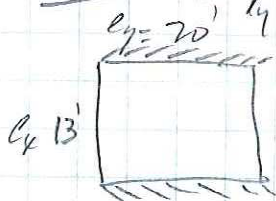
$$L = 80 \times 13 \times 18 = 7.02 \text{ k}$$



## Main House Roof (Cont)

S4g

$$\epsilon = \frac{0.5}{4} = 0.125$$



$$M_c = 0.0828 \times 30.4 = 2.52 \text{ k/F}$$

$$M_x = 0.0391 \times 30.4 = 1.19 \text{ k/F}$$

$$M_y = 0.0058 \times 30.4 = 0.18 \text{ k/F}$$

$$g l^2 = 30.4$$

#4 @ 12" o/c

$$D = 110 \times 13 \times 20 = 28.6 \text{ k}$$

$$L = 30 \times 13 \times 20 = 7.8 \text{ k}$$

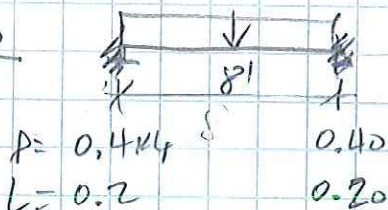
$$R_{12}^D = 0.406 \times 28.6 \div 20 = 0.58 \text{ k/F}$$

$$R_{1-2}^L = 0.406 \times \frac{7.8}{20} = 0.16 \text{ k/F}$$

$$R_{34}^D = 0.094 \times 28.6 \div 13 = 0.21 \text{ k/F}$$

$$R_{3-4}^L = 0.094 \times \frac{7.8}{13} = 0.06 \text{ k/F}$$

S4b



#4 @ 12" EW  
#4 @ 12" T/EE

$$P = 0.4 \text{ k/F}$$

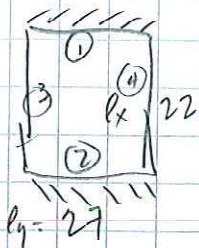
$$L = 0.2$$

S5

$$\epsilon = \frac{22}{27} = 0.81$$

$$h = \frac{1.1 \times 27}{36 + 9 \times \frac{27}{22}} = 0.63 \rightarrow 8"$$

$$g l^2 = 95.8$$



$$M_c = 0.0784 \times 95.8 = 7.51 \text{ k/F}$$

$$M_x = 0.0350 \times 95.8 = 3.35 \text{ k/F}$$

$$M_y = 0.0103 \times 95.8 = 0.99 \text{ k/F}$$

#5 @ 12" T (#4 @ 8" T)  
#4 @ 12" BW

$$D = 74.3 \text{ k}$$

$$L = 17.8 \text{ k}$$

$$R_{1-2}^D = 0.385 \times 74.3 \div 27 = 1.06 \text{ k/F}$$

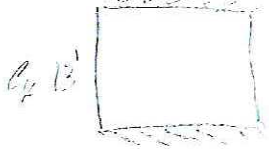
$$R_{1-2}^L = 0.385 \times \frac{17.8}{27} = 0.25 \text{ k/F}$$

$$R_{3-4}^D = 0.115 \times 74.3 \div 22 = 0.39 \text{ k/F}$$

$$R_{3-4}^L = 0.115 \times \frac{17.8}{22} = 0.100 \text{ k/F}$$

# Main House Roof (Cont.)

S4a  $\epsilon = 0.005$   
 $l = 20'$



$$M_x = 0.0828 \times 30.4 = 2.52 \text{ k/F}$$

$$M_y = 0.0391 \times 30.4 = 1.19 \text{ k/F}$$

$$M_z = 0.0058 \times 30.4 = 0.18 \text{ k/F}$$

$$q l^2 = 30.4$$

#4 @ 12" o/c

$$R_D = 0.406 \times 28.6 \div 20 = 0.58 \text{ k/F}$$

$$R_{1-2} = 0.1106 \times \frac{28.6}{20} = 0.16 \text{ k/F}$$

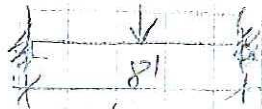
$$D = 110 \times 13 \times 2.5 = 28.6 \text{ k}$$

$$L = 30 \times 13 \times 2.5 = 7.8 \text{ k}$$

$$R_D = 0.074 \times 28.6 \div 13 = 0.21 \text{ k/F}$$

$$R_{3-4} = 0.094 \times \frac{7.8}{13} = 0.06 \text{ k/F}$$

S4b

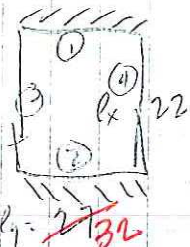


$$P = 0.404$$

$$L = 0.2$$

#4 @ 12" EW  
 #4 @ 12" T/EC

S5



$$\epsilon = \frac{22}{27} = 0.81$$

$$h = \frac{1.1 \times 22}{36 + 9 \times 22} = 0.63 \rightarrow 8"$$

$$D = 100$$

$$L = 30$$

$$AOL = 25$$

$$q l^2 = 95.8$$

$$M_x = 0.0816 \times 11.40 = 0.93 \text{ k/F}$$

$$M_y = 0.0356 \times 11.40 = 0.41 \text{ k/F}$$

$$M_z = 0.0058 \times 11.40 = 0.07 \text{ k/F}$$

#5 @ 12" T (#4 @ 8" T)

#4 @ 12" BW

$$D = 74.3 \text{ k}$$

$$L = 17.8 \text{ k}$$

$$R_{1-2} = 0.385 \times 74.3 \div 22 = 1.06 \text{ k/F}$$

$$R_{3-4} = 0.115 \times 74.3 \div 22 = 0.39 \text{ k/F}$$

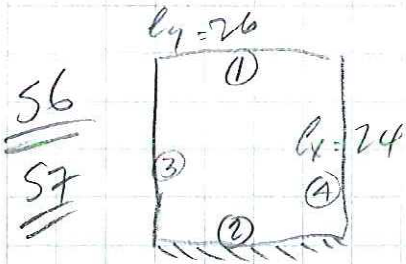
$$R_{1-2} = 0.385 \times 17.8 \div 22 = 0.25 \text{ k/F}$$

$$R_{3-4} = 0.115 \times 17.8 \div 22 = 0.10 \text{ k/F}$$

0.36



# Main House Roof Rev $\Delta$ 8" THK



$$DL = 100 + 30$$

$$LL = 30$$

$$UTL = \frac{210}{410} KSF$$

$$E = \frac{24}{26} = 0.92$$

$$q_u^{1.2} = \frac{121}{236}$$

$$M_x^e = 0.0922 \times \frac{121}{236} = 21.8' K/F$$

$$M_x = 0.0372 \times \frac{121}{236} = 8.8' K/F$$

$$M_y = 0.0234 \times \frac{121}{236} = 5.52' K/F$$

$$D = 12 \times 2 = 81.1$$

$$L = 18.7'$$

$$R_1^D = 0.245 \times \frac{81.1}{18.7} \div 26 = 1.16' K/F$$

$$R_2^D = 0.425 \times \frac{81.1}{18.7} \div 26 = 3.06' K/F$$

$$R_{3-4}^D = 0.165 \times \frac{81.1}{18.7} \div 24 = 1.27' K/F$$

$$R_1^L = 0.245 \times 18.7 \div 26 = 0.18' K/F$$

$$R_2^L = 0.425 \times 18.7 \div 26 = 0.31' K/F$$

$$R_{3-4}^L = 0.165 \times 18.7 \div 24 = 0.13' K/F$$

$$A_s = \frac{11.16}{4 \times 6.5} = 0.43' i^2/F$$

$$A_{sx} = \frac{4.5}{4 \times 6.5} = 0.17' i^2/F$$

$$A_{sy} = \frac{2.83}{4 \times 6.5} = 0.12' i^2/F$$

$$A_{s_{min}} = 0.26' i^2/F$$

#5 @ 12" BOT, EW OK



$$M = 0.180 \times 7^2/2 = 4.41' K/F$$

$$A_s = \frac{4.41}{4 \times 6.5} = 0.20' i^2/F$$

$$D = 110 \times 7 = 770' PLF$$

$$L = 30 \times 7 = 0.21' K/F$$

Check RLB2 Now For

$$DL = 1.33 \times 2 = 2.66' K/F$$

$$LL = 0.31 \times 2 = 0.62' K/F$$

RLB2 10' x 16' #6 T & B #3 @ 6"



SL

$K = p \times l_y = \frac{0.410 \times 26 \times 24}{256} = 0.210$   
 $M_x = \frac{131}{6} = 21.8 \text{ k} \rightarrow A_s = \frac{21.8}{4 \times 6.5} = 0.84 \text{ in}^2$   
 $M_y = \frac{131}{19.7} = 6.6 \text{ k} \rightarrow A_s = \frac{6.6}{4 \times 10.5} = 0.25 \text{ in}^2$   
 $M_y = \frac{131}{36.2} = 3.62 \text{ k} \rightarrow A_s = \frac{3.62}{4 \times 10.5} = 0.15 \text{ in}^2$   
 $A = \frac{K}{a} = 45.1 \text{ K}$   
 $M_{xr} = \frac{131}{14.4} = 9.10 \text{ k} \rightarrow A_s = \frac{9.10}{4 \times 10.5} = 0.44 \text{ in}^2$   
 $M_{yr} = \frac{131}{11.8} = 11.1 \text{ k} \rightarrow A_s = \frac{11.1}{4 \times 10.5} = 0.52 \text{ in}^2$   
 $M_{su} = 0.5 A = 0.5 \times \frac{131}{5.67} = M_{so} = 11.6 \text{ k} \rightarrow A_s = \frac{11.6}{4 \times 6} = 0.48 \text{ in}^2$   
 $A_s \rightarrow \frac{0.84}{0.44} = 1.2 \rightarrow \#6 \text{ eb}'' \text{ Top}$   
 $R_D = 0.76 \text{ k} \text{ f} \quad R_L = 0.18 \text{ on Beam RB1}$

56

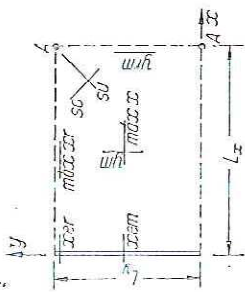
Placa N.º II/5/a

Carga uniforme  $p$

$$K = p \cdot L_x \cdot L_y \quad M = \frac{K}{m} \quad A = \frac{K}{a}$$

| $\frac{L_y}{L_x}$ | $m_{xcr}$ | $m_{xcm}$ | $m_{xcr}$ | $m_{xcr}$ | $m_{xcm}$ | $m_{xcr}$ | $a$    |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|--------|
| 0,5               | -4,06     | -3,99     | 7,30      | 6,78      | 88,5      | 10,7      | 5,34   |
| 0,6               | -4,83     | -4,67     | 8,95      | 8,02      | 62,1      | 10,7      | 5,36   |
| 0,7               | -5,73     | -5,26     | 10,8      | 9,24      | 49,0      | 10,8      | 5,40   |
| 0,8               | -6,71     | -5,75     | 12,7      | 10,5      | 41,7      | 10,9      | 5,45   |
| 0,9               | -7,79     | -6,10     | 14,8      | 11,7      | 37,8      | 11,1      | 5,51   |
| 1,0               | -9,14     | -6,35     | 17,3      | 13,0      | 36,4      | 11,4      | 5,58   |
| 1,1               | -10,6     | -6,50     | 19,7      | 14,4      | 36,2      | 11,8      | 5,67   |
| 1,2               | -12,3     | -6,62     | 22,4      | 15,8      | 36,6      | 12,3      | 5,77   |
| 1,3               | -13,7     | -6,74     | 25,3      | 17,3      | 37,6      | 12,9      | 5,87   |
| 1,4               | -16,3     | -6,83     | 28,6      | 18,9      | 38,8      | 13,5      | 6,00   |
| 1,5               | -18,3     | -6,90     | 32,1      | 20,4      | 40,5      | 14,2      | 6,12   |
| 1,6               | -20,8     | -6,93     | 36,0      | 22,2      | 42,5      | 15,1      | 6,27   |
| 1,7               | -23,8     | -6,95     | 40,3      | 24,4      | 44,8      | 16,1      | 6,43   |
| 1,8               | -27,0     | -6,95     | 45,3      | 26,8      | 47,6      | 17,2      | 6,60   |
| 1,9               | -31,2     | -6,95     | 51,3      | 29,4      | 51,3      | 18,7      | 6,79   |
| 2,0               | -36,2     | -6,95     | 57,8      | 32,3      | 55,6      | 20,3      | 7,00   |
| $\frac{x}{L_x}$   | 0         | 0         | 0,65      | 0,65      | 0,5       | 1,0       | 1,0    |
| $\frac{y}{L_y}$   | 0; 1,0    | 0,5       | 0,5       | 0; 1,0    | 0,5       | 0,5       | 0; 1,0 |

$$\begin{aligned} M_{su} &= 0,5 \cdot A \\ M_{so} &= -0,5 \cdot A \\ \max M_{yr} &= M_{yrm} \end{aligned}$$



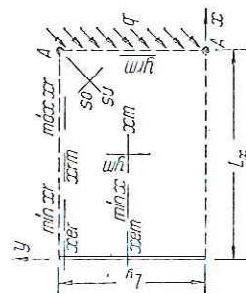
Placa N.º II/5/b

Carga lineal  $q$  en el borde  $x = L_x$

$$K = q \cdot L_y \quad M = \frac{K}{m} \quad A = \frac{K}{a}$$

| $\frac{L_y}{L_x}$ | $m_{xcr}$ | $m_{xcm}$ | $m_{xcm}$ | $m_{xcr}$ | $m_{xcr}$ | $m_{xcm}$ | $m_{xcm}$ | $a$    |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------|
| 0,5               | -165      | -59,3     | -80,5     | -44,0     | 0,88      | 290       | 4,03      | 33,4   |
| 0,6               | -330      | -35,7     | -56,4     | -41,0     | 0,84      | 205       | 4,03      | 23,6   |
| 0,7               | 70,2      | -24,2     | -43,5     | -37,6     | 0,79      | 205       | 4,07      | 18,8   |
| 0,8               | 41,3      | -17,7     | -35,5     | -34,1     | 0,76      | 255       | 4,13      | 16,1   |
| 0,9               | 30,0      | -13,5     | -30,1     | -         | -         | 435       | 4,20      | 14,6   |
| 1,0               | 23,7      | -10,6     | -26,0     | -         | -         | ∞         | 4,32      | 13,7   |
| 1,1               | 19,9      | -8,91     | -23,0     | -         | -         | 350       | 4,46      | 13,6   |
| 1,2               | 17,5      | -7,85     | -20,6     | -         | -         | 175       | 4,65      | 13,7   |
| 1,3               | 15,7      | -6,51     | -18,9     | -         | -         | 120       | 4,85      | 14,1   |
| 1,4               | 14,4      | -6,05     | -17,5     | -         | -         | 91,0      | 5,08      | 14,6   |
| 1,5               | 13,6      | -5,63     | -16,3     | -         | -         | 74,0      | 5,37      | 15,2   |
| 1,6               | 12,9      | -5,30     | -15,3     | -         | -         | 62,5      | 5,70      | 15,9   |
| 1,7               | 12,3      | -5,02     | -14,5     | -         | -         | 54,6      | 6,06      | 16,9   |
| 1,8               | 11,8      | -4,78     | -13,9     | -         | -         | 48,8      | 6,50      | 18,0   |
| 1,9               | 11,3      | -4,56     | -13,3     | -         | -         | 44,5      | 7,04      | 19,4   |
| 2,0               | 11,3      | -4,56     | -12,9     | -         | -         | 41,0      | 7,69      | 21,0   |
| $\frac{x}{L_x}$   | 0         | 0         | 0,5       | Variable  | Variable  | 0,5       | 1,0       | 0,5    |
| $\frac{y}{L_y}$   | 0; 1,0    | 0,5       | 0,5       | 0,5       | 0; 1,0    | 0; 1,0    | 0,5       | 0; 1,0 |

$$\begin{aligned} M_{su} &= 0,5 \cdot A \\ M_{so} &= -0,5 \cdot A \\ \max M_{yr} &= M_{yrm} \end{aligned}$$





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$$h = \frac{1.1 \times 10.5}{36 + 5 \frac{L_D}{10}} = 0.28 \rightarrow 3.4$$

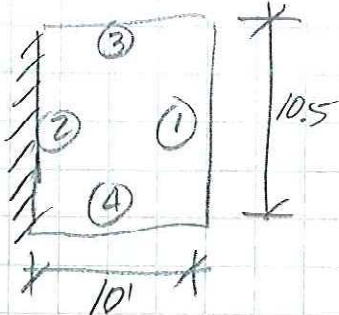
use 6" 74IL

$$\begin{aligned} D_L &= 75 \\ A_{DL} &= 25 \end{aligned} \Bigg) 100$$

$$L_L = 30$$

$$TD = 11 \text{ K}$$

$$TL = 3.3 \text{ K}$$



$$R_{(1)}^D = 0.232 \times 11 \div 10 = 0.26 \text{ KLF}$$

$$R_{(2)}^D = 0.402 \times 11 \div 10 = 0.44 \text{ KLF}$$

$$R_{(3)(4)}^D = 0.183 \times 11 \div 10 = 0.20 \text{ KLF}$$

$$R_{(1)}^L = 0.10 \text{ KLF}$$

$$R_{(2)}^L = 0.13 \text{ KLF}$$

$$R_{(3)(4)}^L = 0.10 \text{ KLF}$$



**GEOMETRY**

|                         |      |    |
|-------------------------|------|----|
| Slab Thickness t .....  | 6.0  | in |
| Effective Width b ..... | 12.0 | in |
| Support Length Ls ..... | 8.0  | in |
| Left Cantilever .....   | 0.00 | ft |
| Right Cantilever .....  | 0.00 | ft |

**BEAM SUPPORTS**

|                          |         |         |        |
|--------------------------|---------|---------|--------|
| Number of Supports ..... |         | 2       |        |
| Span                     | Length  | Support | Type   |
| ①                        | 8.00 ft | ①       | Fixed  |
| ②                        | N.A.    | ②       | Pinned |
| ③                        | N.A.    | ③       | N.A.   |
| ④                        | N.A.    | ④       | N.A.   |
| ⑤                        | N.A.    | ⑤       | N.A.   |
|                          |         | ⑥       | N.A.   |

**SUPPORT REACTIONS (k/ft)**

| Comb |   |     |     |     |     |
|------|---|-----|-----|-----|-----|
| ①    | ① | 0.7 | 0.7 | 0.4 | 0.4 |
| ②    | ② | 0.5 | 0.9 | 0.3 | 0.6 |
| ③    | ③ | 0.5 | 0.9 | 0.3 | 0.6 |
| ④    | ④ | 0.6 | 0.7 | 0.4 | 0.4 |
| ⑤    | ⑤ | 0.6 | 0.7 | 0.4 | 0.4 |
| ⑥    | ⑥ | 0.5 | 0.6 | 0.3 | 0.4 |
| ⑦    | ⑦ | 0.5 | 0.6 | 0.3 | 0.4 |
| ⑧    | ⑧ | 0.6 | 0.7 | 0.4 | 0.4 |
| ⑨    | ⑨ | 0.6 | 0.7 | 0.4 | 0.4 |
| ⑩    | ⑩ | 0.6 | 0.7 | 0.4 | 0.4 |
| ⑪    | ⑪ | 0.3 | 0.4 | 0.2 | 0.3 |
| ⑫    | ⑫ | 0.3 | 0.4 | 0.2 | 0.3 |

**LOAD COMBINATIONS**

| SERVICE |                      | FACTORED |                   |
|---------|----------------------|----------|-------------------|
| ①       | D+L                  | ①        | 1.4D              |
| ②       | D+Lr                 | ②        | 1.2D+1.6L+0.5Lr   |
| ③       | D+S                  | ③        | 1.2D+1.6L+0.5S    |
| ④       | D+0.75L+0.75Lr       | ④        | 1.2D+0.5L+1.6Lr   |
| ⑤       | D+0.75L+0.75S        | ⑤        | 1.2D+0.5L+1.6S    |
| ⑥       | D+0.6W               | ⑥        | 1.2D+1.6Lr+0.5W   |
| ⑦       | D+0.7E               | ⑦        | 1.2D+1.6S+0.5W    |
| ⑧       | D+0.75L+0.75Lr+0.45W | ⑧        | 1.2D+0.5L+0.5Lr+W |
| ⑨       | D+0.75L+0.75S+0.45W  | ⑨        | 1.2D+0.5L+0.5S+W  |
| ⑩       | D+0.75L+0.75S+0.525E | ⑩        | 1.2D+0.5L+0.2S+E  |
| ⑪       | 0.6D+0.6W            | ⑪        | 0.9D+W            |
| ⑫       | 0.6D+0.7E            | ⑫        | 0.9D+E            |

**BENDING MOMENTS Mu (k-ft/ft)**

| Comb |    |   |   |    |  |
|------|----|---|---|----|--|
| ①    | -1 | 1 | 0 | OK |  |
| ②    | -1 | 1 | 0 | OK |  |
| ③    | -1 | 1 | 0 | OK |  |
| ④    | -1 | 1 | 0 | OK |  |
| ⑤    | -1 | 1 | 0 | OK |  |
| ⑥    | -1 | 1 | 0 | OK |  |
| ⑦    | -1 | 1 | 0 | OK |  |
| ⑧    | -1 | 1 | 0 | OK |  |
| ⑨    | -1 | 1 | 0 | OK |  |
| ⑩    | -1 | 1 | 0 | OK |  |
| ⑪    | -1 | 0 | 0 | OK |  |
| ⑫    | -1 | 0 | 0 | OK |  |

**SHEAR FORCES Vu (k/ft)**

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 0.6 | -0.3 | OK |  |  |
| ②    | 0.8 | -0.4 | OK |  |  |
| ③    | 0.8 | -0.4 | OK |  |  |
| ④    | 0.6 | -0.3 | OK |  |  |
| ⑤    | 0.6 | -0.3 | OK |  |  |
| ⑥    | 0.5 | -0.3 | OK |  |  |
| ⑦    | 0.5 | -0.3 | OK |  |  |
| ⑧    | 0.6 | -0.3 | OK |  |  |
| ⑨    | 0.6 | -0.3 | OK |  |  |
| ⑩    | 0.6 | -0.3 | OK |  |  |
| ⑪    | 0.4 | -0.2 | OK |  |  |
| ⑫    | 0.4 | -0.2 | OK |  |  |

**BENDING STRENGTH (k-ft/ft)**

|                                   |             |                                   |                      |
|-----------------------------------|-------------|-----------------------------------|----------------------|
| Bot                               | 2#4 Cont    |                                   |                      |
| Bot                               | 2#4x4.00 ft |                                   |                      |
| d                                 | 1.5         | 1.5                               | 1.5 in               |
| +As                               | 0.20        | 0.20                              | 0.20 in <sup>2</sup> |
| c/d                               | 0.16        | 0.08                              | 0.16                 |
| +φMn                              | 5           | 4                                 | 5                    |
| Top                               | 2#4         |                                   |                      |
| d'                                | 1.5         | 1.5                               | 1.5 in               |
| -As                               | 0.20        |                                   | 0.20 in <sup>2</sup> |
| c/d                               | 0.12        |                                   | 0.12                 |
| -φMn                              | -5          |                                   | -5                   |
| As min = 0.13 in <sup>2</sup> /ft |             | As max = 0.97 in <sup>2</sup> /ft |                      |

**DEFLECTIONS**

|                                   |      |        |
|-----------------------------------|------|--------|
| Comb                              |      |        |
| D                                 | 0.00 | in     |
| L                                 | 0.00 | in     |
| Lr, S                             | 0.00 | in     |
| LS                                | 0.00 | in     |
| LT                                | 0.01 | in     |
| leff D                            | 220  | in4/ft |
| leff L                            | 220  | in4/ft |
| leff LS                           | 220  | in4/ft |
| λ                                 | 2.00 |        |
| LS = 0.30(L+Lr) LT = L+Lr+λ(D+LS) |      |        |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (k/ft)**

|     |     |      |
|-----|-----|------|
| φVc | 3.2 | -3.2 |
|-----|-----|------|

**REINFORCEMENT**

|                                   |      |    |
|-----------------------------------|------|----|
| Steel Area As min Ratio .....     | 0.65 | OK |
| Steel Area As max Ratio .....     | 0.21 | OK |
| Shrinkage As S&T Ratio .....      | 0.65 | OK |
| Rebars Min Spacing Smin Ratio ... | 0.09 | OK |
| Rebars Max Spacing Smax Ratio .   | 0.67 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.01  | OK |
| C    | Long-Term | 7617 | 480    | 0.06  | OK |
| D    | Long-Term | 7617 | 240    | 0.03  | OK |

A - Roofs not attached to non-structural elements.

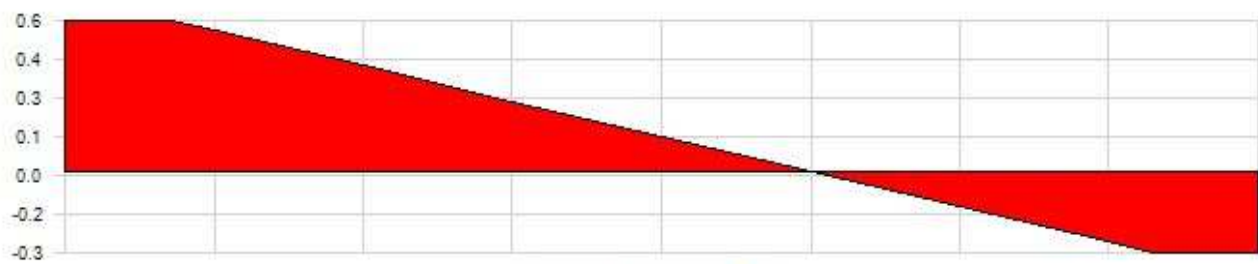
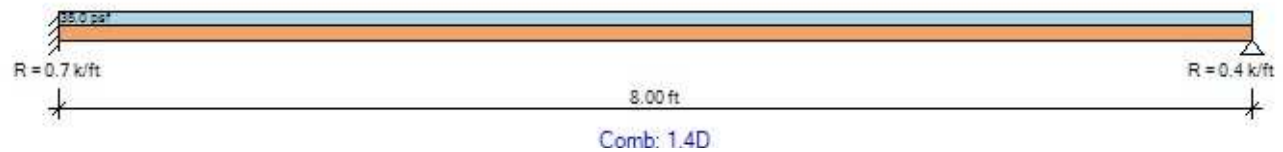
B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

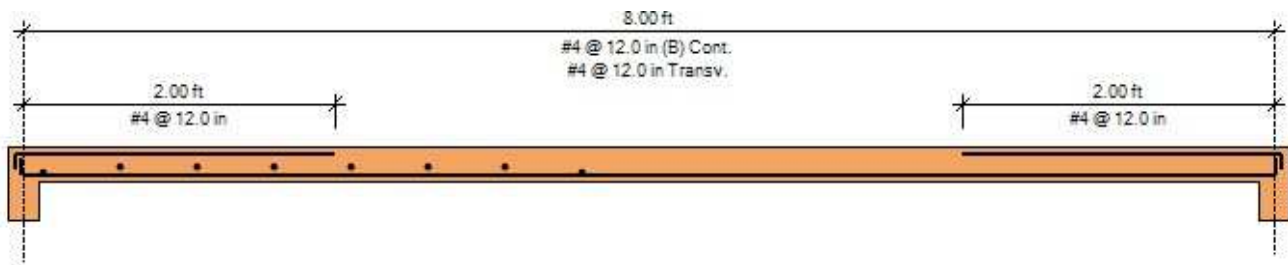
|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |



SHEAR DIAGRAM (k/ft)



MOMENT DIAGRAM (k-ft/ft)



SLAB ELEVATION



**GEOMETRY**

|                         |      |    |
|-------------------------|------|----|
| Slab Thickness t .....  | 8.0  | in |
| Effective Width b ..... | 12.0 | in |
| Support Length Ls ..... | 3.0  | in |
| Left Cantilever .....   | 0.00 | ft |
| Right Cantilever .....  | 6.33 | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |         | 2       |        |
|--------------------------|---------|---------|--------|
| Span                     | Length  | Support | Type   |
| ①                        | 1.00 ft | ①       | Pinned |
| ②                        | N.A.    | ②       | Pinned |
| ③                        | N.A.    | ③       | N.A.   |
| ④                        | N.A.    | ④       | N.A.   |
| ⑤                        | N.A.    | ⑤       | N.A.   |
|                          |         | ⑥       | N.A.   |

**SUPPORT REACTIONS (k/ft)**

| Comb |   |      |      |     |     |
|------|---|------|------|-----|-----|
| ①    | ① | -2.1 | -3.0 | 3.0 | 4.1 |
| ②    | ② | -2.5 | -2.8 | 3.5 | 3.8 |
| ③    | ③ | -2.1 | -2.6 | 3.0 | 3.5 |
| ④    | ④ | -2.4 | -3.2 | 3.4 | 4.4 |
| ⑤    | ⑤ | -2.1 | -2.6 | 3.0 | 3.5 |
| ⑥    | ⑥ | -2.1 | -3.2 | 3.0 | 4.4 |
| ⑦    | ⑦ | -2.1 | -2.6 | 3.0 | 3.5 |
| ⑧    | ⑧ | -2.4 | -2.8 | 3.4 | 3.8 |
| ⑨    | ⑨ | -2.1 | -2.6 | 3.0 | 3.5 |
| ⑩    | ⑩ | -2.1 | -2.6 | 3.0 | 3.5 |
| ⑪    | ⑪ | -1.3 | -1.9 | 1.8 | 2.7 |
| ⑫    | ⑫ | -1.3 | -1.9 | 1.8 | 2.7 |

**LOAD COMBINATIONS**

| SERVICE |                      | FACTORED |                   |
|---------|----------------------|----------|-------------------|
| ①       | D+L                  | ①        | 1.4D              |
| ②       | D+Lr                 | ②        | 1.2D+1.6L+0.5Lr   |
| ③       | D+S                  | ③        | 1.2D+1.6L+0.5S    |
| ④       | D+0.75L+0.75Lr       | ④        | 1.2D+0.5L+1.6Lr   |
| ⑤       | D+0.75L+0.75S        | ⑤        | 1.2D+0.5L+1.6S    |
| ⑥       | D+0.6W               | ⑥        | 1.2D+1.6Lr+0.5W   |
| ⑦       | D+0.7E               | ⑦        | 1.2D+1.6S+0.5W    |
| ⑧       | D+0.75L+0.75Lr+0.45W | ⑧        | 1.2D+0.5L+0.5Lr+W |
| ⑨       | D+0.75L+0.75S+0.45W  | ⑨        | 1.2D+0.5L+0.5S+W  |
| ⑩       | D+0.75L+0.75S+0.525E | ⑩        | 1.2D+0.5L+0.2S+E  |
| ⑪       | 0.6D+0.6W            | ⑪        | 0.9D+W            |
| ⑫       | 0.6D+0.7E            | ⑫        | 0.9D+E            |

**BENDING MOMENTS Mu (k-ft/ft)**

| Comb |    |   |    |    |  |
|------|----|---|----|----|--|
| ①    | -1 | 0 | -3 | OK |  |
| ②    | -1 | 0 | -3 | OK |  |
| ③    | -1 | 0 | -3 | OK |  |
| ④    | -1 | 0 | -3 | OK |  |
| ⑤    | -1 | 0 | -3 | OK |  |
| ⑥    | -1 | 0 | -3 | OK |  |
| ⑦    | -1 | 0 | -3 | OK |  |
| ⑧    | -1 | 0 | -3 | OK |  |
| ⑨    | -1 | 0 | -3 | OK |  |
| ⑩    | -1 | 0 | -3 | OK |  |
| ⑪    | -1 | 0 | -2 | OK |  |
| ⑫    | -1 | 0 | -2 | OK |  |

**SHEAR FORCES Vu (k/ft)**

| Comb |      |      |     |    |  |
|------|------|------|-----|----|--|
| ①    | -3.1 | -3.1 | 0.9 | OK |  |
| ②    | -2.9 | -2.8 | 0.8 | OK |  |
| ③    | -2.7 | -2.6 | 0.7 | OK |  |
| ④    | -3.3 | -3.3 | 0.9 | OK |  |
| ⑤    | -2.7 | -2.6 | 0.7 | OK |  |
| ⑥    | -3.3 | -3.3 | 0.9 | OK |  |
| ⑦    | -2.7 | -2.6 | 0.7 | OK |  |
| ⑧    | -2.9 | -2.8 | 0.8 | OK |  |
| ⑨    | -2.7 | -2.6 | 0.7 | OK |  |
| ⑩    | -2.7 | -2.6 | 0.7 | OK |  |
| ⑪    | -2.0 | -2.0 | 0.6 | OK |  |
| ⑫    | -2.0 | -2.0 | 0.6 | OK |  |

**BENDING STRENGTH (k-ft/ft)**

|                                   |             |                                   |                      |
|-----------------------------------|-------------|-----------------------------------|----------------------|
| Bot                               | 2#4 Cont    |                                   |                      |
| Bot                               | 2#4x0.00 ft |                                   |                      |
| d                                 | 1.5         | 1.5                               | 1.5 in               |
| +As                               | 0.20        | 0.20                              | 0.20 in <sup>2</sup> |
| c/d                               | 0.11        | 0.06                              | 0.11                 |
| +φMn                              | 7           | 6                                 | 7                    |
| Top                               | 2#4         |                                   |                      |
| d'                                | 1.5         | 1.5                               | 1.5 in               |
| -As                               | 0.20        |                                   | 0.20 in <sup>2</sup> |
| c/d                               | 0.09        |                                   | 0.09                 |
| -φMn                              | -7          |                                   | -7                   |
| As min = 0.17 in <sup>2</sup> /ft |             | As max = 1.40 in <sup>2</sup> /ft |                      |

**DEFLECTIONS**

|                                   |      |           |    |
|-----------------------------------|------|-----------|----|
| Comb                              |      |           |    |
| D                                 | 0.00 | 0.02      | in |
| L                                 | 0.00 | 0.00      | in |
| Lr, S                             | 0.00 | 0.00      | in |
| LS                                | 0.00 | 0.00      | in |
| LT                                | 0.00 | 0.05      | in |
| leff D                            | 522  | 530in4/ft |    |
| leff L                            | 522  | 530in4/ft |    |
| leff LS                           | 522  | 530in4/ft |    |
| λ                                 | 2.00 | 2.00      |    |
| LS = 0.30(L+Lr) LT = L+Lr+λ(D+LS) |      |           |    |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (k/ft)**

|     |     |      |     |
|-----|-----|------|-----|
| φVc | 4.1 | -4.1 | 4.1 |
|-----|-----|------|-----|

**REINFORCEMENT**

|                    |                    |      |    |
|--------------------|--------------------|------|----|
| Steel Area         | As min Ratio ..... | 0.86 | OK |
| Steel Area         | As max Ratio ..... | 0.14 | OK |
| Shrinkage          | As S&T Ratio ..... | 0.86 | OK |
| Rebars Min Spacing | Smin Ratio ...     | 0.09 | OK |
| Rebars Max Spacing | Smax Ratio .       | 0.67 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 90     | 0.01  | OK |
| B    | Live Load | 9999 | 180    | 0.00  | OK |
| C    | Long-Term | 1491 | 240    | 0.16  | OK |
| D    | Long-Term | 1491 | 120    | 0.08  | OK |

A - Roofs not attached to non-structural elements.

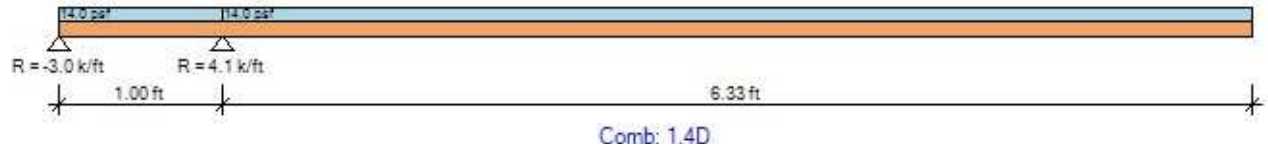
B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

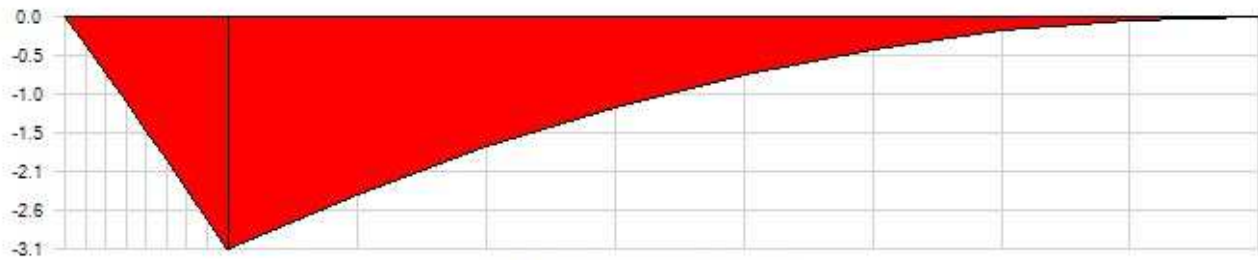
D - Attached to elements not likely to be damaged.

**MATERIALS**

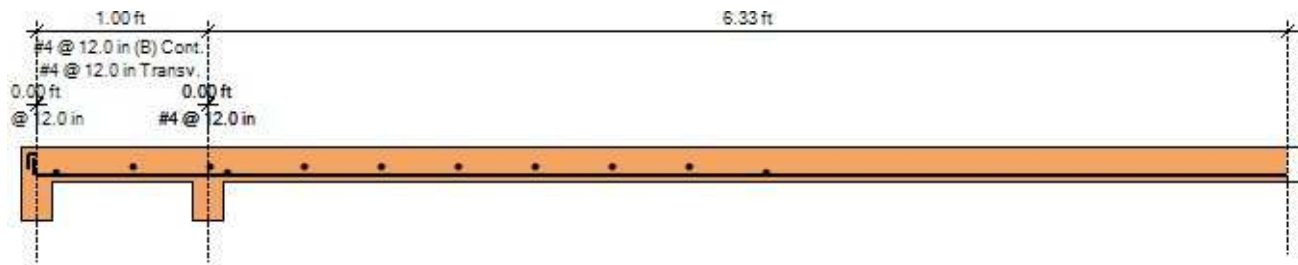
|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |



SHEAR DIAGRAM (k/ft)



MOMENT DIAGRAM (k-ft/ft)



SLAB ELEVATION



Project: CASA PA' FERNANDZ

Page # \_\_\_\_\_

Engineer:

10/17/2024

Descrip: HOUSE S1

ASDIP Concrete 5.4.2.2

**ONE-WAY SLAB DESIGN**

www.asdipsoft.com

**GEOMETRY**

Slab Thickness  $t$  ..... 7.0 in  
 Effective Width  $b$  ..... 12.0 in  
 Support Length  $L_s$  ..... 8.0 in  
 Left Cantilever ..... 0.00 ft  
 Right Cantilever ..... 0.00 ft

**BEAM SUPPORTS**

| Number of Supports ..... |         | 2       |       |
|--------------------------|---------|---------|-------|
| Span                     | Length  | Support | Type  |
| ①                        | 8.00 ft | ①       | Fixed |
| ②                        | N.A.    | ②       | Fixed |
| ③                        | N.A.    | ③       | N.A.  |
| ④                        | N.A.    | ④       | N.A.  |
| ⑤                        | N.A.    | ⑤       | N.A.  |
|                          |         | ⑥       | N.A.  |

**SUPPORT REACTIONS (k/ft)**

| Comb |   |     |     |     |     |
|------|---|-----|-----|-----|-----|
| ①    | ① | 0.4 | 0.6 | 0.5 | 0.6 |
| ②    | ② | 0.6 | 0.6 | 0.6 | 0.6 |
| ③    | ③ | 0.4 | 0.5 | 0.5 | 0.5 |
| ④    | ④ | 0.5 | 0.7 | 0.5 | 0.7 |
| ⑤    | ⑤ | 0.4 | 0.5 | 0.5 | 0.5 |
| ⑥    | ⑥ | 0.4 | 0.7 | 0.5 | 0.7 |
| ⑦    | ⑦ | 0.4 | 0.5 | 0.5 | 0.5 |
| ⑧    | ⑧ | 0.5 | 0.6 | 0.5 | 0.6 |
| ⑨    | ⑨ | 0.4 | 0.5 | 0.5 | 0.5 |
| ⑩    | ⑩ | 0.4 | 0.5 | 0.5 | 0.5 |
| ⑪    | ⑪ | 0.3 | 0.4 | 0.3 | 0.4 |
| ⑫    | ⑫ | 0.3 | 0.4 | 0.3 | 0.4 |

**LOAD COMBINATIONS**

| SERVICE |                      | FACTORED |                   |
|---------|----------------------|----------|-------------------|
| ①       | D+L                  | ①        | 1.4D              |
| ②       | D+Lr                 | ②        | 1.2D+1.6L+0.5Lr   |
| ③       | D+S                  | ③        | 1.2D+1.6L+0.5S    |
| ④       | D+0.75L+0.75Lr       | ④        | 1.2D+0.5L+1.6Lr   |
| ⑤       | D+0.75L+0.75S        | ⑤        | 1.2D+0.5L+1.6S    |
| ⑥       | D+0.6W               | ⑥        | 1.2D+1.6Lr+0.5W   |
| ⑦       | D+0.7E               | ⑦        | 1.2D+1.6S+0.5W    |
| ⑧       | D+0.75L+0.75Lr+0.45W | ⑧        | 1.2D+0.5L+0.5Lr+W |
| ⑨       | D+0.75L+0.75S+0.45W  | ⑨        | 1.2D+0.5L+0.5S+W  |
| ⑩       | D+0.75L+0.75S+0.525E | ⑩        | 1.2D+0.5L+0.2S+E  |
| ⑪       | 0.6D+0.6W            | ⑪        | 0.9D+W            |
| ⑫       | 0.6D+0.7E            | ⑫        | 0.9D+E            |

**BENDING MOMENTS  $M_u$  (k-ft/ft)**

| Comb |    |   |    |    |  |
|------|----|---|----|----|--|
| ①    | -1 | 0 | -1 | OK |  |
| ②    | -1 | 0 | -1 | OK |  |
| ③    | -1 | 0 | -1 | OK |  |
| ④    | -1 | 0 | -1 | OK |  |
| ⑤    | -1 | 0 | -1 | OK |  |
| ⑥    | -1 | 0 | -1 | OK |  |
| ⑦    | -1 | 0 | -1 | OK |  |
| ⑧    | -1 | 0 | -1 | OK |  |
| ⑨    | -1 | 0 | -1 | OK |  |
| ⑩    | -1 | 0 | -1 | OK |  |
| ⑪    | -1 | 0 | -1 | OK |  |
| ⑫    | -1 | 0 | -1 | OK |  |

**SHEAR FORCES  $V_u$  (k/ft)**

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 0.5 | -0.5 | OK |  |  |
| ②    | 0.5 | -0.5 | OK |  |  |
| ③    | 0.4 | -0.4 | OK |  |  |
| ④    | 0.6 | -0.6 | OK |  |  |
| ⑤    | 0.4 | -0.4 | OK |  |  |
| ⑥    | 0.6 | -0.6 | OK |  |  |
| ⑦    | 0.4 | -0.4 | OK |  |  |
| ⑧    | 0.5 | -0.5 | OK |  |  |
| ⑨    | 0.4 | -0.4 | OK |  |  |
| ⑩    | 0.4 | -0.4 | OK |  |  |
| ⑪    | 0.3 | -0.3 | OK |  |  |
| ⑫    | 0.3 | -0.3 | OK |  |  |

**BENDING STRENGTH (k-ft/ft)**

|                                   |             |                                   |                      |
|-----------------------------------|-------------|-----------------------------------|----------------------|
| Bot                               | 2#4 Cont    |                                   |                      |
| Bot                               | 2#4x4.00 ft |                                   |                      |
| d                                 | 1.5         | 1.5                               | 1.5 in               |
| +As                               | 0.20        | 0.20                              | 0.20 in <sup>2</sup> |
| c/d                               | 0.13        | 0.06                              | 0.13                 |
| +φMn                              | 6           | 5                                 | 6                    |
| Top                               | 2#4         |                                   |                      |
| d'                                | 1.5         | 1.5                               | 1.5 in               |
| -As                               | 0.20        |                                   | 0.20 in <sup>2</sup> |
| c/d                               | 0.10        |                                   | 0.10                 |
| -φMn                              | -6          |                                   | -6                   |
| As min = 0.15 in <sup>2</sup> /ft |             | As max = 1.18 in <sup>2</sup> /ft |                      |

**DEFLECTIONS**

|                                   |      |  |        |
|-----------------------------------|------|--|--------|
| Comb                              |      |  |        |
| D                                 | 0.00 |  | in     |
| L                                 | 0.00 |  | in     |
| Lr, S                             | 0.00 |  | in     |
| LS                                | 0.00 |  | in     |
| LT                                | 0.00 |  | in     |
| leff D                            | 350  |  | in4/ft |
| leff L                            | 350  |  | in4/ft |
| leff LS                           | 350  |  | in4/ft |
| λ                                 | 2.00 |  |        |
| LS = 0.30(L+Lr) LT = L+Lr+λ(D+LS) |      |  |        |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (k/ft)**

|     |     |      |
|-----|-----|------|
| φVc | 3.7 | -3.7 |
|-----|-----|------|

**REINFORCEMENT**

|                                   |      |    |
|-----------------------------------|------|----|
| Steel Area As min Ratio .....     | 0.76 | OK |
| Steel Area As max Ratio .....     | 0.17 | OK |
| Shrinkage As S&T Ratio .....      | 0.76 | OK |
| Rebars Min Spacing Smin Ratio ... | 0.09 | OK |
| Rebars Max Spacing Smax Ratio .   | 0.67 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 9999 | 480    | 0.02  | OK |
| D    | Long-Term | 9999 | 240    | 0.01  | OK |

A - Roofs not attached to non-structural elements.

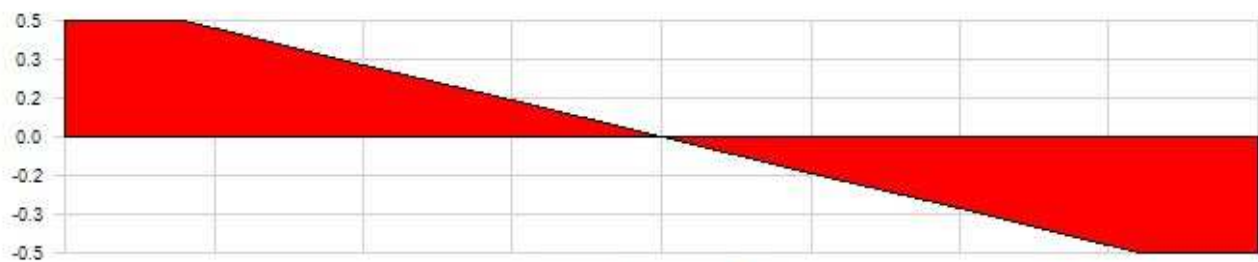
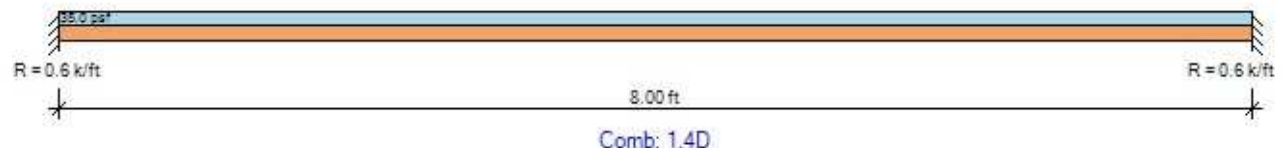
B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

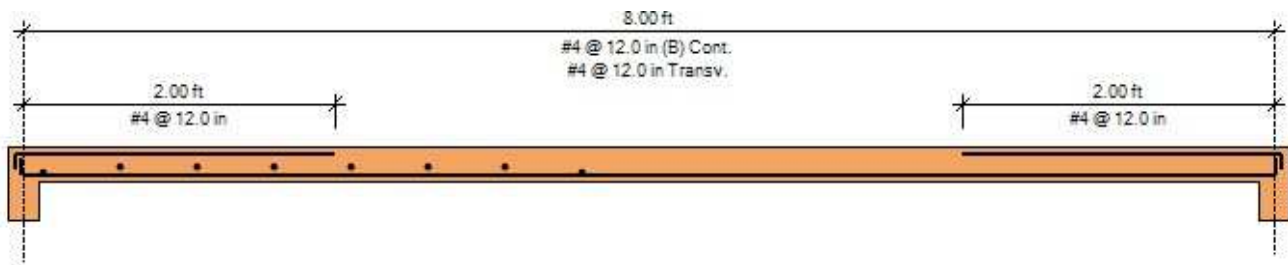
|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |



SHEAR DIAGRAM (k/ft)

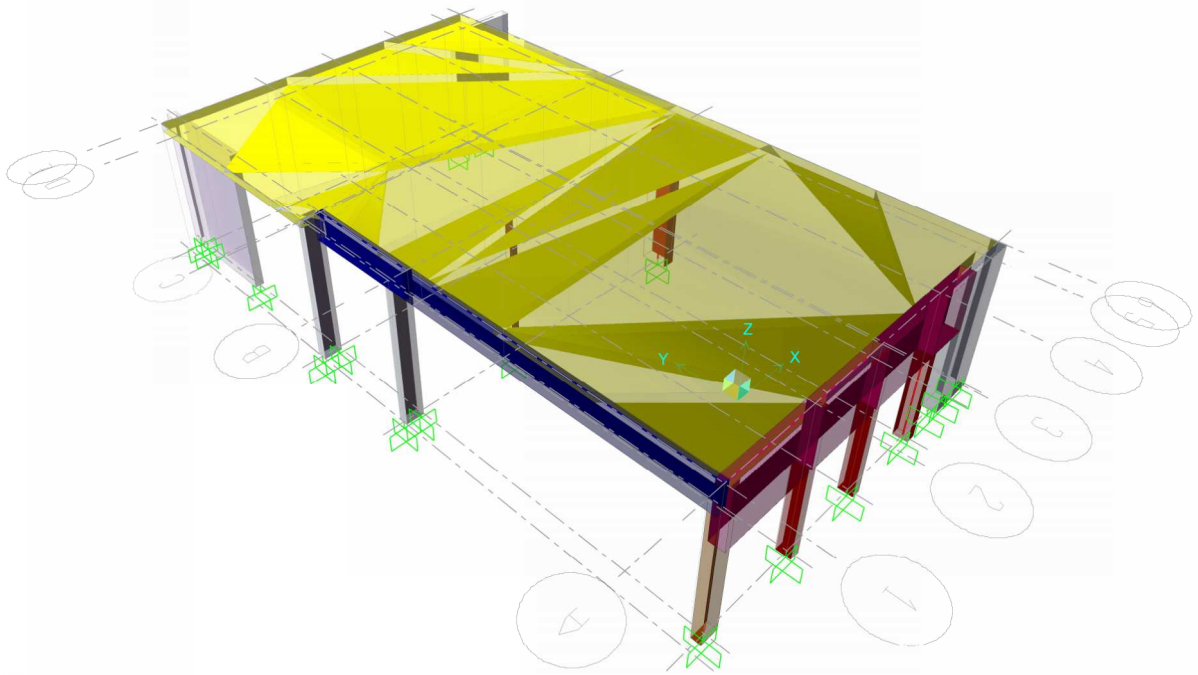


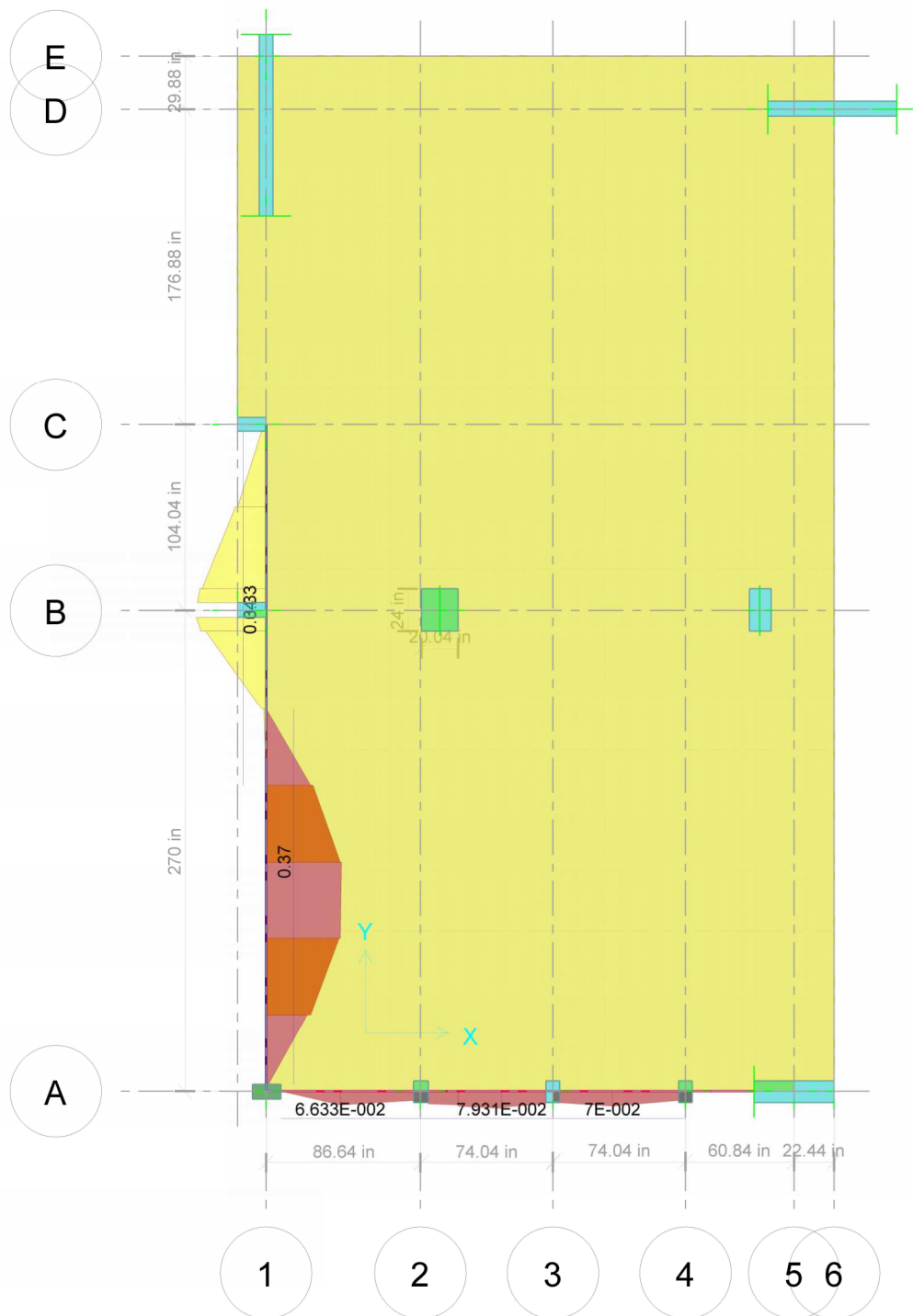
MOMENT DIAGRAM (k-ft/ft)

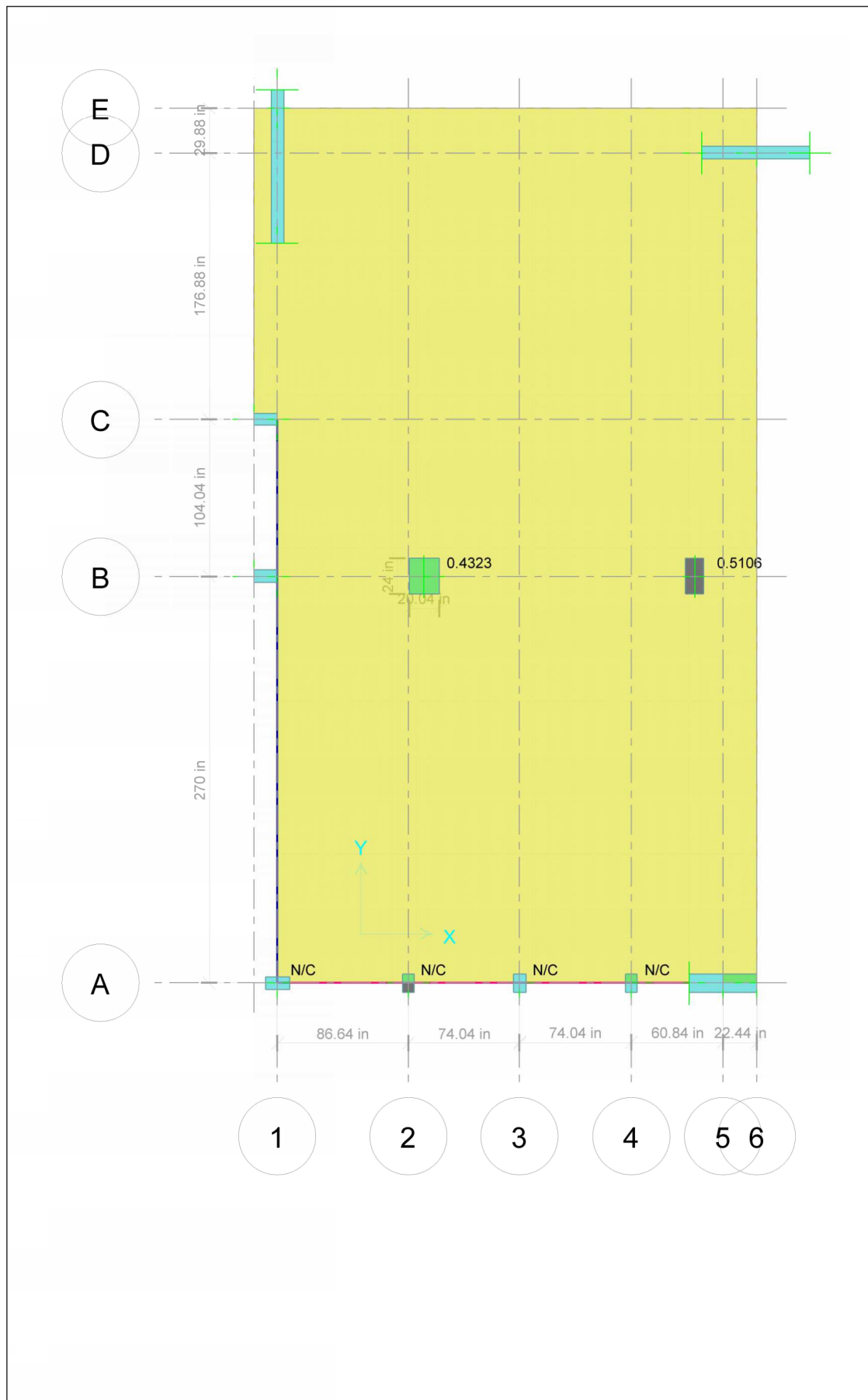


SLAB ELEVATION

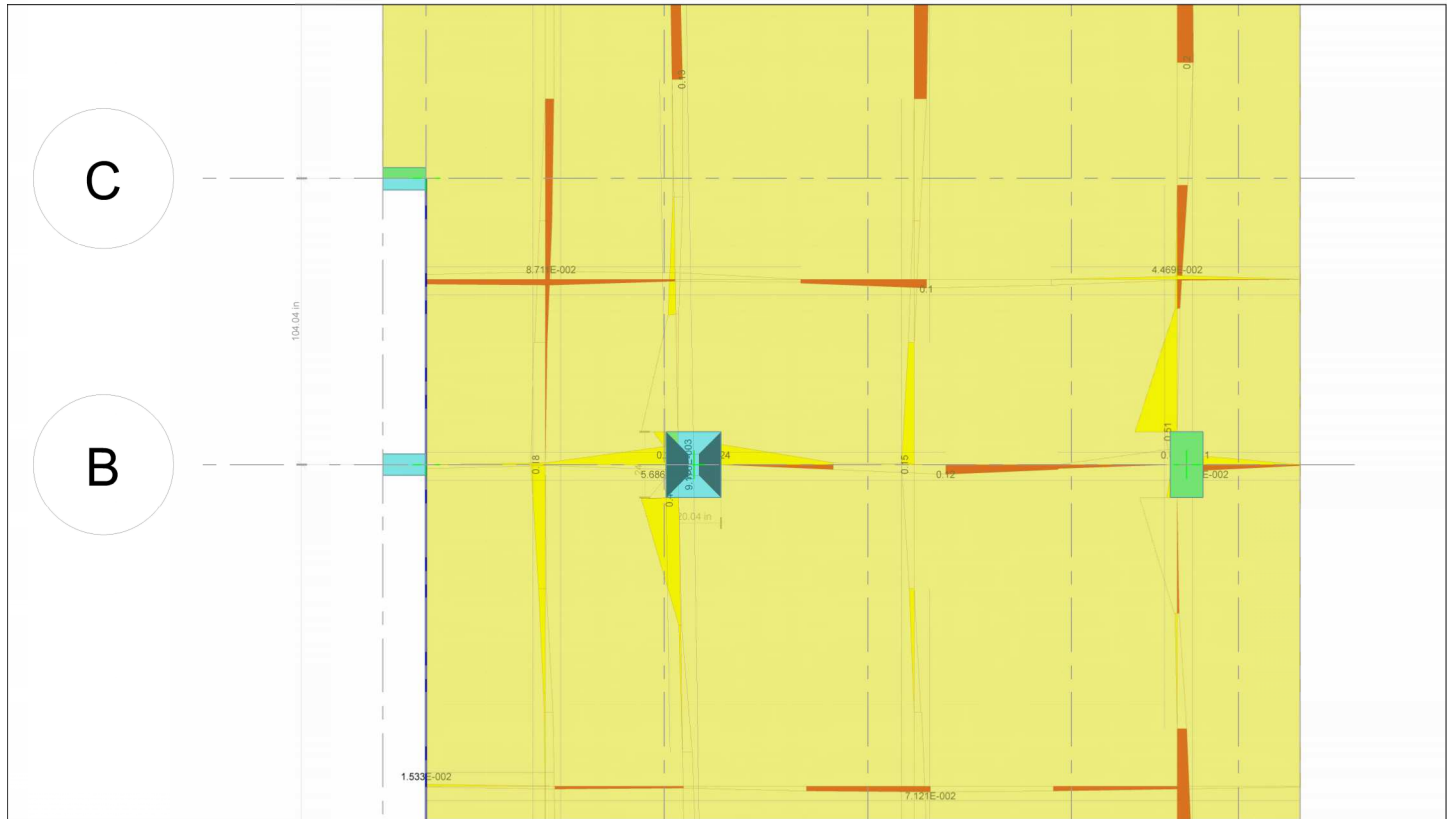


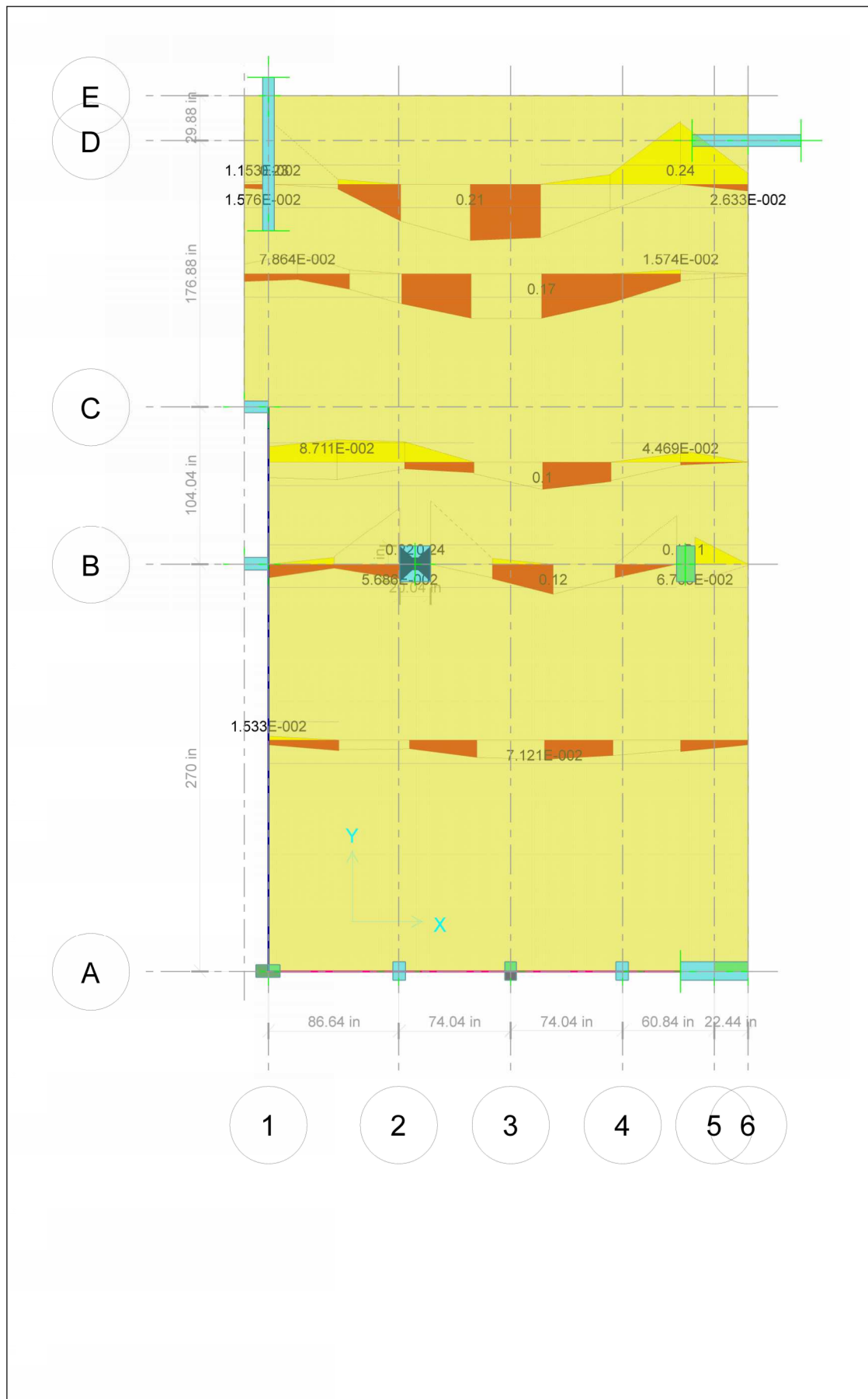


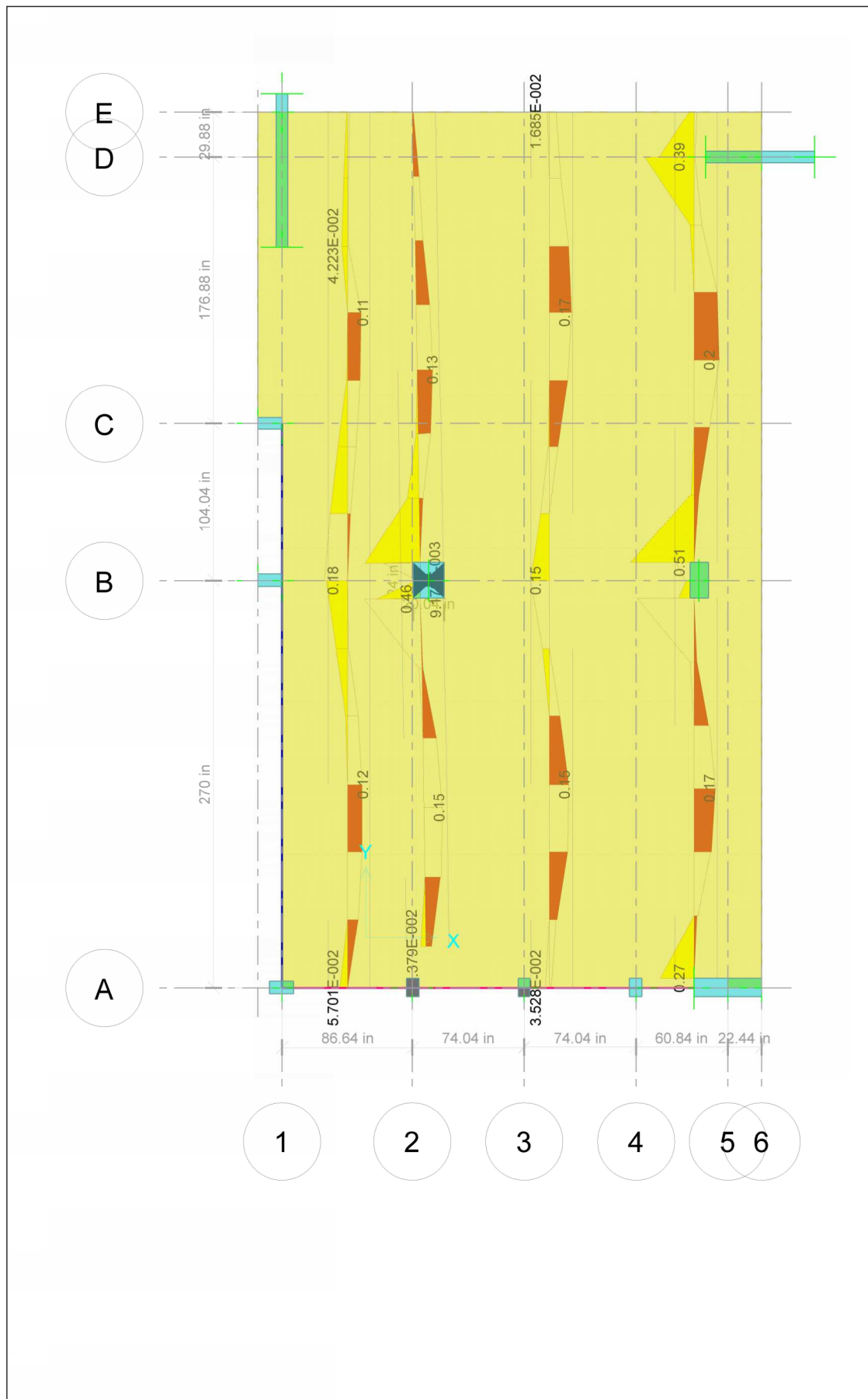




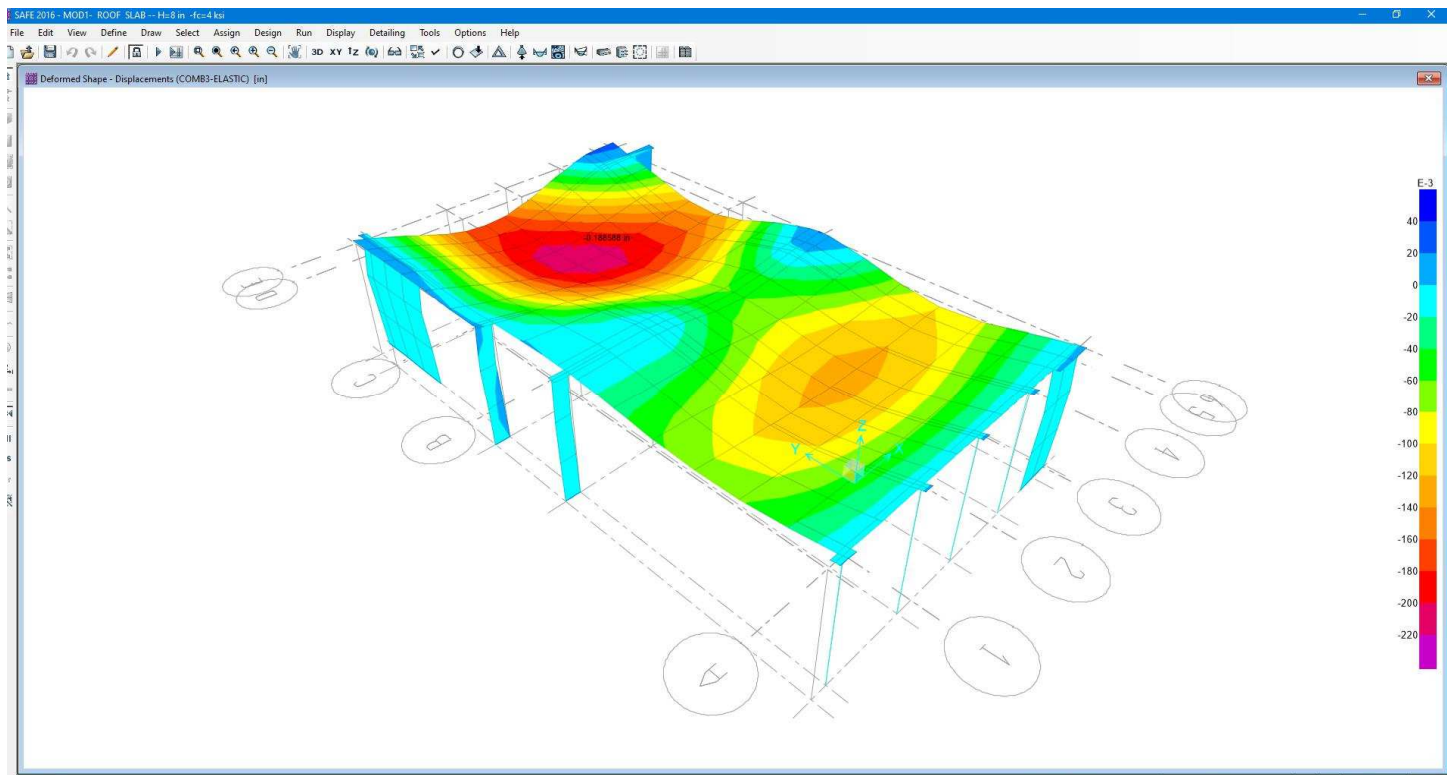












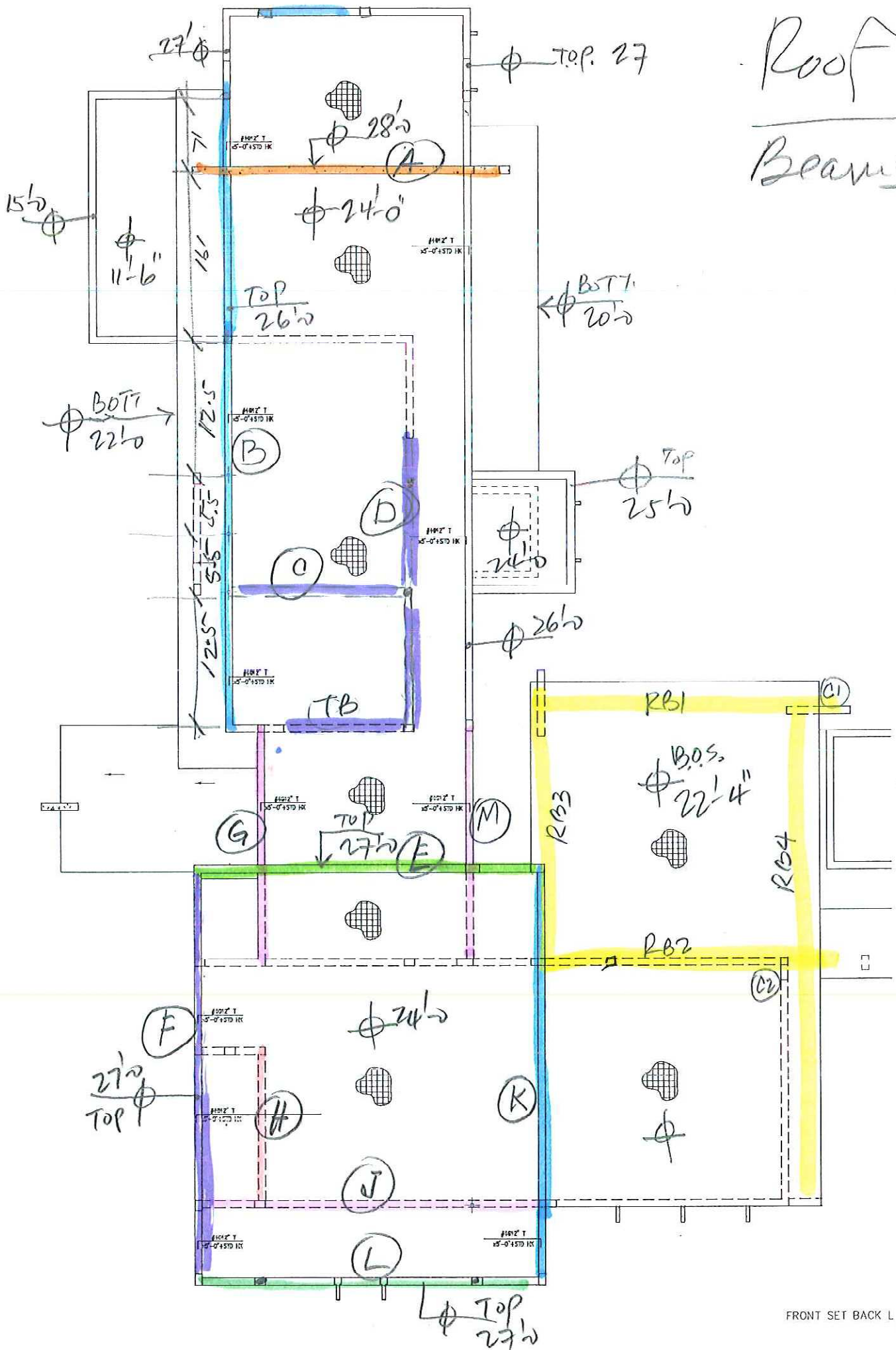
Total Inst. Displacement ===== 1.0 D + 1.0 L

Max = 0.20 in



## *Roof Beams*

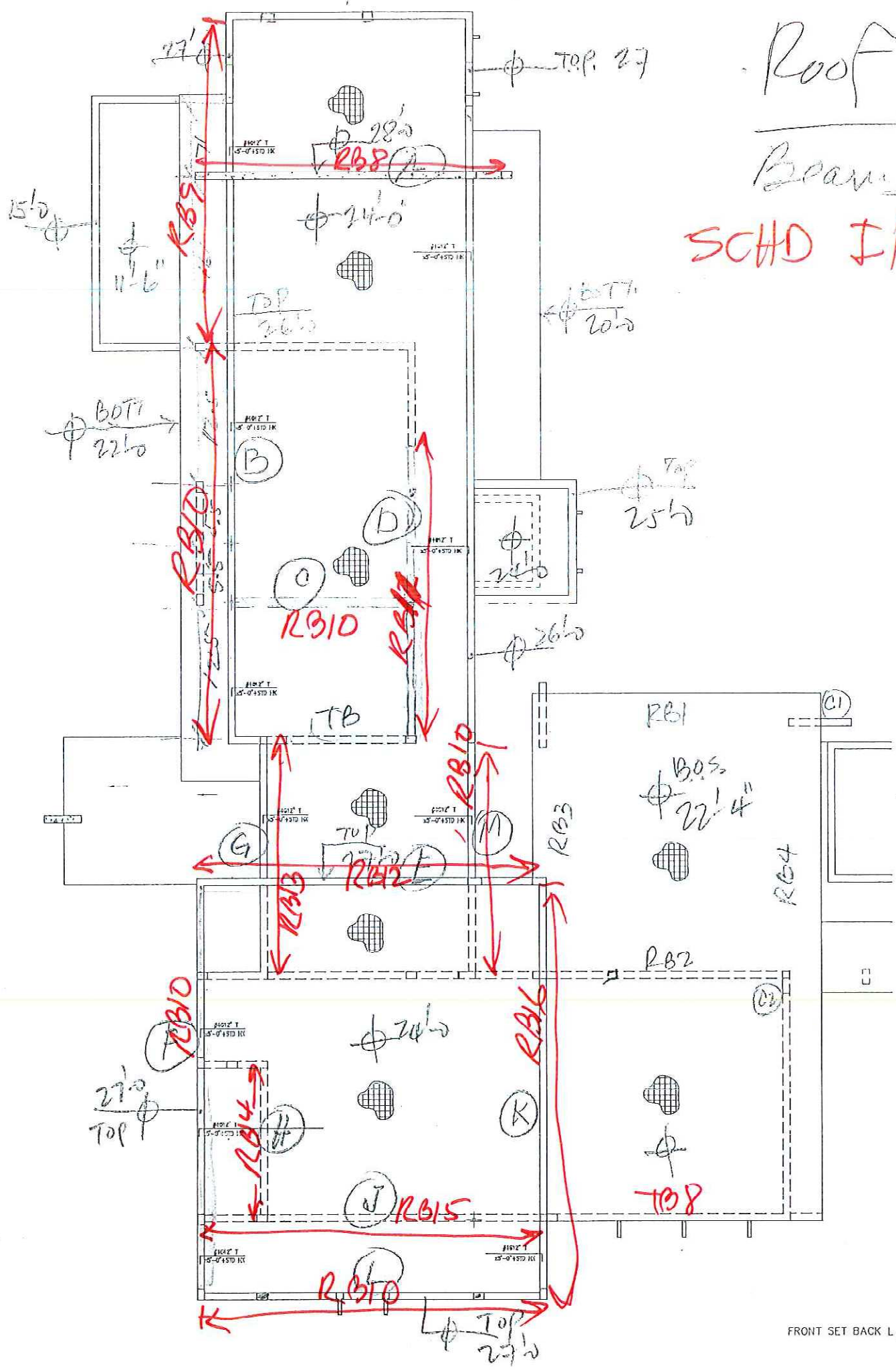
# Roof Beams



Roof

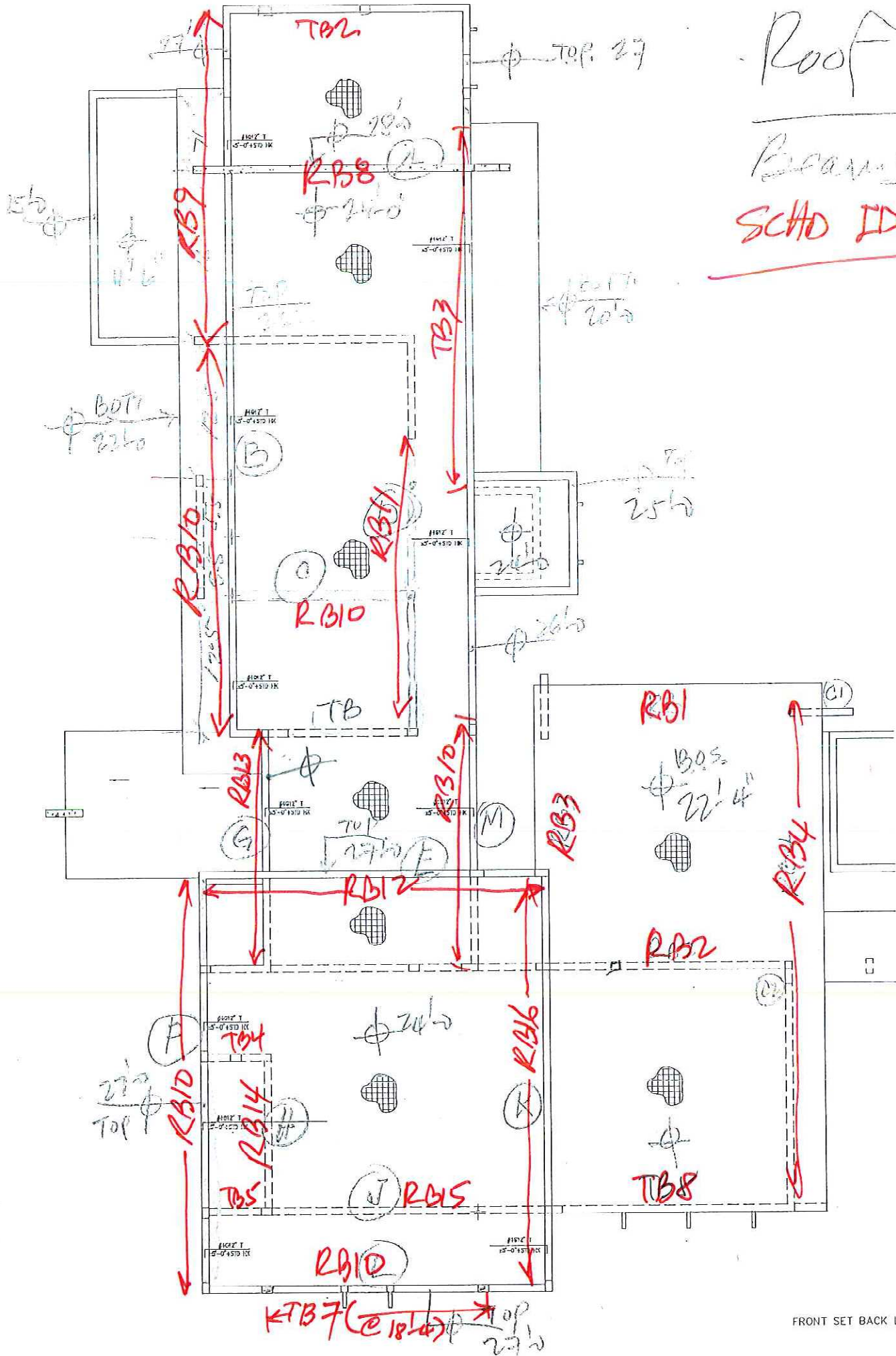
Beams

SCHD IP





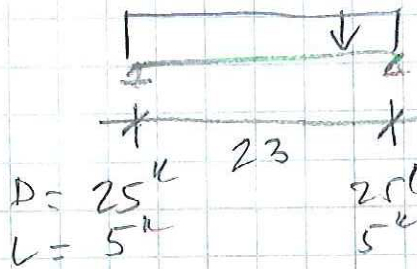
Roof  
Beams  
SCHED ID



# Roof Beams

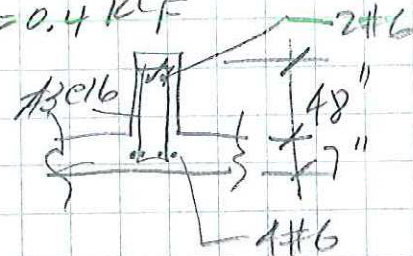
Beam (A)

**R.B.8**

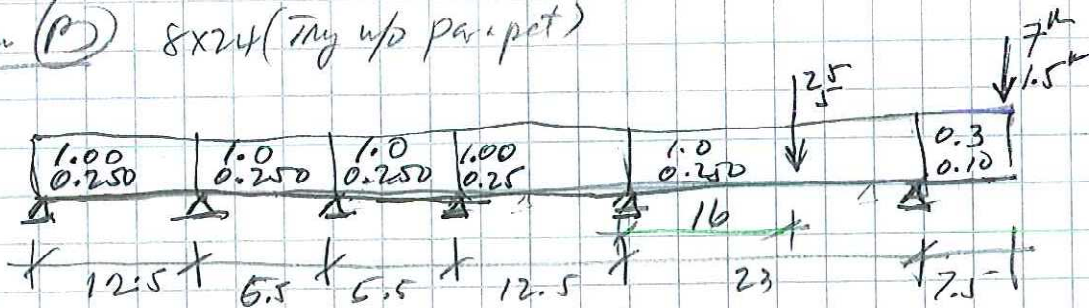


$$D = 1.5 \text{ KLF}$$

$$L = 0.4 \text{ KLF}$$



Beam (B) 8x24 (Tie w/ par. pet)

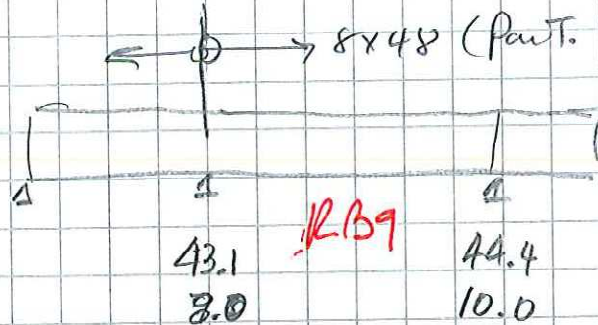


|   |     |      |     |      |      |      |
|---|-----|------|-----|------|------|------|
| D | 6.1 | 14.5 | 7.7 | -1.0 | 38.8 | 40.7 |
| L | 1.4 | 3.1  | 1.5 | -0.3 | 8.0  | 10.0 |

8x24  
2 #6 T/B  
#3 @ 10"

**R.B.10**

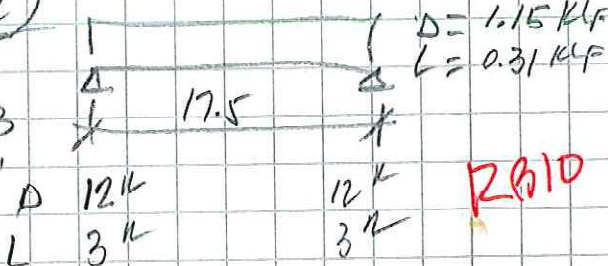
8x48 (Par. T. upturned)  
4 #6 T/B  
#3 @ 10"



**R.B.9**

Beam (C)

8x24  
2 #6 T/B  
#3 @ 10"



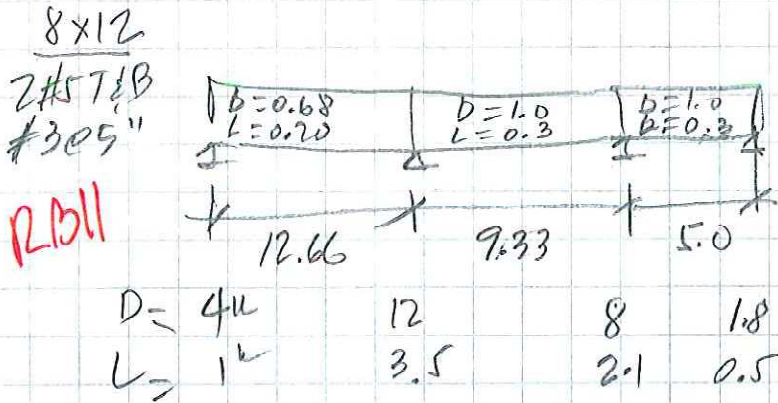
$$D = 1.15 \text{ KLF}$$

$$L = 0.31 \text{ KLF}$$

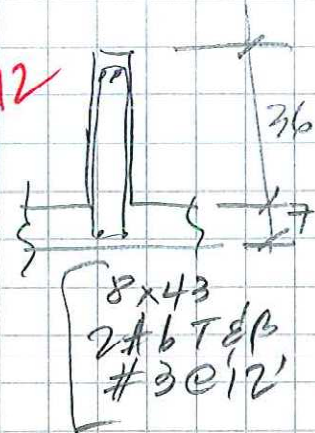
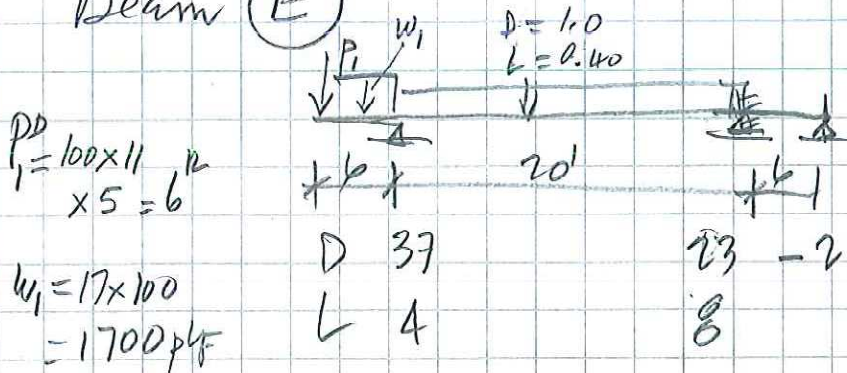
**R.B.10**



Beam (D)

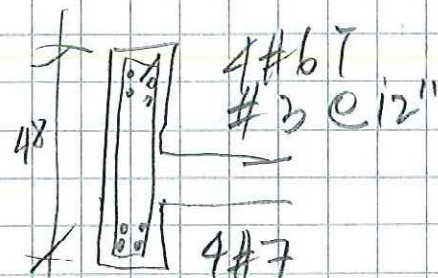
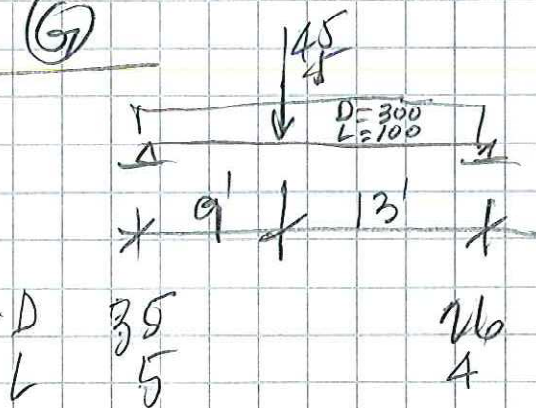


Beam (E)



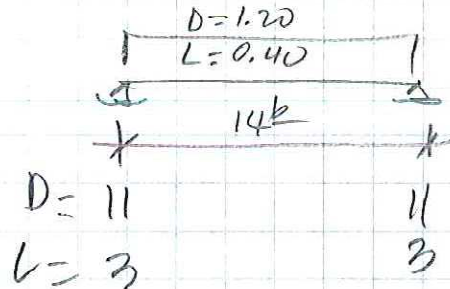
Beam (G)

8x48

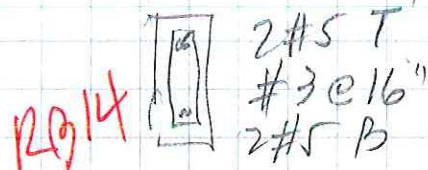


RB13

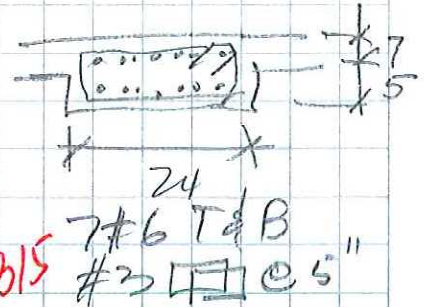
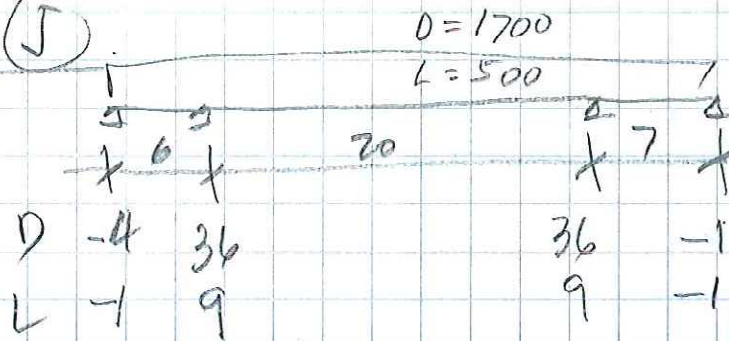
Beam (H)



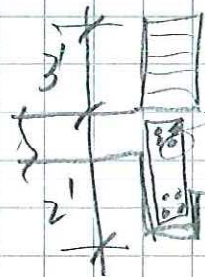
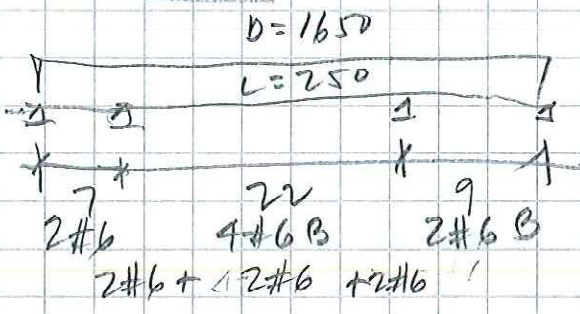
8x36



Beam (J)



Beam (K)



4#6 T & B  
#3 @ 8"

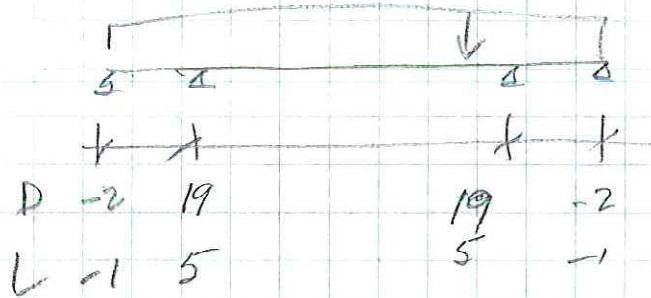
R316

|    |             |             |       |
|----|-------------|-------------|-------|
| B  | 2#6         | 4#6 B       | 2#6 B |
| T  | 2#6 + 1#2#6 | 2#6 + 1#2#6 | 2#6   |
| D: | 37k         | 37          | 1.5   |
| L: | 6"          | 6           | 1.0   |



Beam (L)

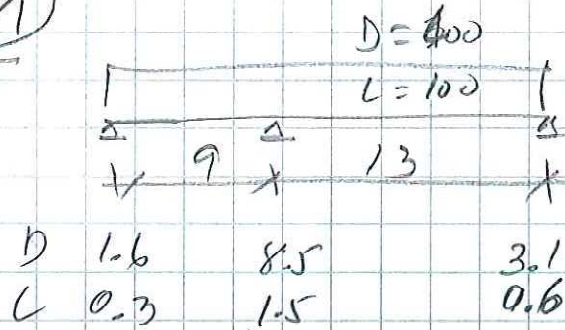
8x24  
2#5 T & B  
#3 @ 10"



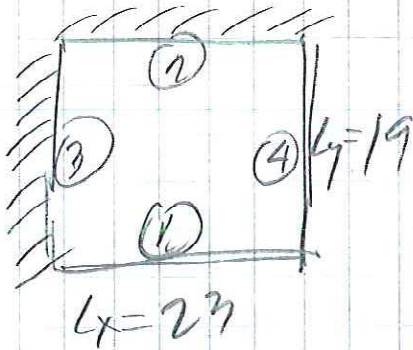
RBD

Beam (M)

8x24  
2#5 T & B  
#3 @ 10"



RBD



$$t = \frac{1.1 \times 23}{36 + 9\beta} = \frac{1.1 \times 23}{36 + 10} = 0.55$$

$$\beta = 1.21 \quad 7" \text{ TAIL}$$

$$DL = 90 \text{ psf}$$

$$AOL = 25 \text{ psf}$$

$$LL = 30 \text{ psf}$$

$$\xi = \frac{L_y}{L_x} = 0.82$$

$$R_4 = 0.15 \times 115 \times 19 \times 23 \div 19 = 0.400 \text{ KLF} / 0.105 \text{ KLF}$$

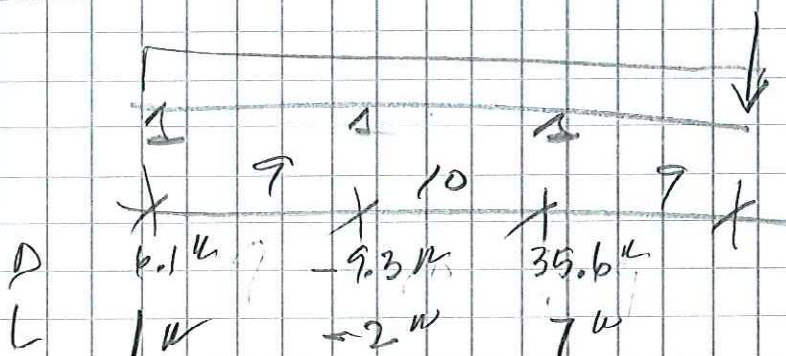
$$R_1 = 0.215 \times 115 \times 19 \times 23 \div 23 = 0.470 \text{ KLF} / 0.122 \text{ KLF}$$

$$R_3 = 0.26 \times 115 \times 19 \times 23 \div 19 = 0.687 \text{ KLF} / 0.179 \text{ KLF}$$

$$D = 115 \times 9 \times 9 \times 0.31 \div 9 = 321 \text{ PLF}$$

$$L = 30 \times 9 \times 9 \times 0.31 \div 9 = 83 \text{ PLF}$$

Revised VRB4



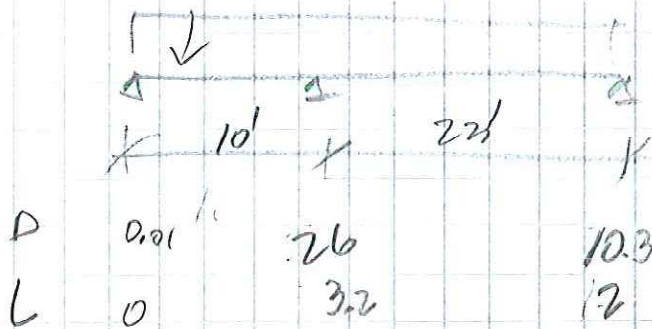
$$D = 0.400$$

$$L = 0.100$$

12x32 4#6 T & B  
#3 @ 12



### Revised URB2



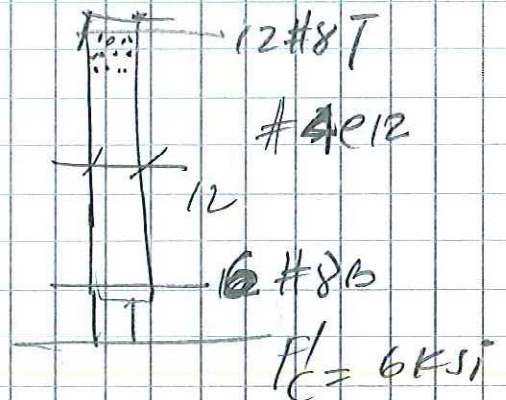
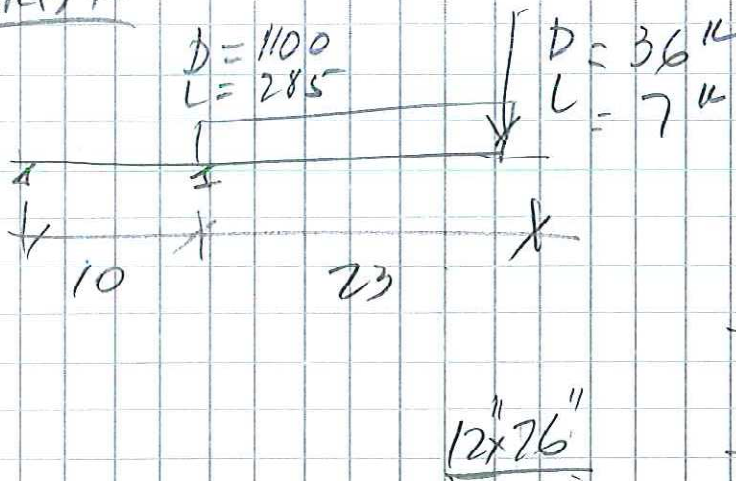
$$D = 115 \times 4.5' = 700$$

$$L = 30 \times 4.5' = 135$$

$$12 \times 32 \quad 3\#6 \text{ T \& B}$$

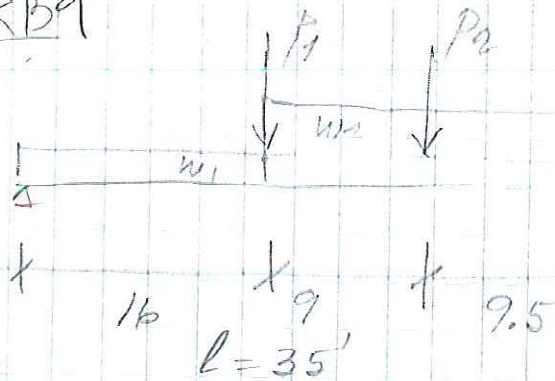
$$\#3 @ 12$$

### URB7





RBD



$$w_{D1} = 150 \text{ p/ft}$$

$$w_{L1} = 150$$

$$w_{D2} = 30 \times 5 = 150$$

$$w_{L2} = 125 \times 5 = 625$$

$$P_{1D} = 4.5' \times 115 \times 5 + 300 \times 5 + 60 \times 2.5 \times 5 + 60 \times 10 \times 5 = 8 \text{ k}$$

$$P_{1L} = 4.5' \times 30 \times 5 = 0.7 \text{ k}$$

$$P_{2D} = 9.25 \times 115 \times 5 + 300 \times 5 + 60 \times 10 \times 5 \approx 10 \text{ k}$$

$$P_{2L} = 1.5 \text{ k}$$

$$R_A = 17 \text{ k} \quad R_B = 26 \text{ k}$$

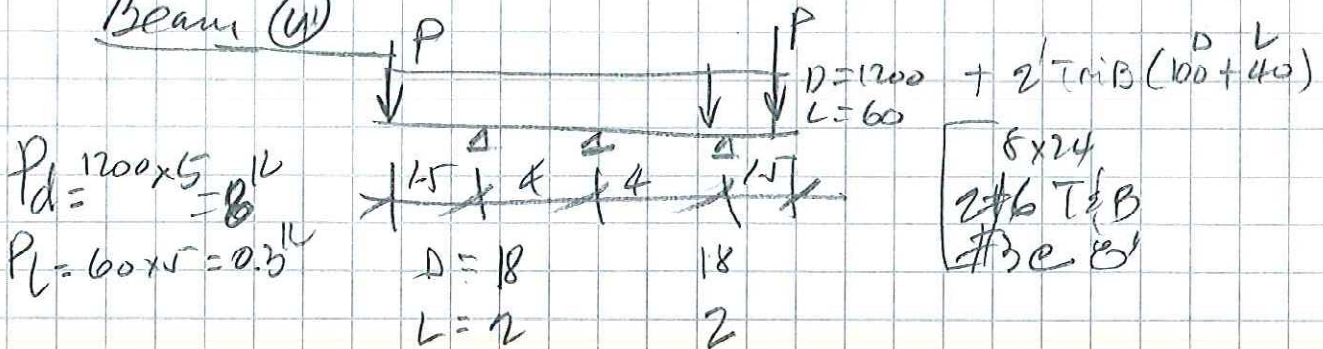
$$W18 \times 40 [14] (1/8)$$

Roof  $11' \times 11'$   
 $6" \text{ THK} \rightarrow DL = 75 \text{ plf}$   
 $ACL = 25 \text{ psf}$   
 $100 \text{ psf}$   
 $IL = 30 \text{ psf}$

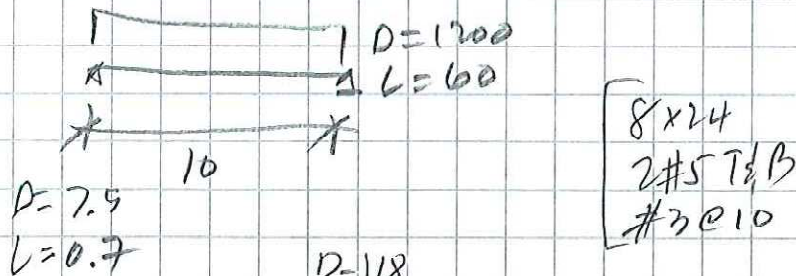
on each Side:  $D = 275 \text{ plf}$   
 $L = 100 \text{ plf}$   
 Parapet to  
 Wall  $\rightarrow D = 12 \times 65 = 780 \text{ plf}$

Load on Beams  $D = 1200 \text{ plf}$   
 $L = 60 \text{ plf}$

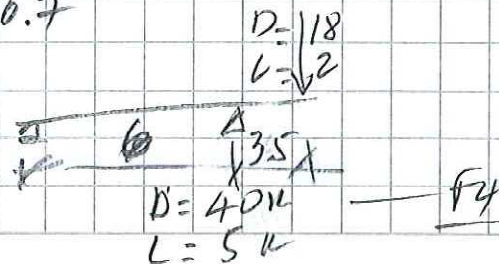
Beam (U)



Beam (W)

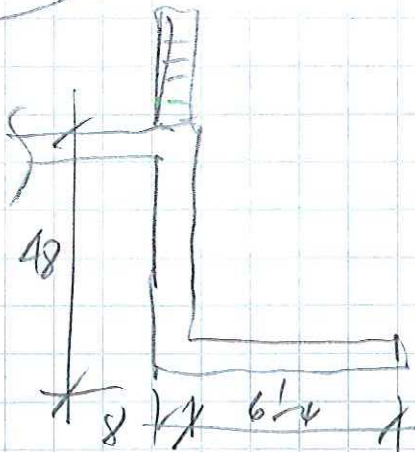


Beam (V)





TR33



Eye brow

$$h = \frac{L}{10} = \frac{76}{10} = 7.6$$

make  $\Phi$ "/check  $\delta$

$$\left. \begin{array}{l} DL - 100 \\ ADL - 10 \\ LL - 30 \end{array} \right\}$$

$$UTL = 0.165$$

$$M_u = \frac{0.165 \times 6.3^2}{2} = 3.27 \text{ k}$$

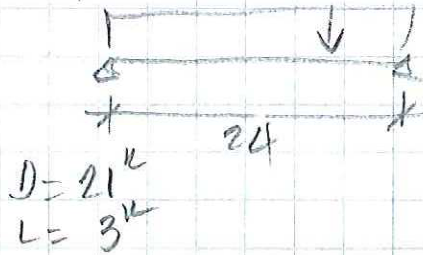
$$A_s = \frac{3.27}{4 \times 6.0} = 0.14 \text{ in}^2/\text{F}$$

#4 @ 12"  $\phi$



# Main Roof Beams (Assuming Flat edge Beams)

RB1



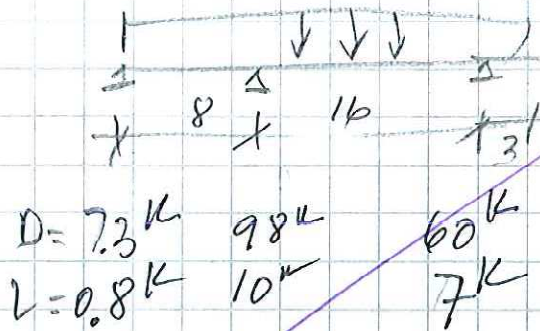
$$D = 1.76 \text{ KLF}$$

$$L = 0.18 \text{ KLF}$$

6#8@8" c T & B  
 8#3 @ 5"

*Revised*

RB2

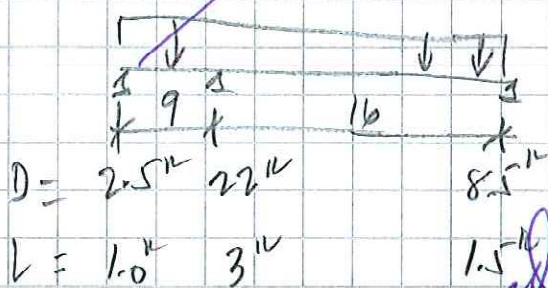


$$D = 6.12 \text{ KLF}$$

$$L = 0.62 \text{ KLF}$$

18#8@5" T & B  
 8#3 @ 5"

RB3



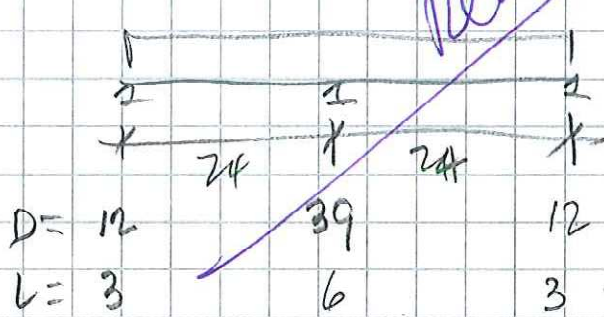
$$D = 1.29 \text{ KLF}$$

$$L = 0.13 \text{ KLF}$$

24x12  
 w/ 5#8@6" T & B

*Revised*

RB4

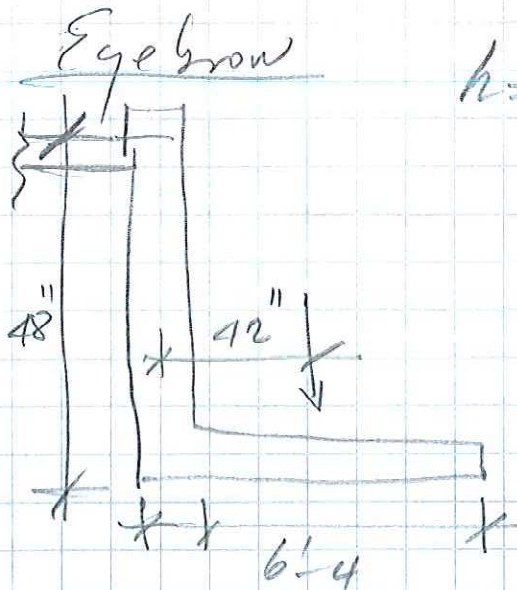


$$D = 1.30 \text{ KLF}$$

$$L = 0.13 \text{ KLF}$$

36"x12"  
 w/ 6#8@8" T & B

2 sets of 4 legs  
 #3 @ 5" c  
 on end.



$$h = \frac{l}{10} = \frac{6.3}{10} = 8" \text{ THK}$$

$$\left. \begin{array}{l} \text{DL} - 100 \\ \text{ADL} - 10 \\ \text{LL} - 20 \end{array} \right\} \text{ VTL} = 165 \text{ psf}$$

$$M_u = \frac{0.165 \times 6.3^2}{2} = 3.31 \text{ k/F}$$

$$A_s = \frac{3.31}{4 \times 6} = 0.14 \text{ in}^2/\text{F}$$

Beam in Tension (TB3)      See comp.



$$T_u = 165 \times 6.33 \times 3.5 \times 4'$$

$$T_u = 14.1 \text{ k}$$

$$M_u = \frac{(165 \times 9.33) \times 8^2}{8} = 12 \text{ k}$$

$$V_u = 1.54 \times 45 = 6.2 \text{ k}$$



|                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date: 22-Aug-2024 Time: 01:16 PM<br>Project: <b>CASA PA FERNANDA</b><br>Descrip: <b>EYEBROW BEAM</b><br>Engineer: <b>FEH</b>                                                                                                                                                                                                                                                                                                          | <div style="background-color: #ffffcc; text-align: center; padding: 5px;"> <b>GF Consulting Engineers</b><br/> <b>CONCRETE BEAM DESIGN</b> </div> <div style="background-color: #ffffcc; text-align: center; padding: 5px;"> <b>REINFORCEMENT DESIGN:</b> </div> <div>           Clear Concrete Cover (in) = <b>1.25</b><br/> <b>- TRANSVERSE:</b><br/>           Transverse Reinf. A/s (in<sup>2</sup>/in/leg) = 0.0084<br/>           Stirrups # <b>3</b> @ 12.0 in.<br/> <b>- LONGITUDINAL:</b><br/>           Bending Longitudinal Reinf. (in<sup>2</sup>) = 0.08<br/>           Bending Reinforcement Ratio Rho = 0.0002<br/>           Torsional Longitudinal Reinf. (in<sup>2</sup>) = 1.73<br/>           Use 3 Bars # <b>4</b> at each Side<br/>           Use 2 Bars # <b>5</b> Top or Bottom         </div> <div style="background-color: #ffffcc; text-align: center; padding: 5px;"> <b>BENDING CAPACITY CHECK:</b> </div> <div>           Minimum Bending Moment (k-ft) = 249<br/>           Allowable Bending Moment (k-ft) = 1579<br/> <b>GREAT !, BENDING CAPACITY IS OK !</b> </div> <div style="background-color: #ffffcc; text-align: center; padding: 5px;"> <b>TORSION CAPACITY CHECK:</b> </div> <div>           Moment to Neglect Torsion (k-ft) = 7.1<br/> <b>TORSION EFFECT MUST BE CONSIDERED !</b><br/>           Max. Shear/Torsion Stress (psi) = 166.0<br/>           Max. Allowable Stress (psi) = 530.3<br/>           Shear-Torsion Stress Ratio = 0.31<br/> <b>GREAT !, BEAM DIMENSIONS ARE OK !</b> </div> |
| <div style="background-color: #ccffcc; text-align: center; padding: 5px;"> <b>SECTION GEOMETRY:</b> </div> <div>           Beam Section Type (Note 1) = <b>2</b><br/>           Left Flange Width (in) = <b>12.0</b><br/>           Beam Web Width (in) = <b>8.0</b><br/>           Right Flange Width (in) = <b>0.0</b><br/>           Beam Total Height (in) = <b>48.0</b><br/>           Flange Thickness (in) = <b>7.0</b> </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <div style="background-color: #ccffcc; text-align: center; padding: 5px;"> <b>COMBINED FACTORED LOADS:</b> </div> <div>           Shear Force Vu (kip) = <b>8.0</b><br/>           Bending Moment Mu (k-ft) = <b>12.0</b><br/>           Torsional Moment Tu (k-ft) = <b>15.0</b> </div>                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <div style="background-color: #ccffcc; text-align: center; padding: 5px;"> <b>MATERIALS:</b> </div> <div>           Concrete Strength f'c (ksi) = <b>5.0</b><br/>           Main Steel Strength fy (ksi) = <b>60.0</b><br/>           Stirrups Strength fyh (ksi) = <b>60.0</b> </div>                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <div style="background-color: #ccffcc; text-align: center; padding: 5px;"> <b>SHEAR CAPACITY CHECK:</b> </div> <div>           Shear Taken by Conc. <math>\phi V_c</math> (kip) = 39.1<br/>           Shear Taken by Steel <math>\phi V_s</math> (kip) = 0.0<br/>           Max. Allow. Shear Force (kip) = 132.9<br/> <b>GREAT !, SHEAR CAPACITY IS OK !</b> </div>                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

Notes:

1.- Beam types are as follows:

Type 1.- Edge or interior beams cast monolithically with slab.

Type 2.- L-shaped or inverted-Tee supporting beams.

2.- In beams type 1, any flange width is either:

a) Total height - slab thickness , or

b) 4 times the slab thickness , whichever is less.

3.- All stirrups must be closed, with 135-deg hooks.

Maximum spacing is  $\phi h/8$  or 12".

4.- If the required number of bars do not fit in the web width,  
place the reinforcement in two layers.

5.- Beams type 2 must be designed also for local effects  
on the beam ledges. Select Design | Beam Ledge to open  
the CORBEL program.

Ref: "Design of Concrete Beams for Torsion"

by D. Fanella and B. Rabbat

Portland Cement Association



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM A

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |            |               |    |
|------------------------|------------|---------------|----|
| Type ...               | Inverted-T | Not deep beam | OK |
| Total Height h         | 55.0       | in            |    |
| Beam Width b           | 8.0        | in            |    |
| Flange Thickness tf    | 7.0        | in            |    |
| Left Flange Width bfl  | 12.0       | in            | OK |
| Right Flange Width bfr | 12.0       | in            | OK |
| Left Cantilever        | 0.00       | ft            |    |
| Right Cantilever       | 0.00       | ft            |    |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 23.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 24.5 | 34.3 | 24.5 | 34.3 |
| ②    | ② | 29.1 | 31.7 | 29.1 | 31.7 |
| ③    | ③ | 24.5 | 29.4 | 24.5 | 29.4 |
| ④    | ④ | 28.0 | 36.8 | 28.0 | 36.8 |
| ⑤    | ⑤ | 24.5 | 29.4 | 24.5 | 29.4 |
| ⑥    | ⑥ | 24.5 | 36.8 | 24.5 | 36.8 |
| ⑦    | ⑦ | 24.5 | 29.4 | 24.5 | 29.4 |
| ⑧    | ⑧ | 28.0 | 31.7 | 28.0 | 31.7 |
| ⑨    | ⑨ | 24.5 | 29.4 | 24.5 | 29.4 |
| ⑩    | ⑩ | 24.5 | 29.4 | 24.5 | 29.4 |
| ⑪    | ⑪ | 14.7 | 22.1 | 14.7 | 22.1 |
| ⑫    | ⑫ | 14.7 | 22.1 | 14.7 | 22.1 |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |     |   |    |  |
|------|---|-----|---|----|--|
| ①    | 0 | 197 | 0 | OK |  |
| ②    | 0 | 183 | 0 | OK |  |
| ③    | 0 | 169 | 0 | OK |  |
| ④    | 0 | 212 | 0 | OK |  |
| ⑤    | 0 | 169 | 0 | OK |  |
| ⑥    | 0 | 212 | 0 | OK |  |
| ⑦    | 0 | 169 | 0 | OK |  |
| ⑧    | 0 | 183 | 0 | OK |  |
| ⑨    | 0 | 169 | 0 | OK |  |
| ⑩    | 0 | 169 | 0 | OK |  |
| ⑪    | 0 | 127 | 0 | OK |  |
| ⑫    | 0 | 127 | 0 | OK |  |

**SHEAR FORCES Vu (kip)**

| Comb |      |       |    |  |  |
|------|------|-------|----|--|--|
| ①    | 20.2 | -20.2 | OK |  |  |
| ②    | 18.6 | -18.6 | OK |  |  |
| ③    | 17.3 | -17.3 | OK |  |  |
| ④    | 21.6 | -21.6 | OK |  |  |
| ⑤    | 17.3 | -17.3 | OK |  |  |
| ⑥    | 21.6 | -21.6 | OK |  |  |
| ⑦    | 17.3 | -17.3 | OK |  |  |
| ⑧    | 18.6 | -18.6 | OK |  |  |
| ⑨    | 17.3 | -17.3 | OK |  |  |
| ⑩    | 17.3 | -17.3 | OK |  |  |
| ⑪    | 13.0 | -13.0 | OK |  |  |
| ⑫    | 13.0 | -13.0 | OK |  |  |

**BENDING STRENGTH (k-ft)**

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#6 Cont     |      |                      |
| Bot    | 2#6x18.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.88         | 1.76 | 0.88 in <sup>2</sup> |
| c/d    | 0.04         | 0.06 | 0.04                 |
| +φMn   | 206          | 399  | 206                  |
| Top    | 2#6 Cont     |      |                      |
| Top    | 0#5          |      |                      |
| d'     | 2.0          | 2.0  | 2.0 in               |
| -As    | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.02         | 0.03 | 0.02                 |
| -φMn   | -214         | -224 | -214                 |
| As min | 0.00         | 1.23 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |         |  |                 |
|---------------------|---------|--|-----------------|
| Comb                |         |  |                 |
| D                   | 0.03    |  | in              |
| L                   | 0.00    |  | in              |
| Lr, S               | 0.01    |  | in              |
| LS                  | 0.00    |  | in              |
| LT                  | 0.06    |  | in              |
| I <sub>eff</sub> D  | 122,402 |  | in <sup>4</sup> |
| I <sub>eff</sub> L  | 122,402 |  | in <sup>4</sup> |
| I <sub>eff</sub> LS | 122,402 |  | in <sup>4</sup> |
| λ                   | 1.81    |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |              |
|----------|-------|--------------|
| φVc      | 40.2  | -40.2        |
| φVs      | 32.8  | -32.8        |
| φVn      | 73.0  | -73.0        |
| Av/s     | 0.014 | 0.014 OK     |
| Min Av/s | 0.007 | N.A.         |
| s        | 16.0  | 15.0 16.0 OK |
| s max    | 24.0  | N.A. N.A.    |

**REINFORCEMENT**

|                               |      |    |
|-------------------------------|------|----|
| Min. Steel Area As min Ratio  | 0.70 | OK |
| Max. Steel Area As max Ratio  | 0.21 | OK |
| Rebars Min Spacing Smin Ratio | 0.53 | OK |
| Rebars Max Spacing Smax Ratio | 0.25 | OK |
| Shear Vs/Vs max Ratio         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio | 0.48 | OK |
| Stirrups Spacing s max Ratio  | 0.67 | OK |
| Stirrups Min. # of Legs Ratio | 0.19 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 4737 | 480    | 0.10  | OK |
| D    | Long-Term | 4737 | 240    | 0.05  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM A

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| AI (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |



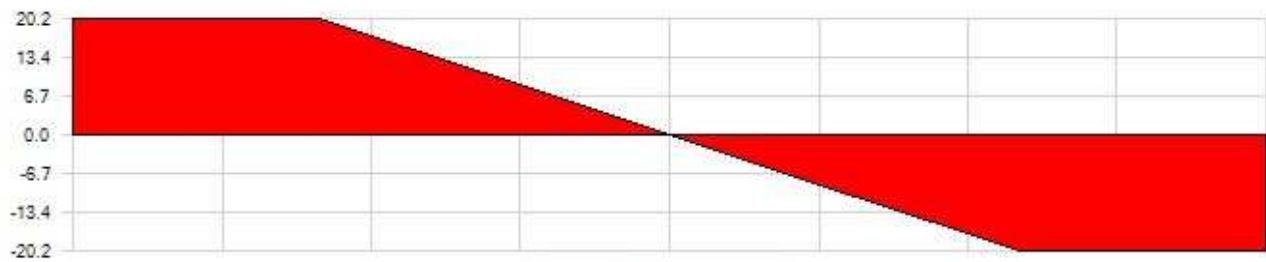
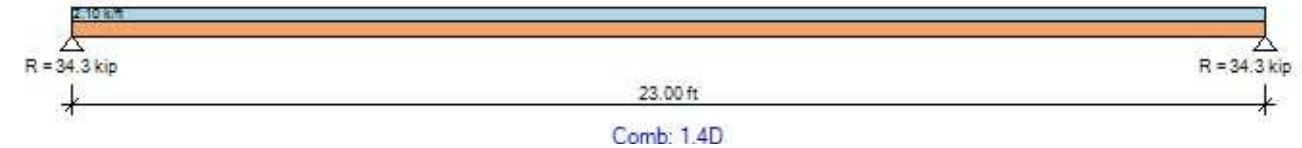
Project: CASA PA' FERNANDZ  
Engineer:  
Descrip: MAIN ROOF BEAM A

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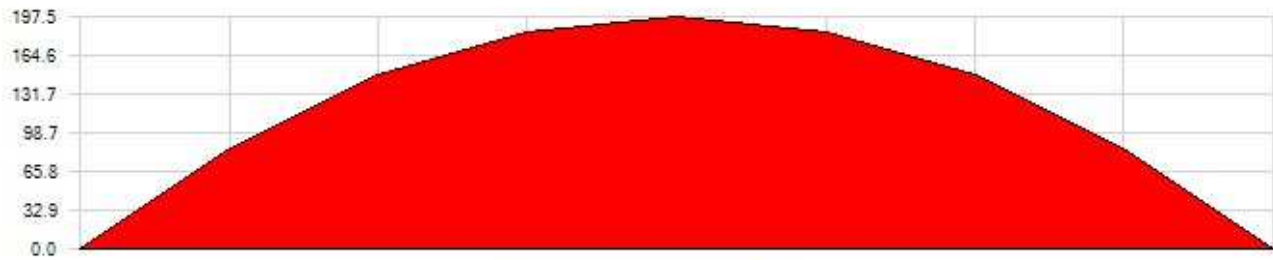
ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

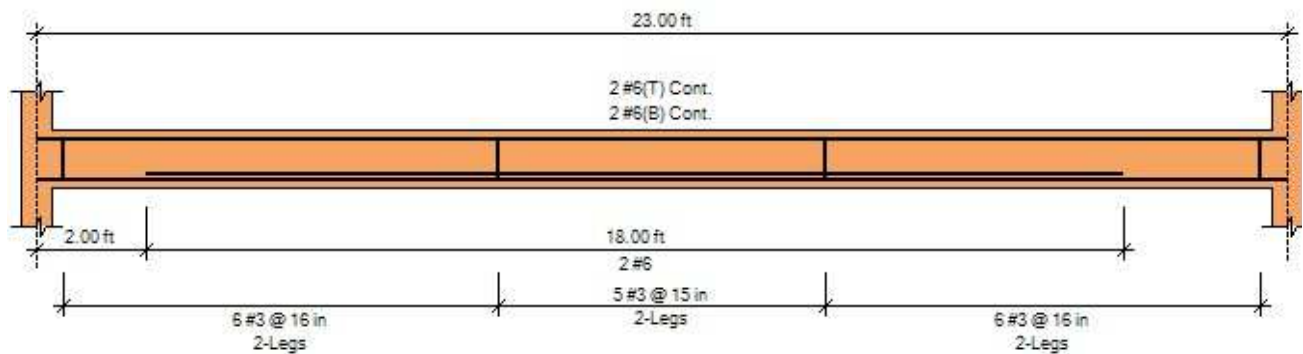
[www.asdipsoft.com](http://www.asdipsoft.com)



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM B(W/8x48 ON LAST SPAN)

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 48.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 0.00      | ft |
| Right Cantilever       | 7.50      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 6       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 12.50 ft | ①       | Pinned |
| ②                        | 5.50 ft  | ②       | Pinned |
| ③                        | 5.50 ft  | ③       | Pinned |
| ④                        | 12.50 ft | ④       | Pinned |
| ⑤                        | 23.00 ft | ⑤       | Pinned |
|                          |          | ⑥       | Pinned |

**SUPPORT REACTIONS (kip)**

| Comb |   |     |      |      |      |     |      |      |      |      |      |      |      |
|------|---|-----|------|------|------|-----|------|------|------|------|------|------|------|
| ①    | ① | 7.2 | 10.0 | 17.1 | 23.9 | 8.3 | 11.6 | -0.1 | -0.2 | 43.1 | 60.3 | 44.4 | 62.2 |
| ②    | ② | 8.4 | 9.2  | 20.2 | 22.0 | 9.7 | 10.6 | 0.0  | -0.1 | 50.6 | 55.4 | 54.2 | 58.2 |
| ③    | ③ | 7.2 | 8.6  | 17.1 | 20.5 | 8.3 | 9.9  | -0.1 | -0.2 | 43.1 | 51.7 | 44.4 | 53.3 |
| ④    | ④ | 8.1 | 10.6 | 19.4 | 25.4 | 9.3 | 12.2 | -0.1 | 0.0  | 48.7 | 63.7 | 51.7 | 68.9 |
| ⑤    | ⑤ | 7.2 | 8.6  | 17.1 | 20.5 | 8.3 | 9.9  | -0.1 | -0.2 | 43.1 | 51.7 | 44.4 | 53.3 |
| ⑥    | ⑥ | 7.2 | 10.6 | 17.1 | 25.4 | 8.3 | 12.2 | -0.1 | 0.0  | 43.1 | 63.7 | 44.4 | 68.9 |
| ⑦    | ⑦ | 7.2 | 8.6  | 17.1 | 20.5 | 8.3 | 9.9  | -0.1 | -0.2 | 43.1 | 51.7 | 44.4 | 53.3 |
| ⑧    | ⑧ | 8.1 | 9.2  | 19.4 | 22.0 | 9.3 | 10.6 | -0.1 | -0.1 | 48.7 | 55.4 | 51.7 | 58.2 |
| ⑨    | ⑨ | 7.2 | 8.6  | 17.1 | 20.5 | 8.3 | 9.9  | -0.1 | -0.2 | 43.1 | 51.7 | 44.4 | 53.3 |
| ⑩    | ⑩ | 7.2 | 8.6  | 17.1 | 20.5 | 8.3 | 9.9  | -0.1 | -0.2 | 43.1 | 51.7 | 44.4 | 53.3 |
| ⑪    | ⑪ | 4.3 | 6.4  | 10.3 | 15.4 | 5.0 | 7.4  | -0.1 | -0.1 | 25.8 | 38.7 | 26.7 | 40.0 |
| ⑫    | ⑫ | 4.3 | 6.4  | 10.3 | 15.4 | 5.0 | 7.4  | -0.1 | -0.1 | 25.8 | 38.7 | 26.7 | 40.0 |

**BENDING MOMENTS Mu (k-ft)**

| Comb |  |  |  |  |  |  |  |    |      |     |      |    |
|------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----|------|-----|------|----|
| ①    | 0                                                                                   | 25                                                                                  | -28                                                                                 | 0                                                                                   | -9                                                                                    | 21                                                                                    | -4                                                                                    | 21 | -141 | 169 | -99  | OK |
| ②    | 0                                                                                   | 23                                                                                  | -26                                                                                 | 0                                                                                   | -9                                                                                    | 19                                                                                    | -4                                                                                    | 19 | -130 | 155 | -93  | OK |
| ③    | 0                                                                                   | 22                                                                                  | -24                                                                                 | 0                                                                                   | -8                                                                                    | 18                                                                                    | -3                                                                                    | 18 | -121 | 145 | -85  | OK |
| ④    | 0                                                                                   | 27                                                                                  | -30                                                                                 | 0                                                                                   | -10                                                                                   | 22                                                                                    | -4                                                                                    | 22 | -149 | 178 | -113 | OK |
| ⑤    | 0                                                                                   | 22                                                                                  | -24                                                                                 | 0                                                                                   | -8                                                                                    | 18                                                                                    | -3                                                                                    | 18 | -121 | 145 | -85  | OK |
| ⑥    | 0                                                                                   | 27                                                                                  | -30                                                                                 | 0                                                                                   | -10                                                                                   | 22                                                                                    | -4                                                                                    | 22 | -149 | 178 | -113 | OK |
| ⑦    | 0                                                                                   | 22                                                                                  | -24                                                                                 | 0                                                                                   | -8                                                                                    | 18                                                                                    | -3                                                                                    | 18 | -121 | 145 | -85  | OK |
| ⑧    | 0                                                                                   | 23                                                                                  | -26                                                                                 | 0                                                                                   | -9                                                                                    | 19                                                                                    | -4                                                                                    | 19 | -130 | 155 | -93  | OK |
| ⑨    | 0                                                                                   | 22                                                                                  | -24                                                                                 | 0                                                                                   | -8                                                                                    | 18                                                                                    | -3                                                                                    | 18 | -121 | 145 | -85  | OK |
| ⑩    | 0                                                                                   | 22                                                                                  | -24                                                                                 | 0                                                                                   | -8                                                                                    | 18                                                                                    | -3                                                                                    | 18 | -121 | 145 | -85  | OK |
| ⑪    | 0                                                                                   | 16                                                                                  | -18                                                                                 | 0                                                                                   | -6                                                                                    | 14                                                                                    | -3                                                                                    | 14 | -91  | 108 | -63  | OK |
| ⑫    | 0                                                                                   | 16                                                                                  | -18                                                                                 | 0                                                                                   | -6                                                                                    | 14                                                                                    | -3                                                                                    | 14 | -91  | 108 | -63  | OK |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM B(W/8x48 ON LAST SPAN)

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**SHEAR FORCES  $V_u$  (kip)**

| Comb |     |      |     |     |     |     |      |       |      |       |      |    |
|------|-----|------|-----|-----|-----|-----|------|-------|------|-------|------|----|
| ①    | 1.8 | -6.3 | 1.3 | 6.8 | 2.1 | 7.6 | -8.9 | -17.1 | 26.9 | -36.9 | 13.1 | OK |
| ②    | 1.7 | -5.8 | 1.2 | 6.3 | 1.9 | 7.0 | -8.2 | -15.7 | 24.7 | -34.3 | 12.4 | OK |
| ③    | 1.6 | -5.4 | 1.1 | 5.9 | 1.8 | 6.5 | -7.6 | -14.6 | 23.0 | -31.6 | 11.2 | OK |
| ④    | 2.0 | -6.7 | 1.4 | 7.3 | 2.1 | 8.0 | -9.3 | -18.0 | 28.4 | -40.1 | 14.9 | OK |
| ⑤    | 1.6 | -5.4 | 1.1 | 5.9 | 1.8 | 6.5 | -7.6 | -14.6 | 23.0 | -31.6 | 11.2 | OK |
| ⑥    | 2.0 | -6.7 | 1.4 | 7.3 | 2.1 | 8.0 | -9.3 | -18.0 | 28.4 | -40.1 | 14.9 | OK |
| ⑦    | 1.6 | -5.4 | 1.1 | 5.9 | 1.8 | 6.5 | -7.6 | -14.6 | 23.0 | -31.6 | 11.2 | OK |
| ⑧    | 1.7 | -5.8 | 1.2 | 6.3 | 1.9 | 7.0 | -8.2 | -15.7 | 24.7 | -34.3 | 12.4 | OK |
| ⑨    | 1.6 | -5.4 | 1.1 | 5.9 | 1.8 | 6.5 | -7.6 | -14.6 | 23.0 | -31.6 | 11.2 | OK |
| ⑩    | 1.6 | -5.4 | 1.1 | 5.9 | 1.8 | 6.5 | -7.6 | -14.6 | 23.0 | -31.6 | 11.2 | OK |
| ⑪    | 1.2 | -4.1 | 0.8 | 4.4 | 1.3 | 4.9 | -5.7 | -11.0 | 17.3 | -23.7 | 8.4  | OK |
| ⑫    | 1.2 | -4.1 | 0.8 | 4.4 | 1.3 | 4.9 | -5.7 | -11.0 | 17.3 | -23.7 | 8.4  | OK |

**BENDING STRENGTH (k-ft)**

| Bot         | 2#6 Cont     |      | 2#6 Cont    |      | 2#6 Cont    |      | 2#6 Cont     |      | 2#6 Cont     |      |                      |
|-------------|--------------|------|-------------|------|-------------|------|--------------|------|--------------|------|----------------------|
| Bot         | 0#6x10.50 ft |      | 0#6x3.50 ft |      | 0#6x3.50 ft |      | 0#6x10.50 ft |      | 2#6x18.00 ft |      |                      |
| d           | 2.0          | 4.0  | 2.0         | 4.0  | 2.0         | 4.0  | 2.0          | 4.0  | 2.0          | 4.0  | 2.0 in               |
| +As         | 0.88         | 0.88 | 0.88        | 0.88 | 0.88        | 0.88 | 0.88         | 0.88 | 0.88         | 1.76 | 0.88 in <sup>2</sup> |
| c/d         | 0.05         | 0.05 | 0.05        | 0.05 | 0.05        | 0.05 | 0.05         | 0.05 | 0.05         | 0.07 | 0.05                 |
| + $\phi$ Mn | 178          | 178  | 178         | 178  | 178         | 178  | 178          | 178  | 178          | 344  | 178                  |
| Top         | 2#6 Cont     |      | 2#6 Cont    |      | 2#6 Cont    |      | 2#6 Cont     |      | 2#6 Cont     |      |                      |
| Top         | 0#5          |      | 0#5         |      | 0#5         |      | 0#5          |      | 0#5          |      | 0#6                  |
| d'          | 2.0          | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | 2.0          | 2.0  | 2.0          | 2.0  | 4.0 in               |
| -As         | 0.88         | 0.88 | 0.88        | 0.88 | 0.88        | 0.88 | 0.88         | 0.88 | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d         | 0.05         | 0.05 | 0.05        | 0.05 | 0.05        | 0.05 | 0.05         | 0.05 | 0.05         | 0.06 | 0.05                 |
| - $\phi$ Mn | -178         | -178 | -178        | -178 | -178        | -178 | -178         | -178 | -178         | -183 | -178                 |
| As min      | 0.00         | 0.18 | 0.19        | 0.00 | 0.06        | 0.14 | 0.03         | 0.14 | 0.98         | 1.20 | 0.74 in <sup>2</sup> |

**SHEAR STRENGTH (kip, in)**

| $\phi V_c$ | 34.9  | -34.9 | 34.9  | -34.9 | 34.9  | -34.9 | 34.9  | -34.9 | 34.9  | -34.9 | 34.9        |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------|
| $\phi V_s$ | 56.9  | -56.9 | 56.9  | -56.9 | 56.9  | -56.9 | 56.9  | -56.9 | 38.0  | -38.0 | 56.9        |
| $\phi V_n$ | 91.8  | -91.8 | 91.8  | -91.8 | 91.8  | -91.8 | 91.8  | -91.8 | 72.9  | -72.9 | 91.8        |
| Av/s       | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.018 | 0.018 | 0.028 OK    |
| Min Av/s   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | 0.007 | N.A.  | N.A.        |
| s          | 8.0   | 6.0   | 8.0   | 8.0   | 6.0   | 8.0   | 8.0   | 6.0   | 8.0   | 12.0  | 12.0 8.0 OK |
| s max      | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | 23.0  | 23.0  | 23.0 N.A.   |



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM B(W/8x48 ON LAST SPAN)

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**DEFLECTIONS**

| Comb      |        |        |        |        |        |        |     |
|-----------|--------|--------|--------|--------|--------|--------|-----|
| D         | 0.00   | 0.00   | 0.00   | 0.00   | 0.03   | -0.02  | in  |
| L         | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | in  |
| Lr, S     | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   | in  |
| LS        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | in  |
| LT        | 0.00   | 0.00   | 0.00   | 0.00   | 0.05   | -0.05  | in  |
| leff D    | 79,729 | 79,729 | 79,729 | 79,729 | 81,464 | 79,729 | in4 |
| leff L    | 79,729 | 79,729 | 79,729 | 79,729 | 81,464 | 79,729 | in4 |
| leff LS   | 79,729 | 79,729 | 79,729 | 79,729 | 81,464 | 79,729 | in4 |
| $\lambda$ | 1.79   | 1.79   | 1.79   | 1.79   | 1.79   | 2.00   |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 1.11 | NG |
| Max. Steel Area As max Ratio ....   | 0.24 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio .....  | 0.52 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.19 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 9999       | 180    | 0.00  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 5544       | 480    | 0.09  | OK |
| D    | Long-Term | 5544       | 240    | 0.04  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS****SERVICE****FACTORED**

|                        |                     |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: MAIN ROOF BEAM B(W/8x48 ON LAST SPAN)

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

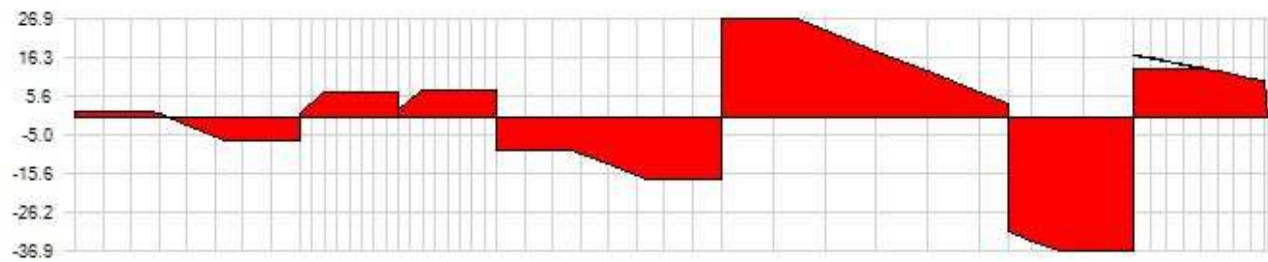
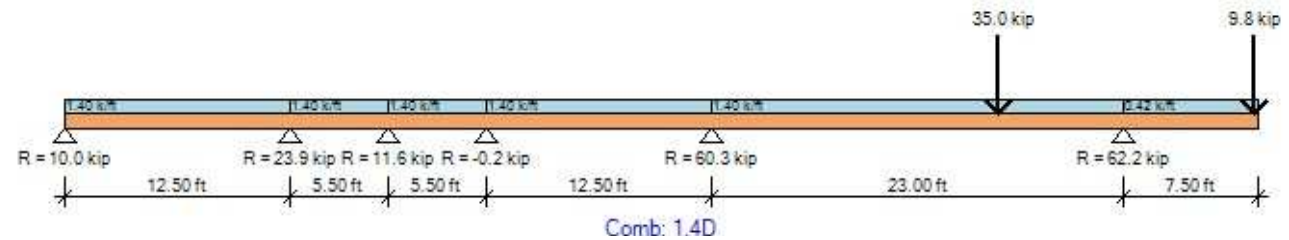
www.asdipsoft.com

**TORSION MOMENTS  $T_u$  (k-ft)**

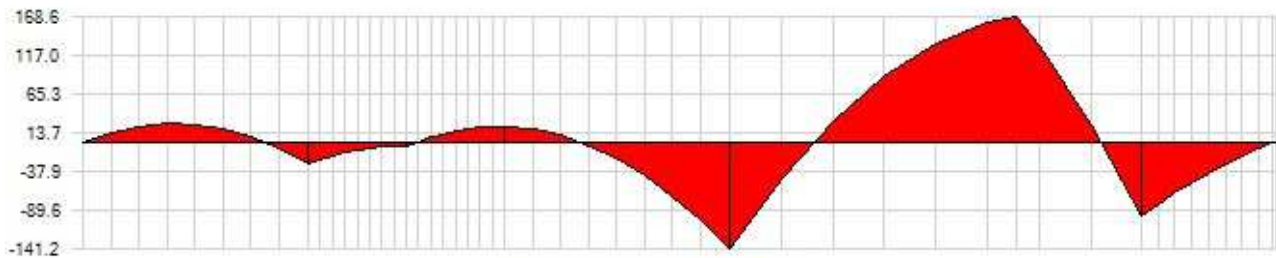
| Comb |     |     |     |     |     |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

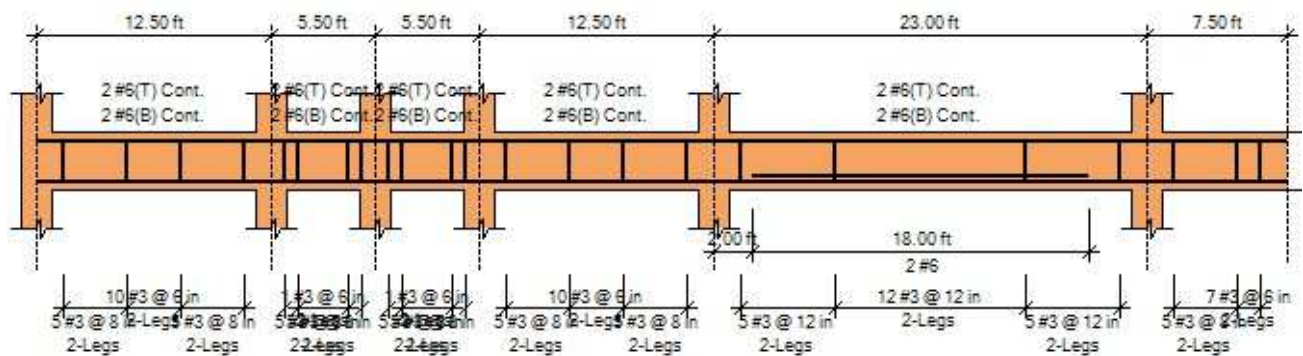
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION



Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: MAIN ROOF BEAM B

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

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**GEOMETRY**

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 24.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 0.00      | ft |
| Right Cantilever       | 7.50      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 6       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 12.50 ft | ①       | Pinned |
| ②                        | 5.50 ft  | ②       | Pinned |
| ③                        | 5.50 ft  | ③       | Pinned |
| ④                        | 12.50 ft | ④       | Pinned |
| ⑤                        | 23.00 ft | ⑤       | Pinned |
|                          |          | ⑥       | Pinned |

**SUPPORT REACTIONS (kip)**

| Comb |   |     |     |      |      |     |      |      |      |      |      |      |      |
|------|---|-----|-----|------|------|-----|------|------|------|------|------|------|------|
| ①    | ① | 6.1 | 8.6 | 14.5 | 20.3 | 7.7 | 10.8 | -1.3 | -1.9 | 38.8 | 54.3 | 40.7 | 57.0 |
| ②    | ② | 7.4 | 8.0 | 17.6 | 19.0 | 9.2 | 10.0 | -1.2 | -1.6 | 46.3 | 50.3 | 50.5 | 53.7 |
| ③    | ③ | 6.1 | 7.4 | 14.5 | 17.4 | 7.7 | 9.3  | -1.3 | -1.6 | 38.8 | 46.5 | 40.7 | 48.9 |
| ④    | ④ | 7.1 | 9.4 | 16.8 | 22.3 | 8.8 | 11.5 | -1.3 | -1.4 | 44.4 | 58.5 | 48.0 | 64.5 |
| ⑤    | ⑤ | 6.1 | 7.4 | 14.5 | 17.4 | 7.7 | 9.3  | -1.3 | -1.6 | 38.8 | 46.5 | 40.7 | 48.9 |
| ⑥    | ⑥ | 6.1 | 9.4 | 14.5 | 22.3 | 7.7 | 11.5 | -1.3 | -1.4 | 38.8 | 58.5 | 40.7 | 64.5 |
| ⑦    | ⑦ | 6.1 | 7.4 | 14.5 | 17.4 | 7.7 | 9.3  | -1.3 | -1.6 | 38.8 | 46.5 | 40.7 | 48.9 |
| ⑧    | ⑧ | 7.1 | 8.0 | 16.8 | 19.0 | 8.8 | 10.0 | -1.3 | -1.6 | 44.4 | 50.3 | 48.0 | 53.7 |
| ⑨    | ⑨ | 6.1 | 7.4 | 14.5 | 17.4 | 7.7 | 9.3  | -1.3 | -1.6 | 38.8 | 46.5 | 40.7 | 48.9 |
| ⑩    | ⑩ | 6.1 | 7.4 | 14.5 | 17.4 | 7.7 | 9.3  | -1.3 | -1.6 | 38.8 | 46.5 | 40.7 | 48.9 |
| ⑪    | ⑪ | 3.7 | 5.5 | 8.7  | 13.1 | 4.6 | 7.0  | -0.8 | -1.2 | 23.3 | 34.9 | 24.4 | 36.7 |
| ⑫    | ⑫ | 3.7 | 5.5 | 8.7  | 13.1 | 4.6 | 7.0  | -0.8 | -1.2 | 23.3 | 34.9 | 24.4 | 36.7 |

**BENDING MOMENTS Mu (k-ft)**

| Comb |  |  |  |  |  |  |  |    |      |     |      |    |
|------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----|------|-----|------|----|
| ①    | 0                                                                                   | 22                                                                                  | -24                                                                                 | 0                                                                                   | -8                                                                                    | 21                                                                                    | -5                                                                                    | 21 | -130 | 162 | -91  | NG |
| ②    | 0                                                                                   | 20                                                                                  | -22                                                                                 | 0                                                                                   | -8                                                                                    | 19                                                                                    | -4                                                                                    | 19 | -120 | 149 | -87  | NG |
| ③    | 0                                                                                   | 19                                                                                  | -20                                                                                 | 0                                                                                   | -7                                                                                    | 18                                                                                    | -4                                                                                    | 18 | -111 | 139 | -78  | NG |
| ④    | 0                                                                                   | 24                                                                                  | -26                                                                                 | 0                                                                                   | -9                                                                                    | 22                                                                                    | -5                                                                                    | 22 | -139 | 172 | -106 | NG |
| ⑤    | 0                                                                                   | 19                                                                                  | -20                                                                                 | 0                                                                                   | -7                                                                                    | 18                                                                                    | -4                                                                                    | 18 | -111 | 139 | -78  | NG |
| ⑥    | 0                                                                                   | 24                                                                                  | -26                                                                                 | 0                                                                                   | -9                                                                                    | 22                                                                                    | -5                                                                                    | 22 | -139 | 172 | -106 | NG |
| ⑦    | 0                                                                                   | 19                                                                                  | -20                                                                                 | 0                                                                                   | -7                                                                                    | 18                                                                                    | -4                                                                                    | 18 | -111 | 139 | -78  | NG |
| ⑧    | 0                                                                                   | 20                                                                                  | -22                                                                                 | 0                                                                                   | -8                                                                                    | 19                                                                                    | -4                                                                                    | 19 | -120 | 149 | -87  | NG |
| ⑨    | 0                                                                                   | 19                                                                                  | -20                                                                                 | 0                                                                                   | -7                                                                                    | 18                                                                                    | -4                                                                                    | 18 | -111 | 139 | -78  | NG |
| ⑩    | 0                                                                                   | 19                                                                                  | -20                                                                                 | 0                                                                                   | -7                                                                                    | 18                                                                                    | -4                                                                                    | 18 | -111 | 139 | -78  | NG |
| ⑪    | 0                                                                                   | 14                                                                                  | -15                                                                                 | 0                                                                                   | -5                                                                                    | 14                                                                                    | -3                                                                                    | 14 | -83  | 104 | -58  | NG |
| ⑫    | 0                                                                                   | 14                                                                                  | -15                                                                                 | 0                                                                                   | -5                                                                                    | 14                                                                                    | -3                                                                                    | 14 | -83  | 104 | -58  | NG |

SHEAR FORCES  $V_u$  (kip)

| Comb |     |      |     |     |     |     |      |       |      |       |      |    |
|------|-----|------|-----|-----|-----|-----|------|-------|------|-------|------|----|
| ①    | 5.0 | -8.8 | 4.3 | 2.3 | 5.9 | 3.9 | -5.2 | -19.0 | 28.0 | -38.3 | 13.5 | OK |
| ②    | 4.6 | -8.2 | 4.0 | 2.2 | 5.4 | 3.6 | -4.8 | -17.5 | 25.9 | -35.8 | 13.0 | OK |
| ③    | 4.2 | -7.5 | 3.7 | 2.0 | 5.0 | 3.4 | -4.5 | -16.2 | 24.0 | -32.9 | 11.6 | OK |
| ④    | 5.4 | -9.6 | 4.8 | 2.6 | 6.2 | 4.0 | -5.4 | -20.4 | 30.2 | -42.2 | 16.1 | OK |
| ⑤    | 4.2 | -7.5 | 3.7 | 2.0 | 5.0 | 3.4 | -4.5 | -16.2 | 24.0 | -32.9 | 11.6 | OK |
| ⑥    | 5.4 | -9.6 | 4.8 | 2.6 | 6.2 | 4.0 | -5.4 | -20.4 | 30.2 | -42.2 | 16.1 | OK |
| ⑦    | 4.2 | -7.5 | 3.7 | 2.0 | 5.0 | 3.4 | -4.5 | -16.2 | 24.0 | -32.9 | 11.6 | OK |
| ⑧    | 4.6 | -8.2 | 4.0 | 2.2 | 5.4 | 3.6 | -4.8 | -17.5 | 25.9 | -35.8 | 13.0 | OK |
| ⑨    | 4.2 | -7.5 | 3.7 | 2.0 | 5.0 | 3.4 | -4.5 | -16.2 | 24.0 | -32.9 | 11.6 | OK |
| ⑩    | 4.2 | -7.5 | 3.7 | 2.0 | 5.0 | 3.4 | -4.5 | -16.2 | 24.0 | -32.9 | 11.6 | OK |
| ⑪    | 3.2 | -5.6 | 2.8 | 1.5 | 3.8 | 2.5 | -3.4 | -12.2 | 18.0 | -24.6 | 8.7  | OK |
| ⑫    | 3.2 | -5.6 | 2.8 | 1.5 | 3.8 | 2.5 | -3.4 | -12.2 | 18.0 | -24.6 | 8.7  | OK |

## BENDING STRENGTH (k-ft)

| Bot         | 2#6 Cont     |      | 2#6 Cont    |      | 2#6 Cont    |      | 2#6 Cont     |      | 2#6 Cont     |      |                      |
|-------------|--------------|------|-------------|------|-------------|------|--------------|------|--------------|------|----------------------|
| Bot         | 0#6x10.50 ft |      | 0#6x3.50 ft |      | 0#6x3.50 ft |      | 0#6x10.50 ft |      | 2#6x18.00 ft |      |                      |
| d           | 2.0          | 4.0  | 2.0         | 4.0  | 2.0         | 4.0  | 2.0          | 4.0  | 2.0          | 4.0  | 2.0 in               |
| +As         | 0.88         | 0.88 | 0.88        | 0.88 | 0.88        | 0.88 | 0.88         | 0.88 | 0.88         | 1.76 | 0.88 in <sup>2</sup> |
| c/d         | 0.10         | 0.10 | 0.10        | 0.10 | 0.10        | 0.10 | 0.10         | 0.10 | 0.10         | 0.15 | 0.13                 |
| + $\phi$ Mn | 83           | 83   | 83          | 83   | 83          | 83   | 83           | 83   | 83           | 154  | 88                   |
| Top         | 2#6 Cont     |      | 2#6 Cont    |      | 2#6 Cont    |      | 2#6 Cont     |      | 2#6 Cont     |      |                      |
| Top         | 0#5          |      | 0#5         |      | 0#5         |      | 0#5          |      | 0#5          |      | 2#6                  |
| d'          | 2.0          | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | 2.0          | 2.0  | 2.0          | 2.0  | 4.0 in               |
| -As         | 0.88         | 0.88 | 0.88        | 0.88 | 0.88        | 0.88 | 0.88         | 0.88 | 0.88         | 0.88 | 1.76 in <sup>2</sup> |
| c/d         | 0.10         | 0.10 | 0.10        | 0.10 | 0.10        | 0.10 | 0.10         | 0.10 | 0.10         | 0.13 | 0.15                 |
| - $\phi$ Mn | -83          | -83  | -83         | -83  | -83         | -83  | -83          | -83  | -83          | -88  | -154                 |
| As min      | 0.00         | 0.34 | 0.36        | 0.00 | 0.12        | 0.32 | 0.06         | 0.32 | 0.59         | 0.59 | 0.59 in <sup>2</sup> |

## SHEAR STRENGTH (kip, in)

|            |       |       |       |       |       |       |       |       |       |       |                    |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------|
| $\phi V_c$ | 16.7  | -16.7 | 16.7  | -16.7 | 16.7  | -16.7 | 16.7  | -16.7 | 16.7  | -16.7 | 16.7               |
| $\phi V_s$ | 21.8  | -21.8 | 21.8  | -21.8 | 21.8  | -21.8 | 21.8  | -21.8 | 27.2  | -27.2 | 27.2               |
| $\phi V_n$ | 38.5  | -38.5 | 38.5  | -38.5 | 38.5  | -38.5 | 38.5  | -38.5 | 43.9  | -43.9 | 43.9               |
| Av/s       | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | 0.028 | 0.028 | 0.028 OK           |
| Min Av/s   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | 0.007 | N.A.  | 0.007              |
| s          | 10.0  | 10.0  | 10.0  | 10.0  | 6.0   | 10.0  | 10.0  | 6.0   | 10.0  | 10.0  | 8.0 6.0 8.0 8.0 OK |
| s max      | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | 11.0  | N.A.  | 11.0               |

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: MAIN ROOF BEAM B

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**DEFLECTIONS**

| Comb      |        |        |        |       |       |       |       |     |
|-----------|--------|--------|--------|-------|-------|-------|-------|-----|
| D         | 0.01   | 0.00   | 0.00   | 0.00  | 0.00  | 0.48  | -0.51 | in  |
| L         | 0.00   | 0.00   | 0.00   | 0.00  | 0.00  | 0.00  | 0.00  | in  |
| Lr, S     | 0.00   | 0.00   | 0.00   | 0.00  | 0.00  | 0.11  | 0.00  | in  |
| LS        | 0.00   | 0.00   | 0.00   | 0.00  | 0.00  | 0.03  | -0.06 | in  |
| LT        | 0.02   | 0.00   | 0.00   | 0.00  | 0.00  | 0.82  | -1.15 | in  |
| Ieff D    | 10,456 | 10,456 | 10,456 | 9,314 | 4,229 | 3,639 |       | in4 |
| Ieff L    | 10,456 | 10,456 | 10,456 | 9,314 | 4,229 | 3,639 |       | in4 |
| Ieff LS   | 10,456 | 10,456 | 10,456 | 9,305 | 4,162 | 3,383 |       | in4 |
| $\lambda$ | 1.60   | 1.60   | 1.60   | 1.60  | 1.60  | 2.00  |       |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.67 | OK |
| Max. Steel Area As max Ratio ....   | 0.44 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.30 | OK |
| Stirrups Spacing s max Ratio .....  | 0.91 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 2507       | 180    | 0.07  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 336        | 480    | 1.43  | NG |
| D    | Long-Term | 336        | 240    | 0.71  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS****SERVICE****FACTORED**

|   |                      |   |                   |
|---|----------------------|---|-------------------|
| ① | D+L                  | ① | 1.4D              |
| ② | D+Lr                 | ② | 1.2D+1.6L+0.5Lr   |
| ③ | D+S                  | ③ | 1.2D+1.6L+0.5S    |
| ④ | D+0.75L+0.75Lr       | ④ | 1.2D+0.5L+1.6Lr   |
| ⑤ | D+0.75L+0.75S        | ⑤ | 1.2D+0.5L+1.6S    |
| ⑥ | D+0.6W               | ⑥ | 1.2D+1.6Lr+0.5W   |
| ⑦ | D+0.7E               | ⑦ | 1.2D+1.6S+0.5W    |
| ⑧ | D+0.75L+0.75Lr+0.45W | ⑧ | 1.2D+0.5L+0.5Lr+W |
| ⑨ | D+0.75L+0.75S+0.45W  | ⑨ | 1.2D+0.5L+0.5S+W  |
| ⑩ | D+0.75L+0.75S+0.525E | ⑩ | 1.2D+0.5L+0.2S+E  |
| ⑪ | 0.6D+0.6W            | ⑪ | 0.9D+W            |
| ⑫ | 0.6D+0.7E            | ⑫ | 0.9D+E            |



Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: MAIN ROOF BEAM B

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

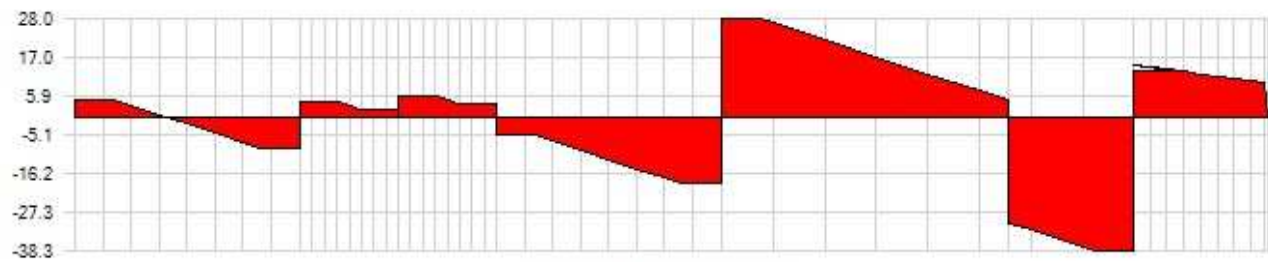
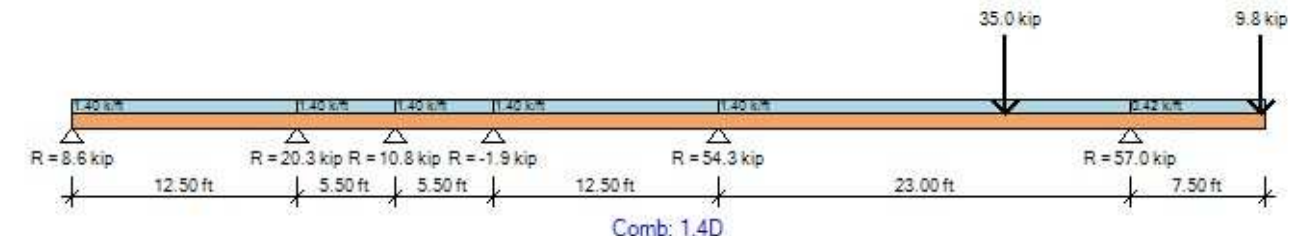
www.asdipsoft.com

**TORSION MOMENTS  $T_u$  (k-ft)**

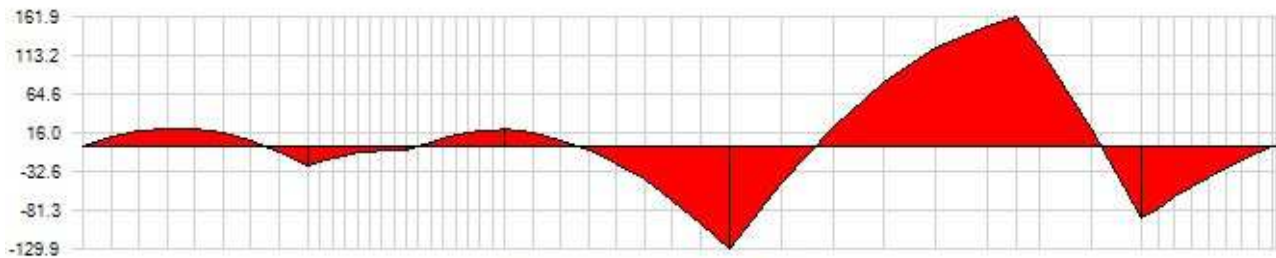
| Comb |     |     |     |     |     |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

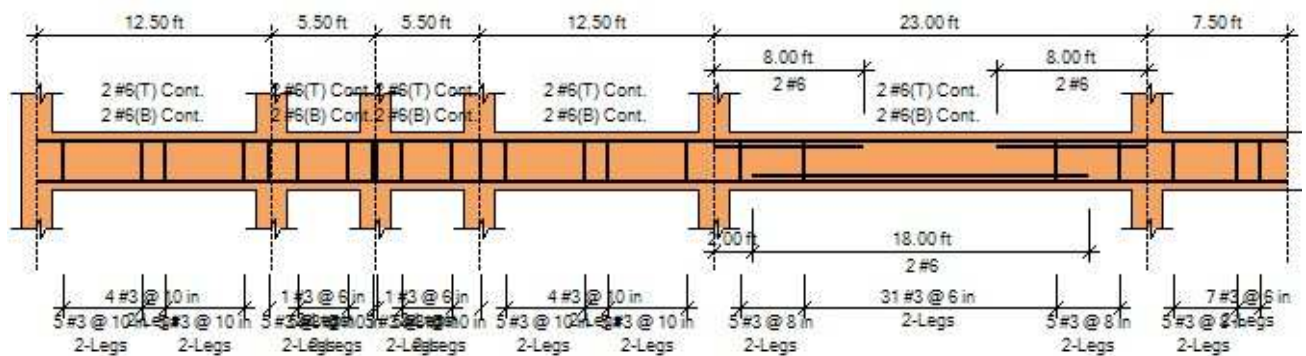
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: MAIN ROOF BEAM C

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

www.asdipsoft.com

### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 17.50 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 11.8 | 16.5 | 11.8 | 16.5 |
| ②    | ② | 14.5 | 15.5 | 14.5 | 15.5 |
| ③    | ③ | 11.8 | 14.2 | 11.8 | 14.2 |
| ④    | ④ | 13.8 | 18.5 | 13.8 | 18.5 |
| ⑤    | ⑤ | 11.8 | 14.2 | 11.8 | 14.2 |
| ⑥    | ⑥ | 11.8 | 18.5 | 11.8 | 18.5 |
| ⑦    | ⑦ | 11.8 | 14.2 | 11.8 | 14.2 |
| ⑧    | ⑧ | 13.8 | 15.5 | 13.8 | 15.5 |
| ⑨    | ⑨ | 11.8 | 14.2 | 11.8 | 14.2 |
| ⑩    | ⑩ | 11.8 | 14.2 | 11.8 | 14.2 |
| ⑪    | ⑪ | 7.1  | 10.6 | 7.1  | 10.6 |
| ⑫    | ⑫ | 7.1  | 10.6 | 7.1  | 10.6 |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 72 | 0 | OK |  |
| ②    | 0 | 68 | 0 | OK |  |
| ③    | 0 | 62 | 0 | OK |  |
| ④    | 0 | 81 | 0 | OK |  |
| ⑤    | 0 | 62 | 0 | OK |  |
| ⑥    | 0 | 81 | 0 | OK |  |
| ⑦    | 0 | 62 | 0 | OK |  |
| ⑧    | 0 | 68 | 0 | OK |  |
| ⑨    | 0 | 62 | 0 | OK |  |
| ⑩    | 0 | 62 | 0 | OK |  |
| ⑪    | 0 | 47 | 0 | OK |  |
| ⑫    | 0 | 47 | 0 | OK |  |

### SHEAR FORCES Vu (kip)

| Comb |      |       |    |  |  |
|------|------|-------|----|--|--|
| ①    | 12.4 | -12.4 | OK |  |  |
| ②    | 11.7 | -11.7 | OK |  |  |
| ③    | 10.7 | -10.7 | OK |  |  |
| ④    | 13.9 | -13.9 | OK |  |  |
| ⑤    | 10.7 | -10.7 | OK |  |  |
| ⑥    | 13.9 | -13.9 | OK |  |  |
| ⑦    | 10.7 | -10.7 | OK |  |  |
| ⑧    | 11.7 | -11.7 | OK |  |  |
| ⑨    | 10.7 | -10.7 | OK |  |  |
| ⑩    | 10.7 | -10.7 | OK |  |  |
| ⑪    | 8.0  | -8.0  | OK |  |  |
| ⑫    | 8.0  | -8.0  | OK |  |  |

**BENDING STRENGTH (k-ft)**

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#6 Cont     |      |                      |
| Bot    | 0#6x15.50 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.10         | 0.10 | 0.10                 |
| +φMn   | 83           | 83   | 83                   |
| Top    | 2#5 Cont     |      |                      |
| Top    | 0#5          |      |                      |
| d'     | 2.0          | 2.0  | 2.0 in               |
| -As    | 0.62         | 0.62 | 0.62 in <sup>2</sup> |
| c/d    | 0.09         | 0.09 | 0.09                 |
| -φMn   | -60          | -60  | -60                  |
| As min | 0.00         | 0.59 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|         |       |  |                 |
|---------|-------|--|-----------------|
| Comb    |       |  |                 |
| D       | 0.17  |  | in              |
| L       | 0.00  |  | in              |
| Lr, S   | 0.10  |  | in              |
| LS      | 0.03  |  | in              |
| LT      | 0.34  |  | in              |
| Ieff D  | 4,623 |  | in <sup>4</sup> |
| Ieff L  | 4,623 |  | in <sup>4</sup> |
| Ieff LS | 4,223 |  | in <sup>4</sup> |
| λ       | 1.70  |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |              |
|----------|-------|--------------|
| φVc      | 16.7  | -16.7        |
| φVs      | 21.8  | -21.8        |
| φVn      | 38.5  | -38.5        |
| Av/s     | 0.022 | 0.022 OK     |
| Min Av/s | 0.007 | N.A.         |
| s        | 10.0  | 10.0 10.0 OK |
| s max    | 11.0  | N.A. N.A.    |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.67 | OK |
| Max. Steel Area As max Ratio ....   | 0.24 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.30 | OK |
| Stirrups Spacing s max Ratio .....  | 0.91 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 2128 | 180    | 0.08  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 617  | 480    | 0.78  | OK |
| D    | Long-Term | 617  | 240    | 0.39  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM C

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |

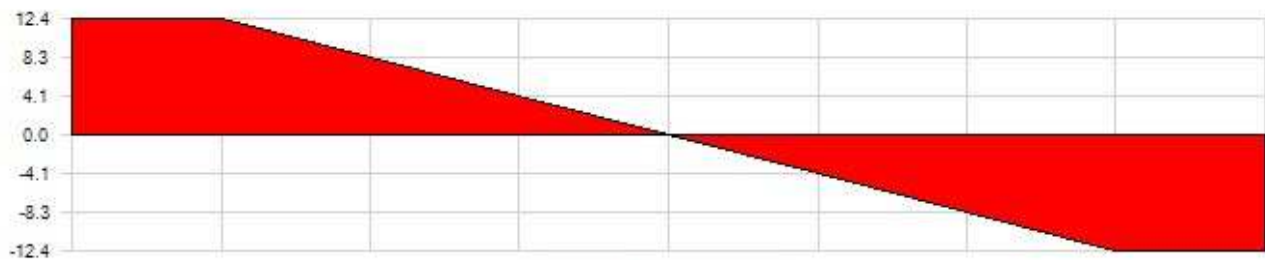
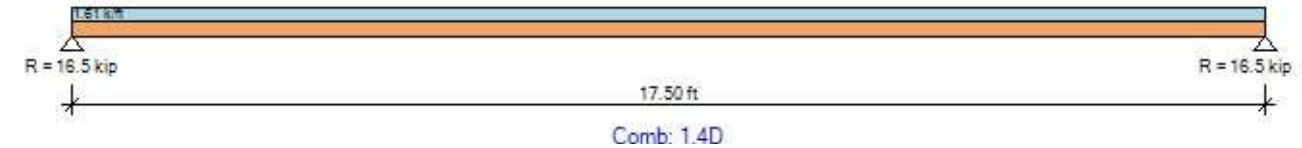
Project: CASA PA' FERNANDZ  
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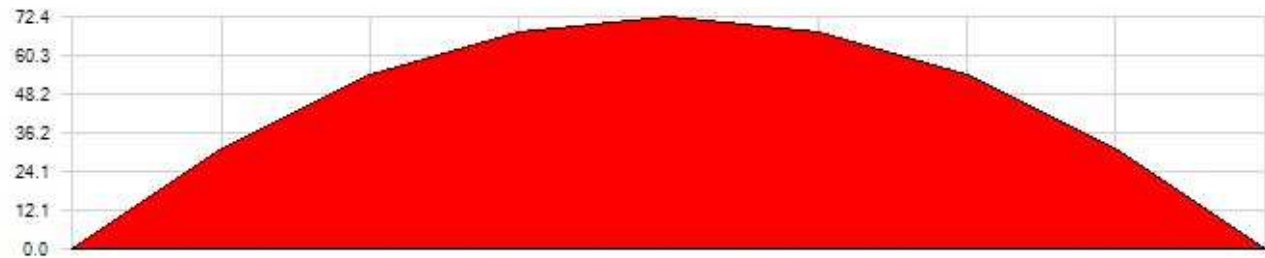
ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

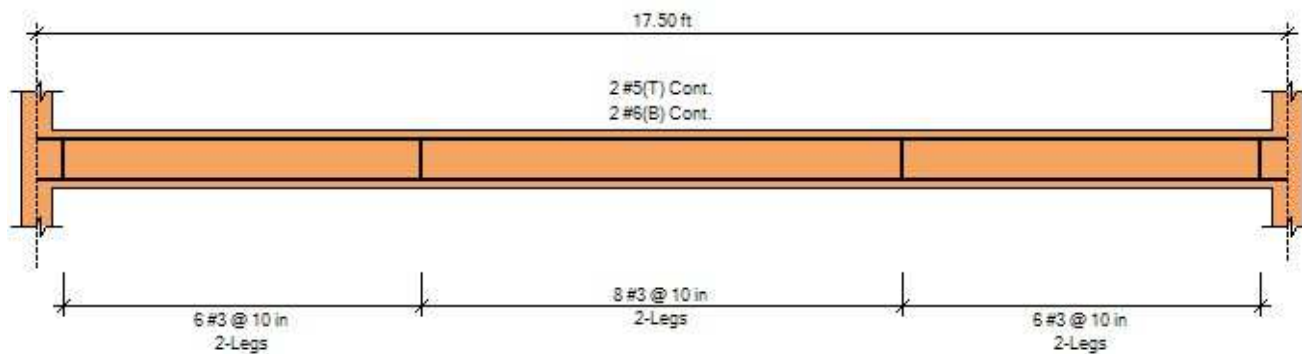
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SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

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**CONCRETE BEAM DESIGN**

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**GEOMETRY**

|                        |             |               |    |
|------------------------|-------------|---------------|----|
| Type ...               | Rectangular | Not deep beam | OK |
| Total Height h         | 12.0        | in            |    |
| Beam Width b           | 8.0         | in            |    |
| Flange Thickness tf    | N.A.        |               |    |
| Left Flange Width bfl  | N.A.        |               |    |
| Right Flange Width bfr | N.A.        |               |    |
| Left Cantilever        | 0.00        | ft            |    |
| Right Cantilever       | 0.00        | ft            |    |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 4       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 12.66 ft | ①       | Pinned |
| ②                        | 9.33 ft  | ②       | Pinned |
| ③                        | 5.00 ft  | ③       | Pinned |
| ④                        | N.A.     | ④       | Pinned |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |     |     |      |      |      |      |     |     |
|------|---|-----|-----|------|------|------|------|-----|-----|
| ①    | ① | 3.9 | 5.5 | 12.0 | 16.8 | 7.9  | 11.1 | 1.8 | 2.5 |
| ②    | ② | 4.9 | 5.2 | 15.2 | 16.0 | 10.1 | 10.6 | 2.3 | 2.4 |
| ③    | ③ | 3.9 | 4.7 | 12.0 | 14.4 | 7.9  | 9.5  | 1.8 | 2.2 |
| ④    | ④ | 4.7 | 6.3 | 14.4 | 19.4 | 9.6  | 13.0 | 2.2 | 2.9 |
| ⑤    | ⑤ | 3.9 | 4.7 | 12.0 | 14.4 | 7.9  | 9.5  | 1.8 | 2.2 |
| ⑥    | ⑥ | 3.9 | 6.3 | 12.0 | 19.4 | 7.9  | 13.0 | 1.8 | 2.9 |
| ⑦    | ⑦ | 3.9 | 4.7 | 12.0 | 14.4 | 7.9  | 9.5  | 1.8 | 2.2 |
| ⑧    | ⑧ | 4.7 | 5.2 | 14.4 | 16.0 | 9.6  | 10.6 | 2.2 | 2.4 |
| ⑨    | ⑨ | 3.9 | 4.7 | 12.0 | 14.4 | 7.9  | 9.5  | 1.8 | 2.2 |
| ⑩    | ⑩ | 3.9 | 4.7 | 12.0 | 14.4 | 7.9  | 9.5  | 1.8 | 2.2 |
| ⑪    | ⑪ | 2.3 | 3.5 | 7.2  | 10.8 | 4.8  | 7.1  | 1.1 | 1.6 |
| ⑫    | ⑫ | 2.3 | 3.5 | 7.2  | 10.8 | 4.8  | 7.1  | 1.1 | 1.6 |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |   |    |     |   |    |   |   |    |
|------|---|---|----|-----|---|----|---|---|----|
| ①    | ① | 0 | 14 | -18 | 5 | -7 | 2 | 0 | OK |
| ②    | ② | 0 | 13 | -17 | 5 | -6 | 2 | 0 | OK |
| ③    | ③ | 0 | 12 | -16 | 4 | -6 | 2 | 0 | OK |
| ④    | ④ | 0 | 16 | -21 | 6 | -8 | 2 | 0 | OK |
| ⑤    | ⑤ | 0 | 12 | -16 | 4 | -6 | 2 | 0 | OK |
| ⑥    | ⑥ | 0 | 16 | -21 | 6 | -8 | 2 | 0 | OK |
| ⑦    | ⑦ | 0 | 12 | -16 | 4 | -6 | 2 | 0 | OK |
| ⑧    | ⑧ | 0 | 13 | -17 | 5 | -6 | 2 | 0 | OK |
| ⑨    | ⑨ | 0 | 12 | -16 | 4 | -6 | 2 | 0 | OK |
| ⑩    | ⑩ | 0 | 12 | -16 | 4 | -6 | 2 | 0 | OK |
| ⑪    | ⑪ | 0 | 9  | -12 | 3 | -4 | 1 | 0 | OK |
| ⑫    | ⑫ | 0 | 9  | -12 | 3 | -4 | 1 | 0 | OK |

SHEAR FORCES  $V_u$  (kip)

| Comb |     |      |     |      |     |      |    |
|------|-----|------|-----|------|-----|------|----|
| ①    | 4.2 | -7.1 | 6.6 | -4.1 | 3.4 | -0.7 | OK |
| ②    | 4.0 | -6.7 | 6.3 | -4.0 | 3.2 | -0.7 | OK |
| ③    | 3.6 | -6.1 | 5.7 | -3.5 | 2.9 | -0.6 | OK |
| ④    | 4.8 | -8.2 | 7.7 | -4.9 | 4.0 | -0.8 | OK |
| ⑤    | 3.6 | -6.1 | 5.7 | -3.5 | 2.9 | -0.6 | OK |
| ⑥    | 4.8 | -8.2 | 7.7 | -4.9 | 4.0 | -0.8 | OK |
| ⑦    | 3.6 | -6.1 | 5.7 | -3.5 | 2.9 | -0.6 | OK |
| ⑧    | 4.0 | -6.7 | 6.3 | -4.0 | 3.2 | -0.7 | OK |
| ⑨    | 3.6 | -6.1 | 5.7 | -3.5 | 2.9 | -0.6 | OK |
| ⑩    | 3.6 | -6.1 | 5.7 | -3.5 | 2.9 | -0.6 | OK |
| ⑪    | 2.7 | -4.6 | 4.3 | -2.7 | 2.2 | -0.5 | OK |
| ⑫    | 2.7 | -4.6 | 4.3 | -2.7 | 2.2 | -0.5 | OK |

## BENDING STRENGTH (k-ft)

| Bot         | 2#5 Cont     |      | 2#5 Cont    |      | 2#5 Cont    |      |                      |
|-------------|--------------|------|-------------|------|-------------|------|----------------------|
| Bot         | 0#6x10.66 ft |      | 0#6x7.33 ft |      | 0#6x3.00 ft |      |                      |
| d           | 2.0          | 4.0  | 2.0         | 4.0  | 2.0         | 4.0  | 2.0 in               |
| +As         | 0.62         | 0.62 | 0.62        | 0.62 | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d         | 0.18         | 0.18 | 0.18        | 0.18 | 0.18        | 0.18 | 0.18                 |
| + $\phi$ Mn | 26           | 26   | 26          | 26   | 26          | 26   | 26                   |
| Top         | 2#5 Cont     |      | 2#5 Cont    |      | 2#5 Cont    |      |                      |
| Top         | 0#5          |      | 0#5         |      | 0#5         |      |                      |
| d'          | 2.0          | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | 2.0 in               |
| -As         | 0.62         | 0.62 | 0.62        | 0.62 | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d         | 0.18         | 0.18 | 0.18        | 0.18 | 0.18        | 0.18 | 0.18                 |
| - $\phi$ Mn | -26          | -26  | -26         | -26  | -26         | -26  | -26                  |
| As min      | 0.00         | 0.27 | 0.27        | 0.19 | 0.24        | 0.08 | 0.00 in <sup>2</sup> |

## SHEAR STRENGTH (kip, in)

| $\phi V_c$ | 7.6   | -7.6  | 7.6   | -7.6  | 7.6   | -7.6  |               |
|------------|-------|-------|-------|-------|-------|-------|---------------|
| $\phi V_s$ | 19.8  | -19.8 | 19.8  | -19.8 | 19.8  | -19.8 |               |
| $\phi V_n$ | 27.4  | -27.4 | 27.4  | -27.4 | 27.4  | -27.4 |               |
| Av/s       | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | OK            |
| Min Av/s   | 0.007 | N.A.  | 0.007 | N.A.  | 0.007 | N.A.  |               |
| s          | 5.0   | 5.0   | 5.0   | 5.0   | 5.0   | 5.0   | 6.0 5.0 OK    |
| s max      | 5.0   | 5.0   | N.A.  | 5.0   | 5.0   | N.A.  | 5.0 N.A. N.A. |



## DEFLECTIONS

| Comb      |      |       |       |     |
|-----------|------|-------|-------|-----|
| D         | 0.07 | 0.01  | 0.00  | in  |
| L         | 0.00 | 0.00  | 0.00  | in  |
| Lr, S     | 0.06 | 0.00  | 0.00  | in  |
| LS        | 0.02 | 0.00  | 0.00  | in  |
| LT        | 0.12 | 0.01  | 0.00  | in  |
| Ieff D    | 910  | 1,186 | 1,292 | in4 |
| Ieff L    | 910  | 1,186 | 1,292 | in4 |
| Ieff LS   | 793  | 1,178 | 1,292 | in4 |
| $\lambda$ | 1.44 | 1.44  | 1.44  |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

## REINFORCEMENT

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.43 | OK |
| Max. Steel Area As max Ratio ....   | 0.34 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.26 | OK |
| Shear Vs/Vs max Ratio .....         | 0.65 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.15 | OK |
| Stirrups Spacing s max Ratio .....  | 1.00 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.46 | OK |

## MATERIALS

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

## DESIGN CODES

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

MAX. DEFLECTIONS  $L/\delta$ 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 2635       | 180    | 0.07  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 1247       | 480    | 0.38  | OK |
| D    | Long-Term | 1247       | 240    | 0.19  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

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**CONCRETE BEAM DESIGN**

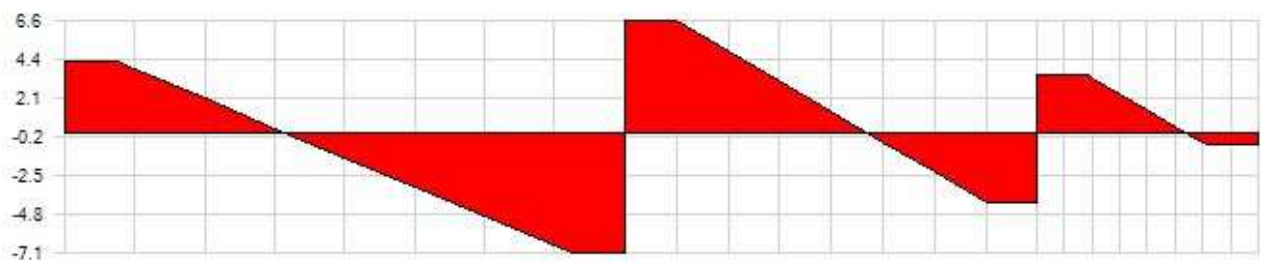
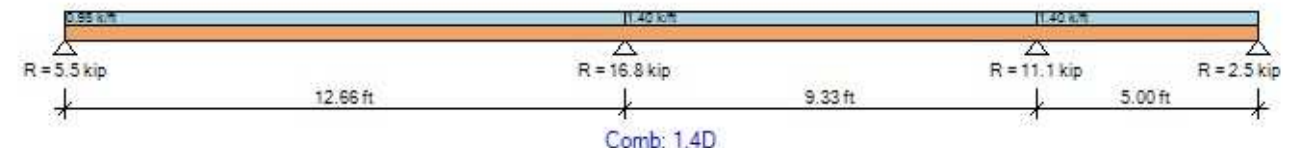
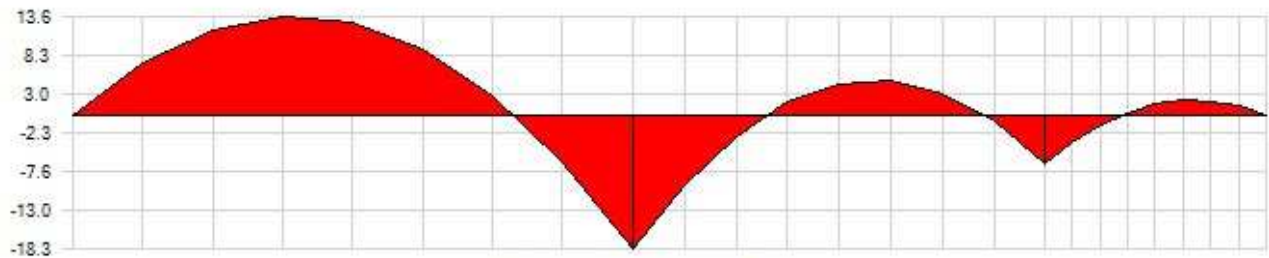
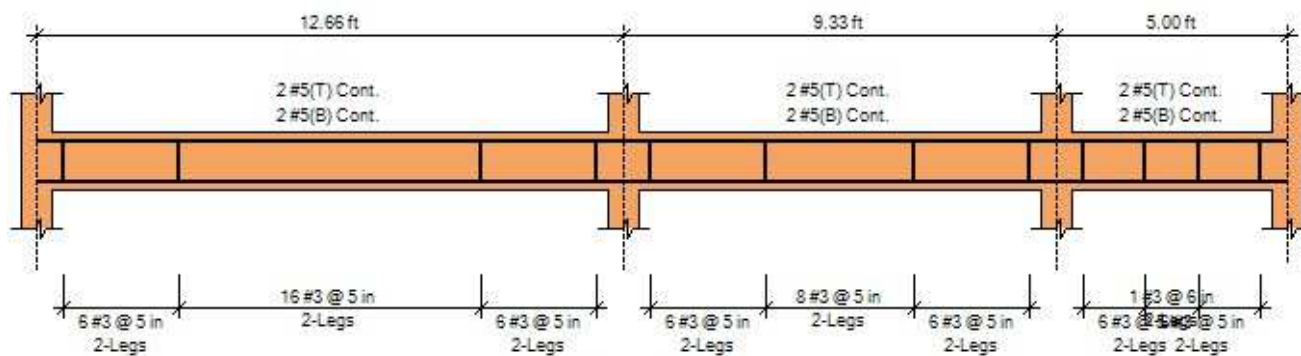
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**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |

**SHEAR DIAGRAM (kip)****MOMENT DIAGRAM (k-ft)****BEAM ELEVATION**

## GEOMETRY

|                        |           |    |
|------------------------|-----------|----|
| Type ...Inverted-T     | Deep beam | NG |
| Total Height h         | 42.0 in   |    |
| Beam Width b           | 8.0 in    |    |
| Flange Thickness tf    | 7.0 in    |    |
| Left Flange Width bfl  | 12.0 in   | OK |
| Right Flange Width bfr | 12.0 in   | OK |
| Left Cantilever        | 6.00 ft   |    |
| Right Cantilever       | 0.00 ft   |    |

## BEAM SUPPORTS

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 20.00 ft | ①       | Pinned |
| ②                        | 6.00 ft  | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |     |
|------|---|------|------|------|------|-----|
| ①    | ① | 45.3 | 63.5 | 17.9 | 25.1 | 1.7 |
| ②    | ② | 49.1 | 56.3 | 26.0 | 25.6 | 0.1 |
| ③    | ③ | 45.3 | 54.4 | 17.9 | 21.5 | 1.7 |
| ④    | ④ | 48.1 | 60.4 | 24.0 | 34.4 | 0.5 |
| ⑤    | ⑤ | 45.3 | 54.4 | 17.9 | 21.5 | 1.7 |
| ⑥    | ⑥ | 45.3 | 60.4 | 17.9 | 34.4 | 1.7 |
| ⑦    | ⑦ | 45.3 | 54.4 | 17.9 | 21.5 | 1.7 |
| ⑧    | ⑧ | 48.1 | 56.3 | 24.0 | 25.6 | 0.5 |
| ⑨    | ⑨ | 45.3 | 54.4 | 17.9 | 21.5 | 1.7 |
| ⑩    | ⑩ | 45.3 | 54.4 | 17.9 | 21.5 | 1.7 |
| ⑪    | ⑪ | 27.2 | 40.8 | 10.8 | 16.1 | 1.0 |
| ⑫    | ⑫ | 27.2 | 40.8 | 10.8 | 16.1 | 1.0 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |      |    |     |   |     |    |
|------|------|----|-----|---|-----|----|
| ①    | -157 | 26 | -24 | 1 | -2  | OK |
| ②    | -135 | 27 | -28 | 0 | -5  | OK |
| ③    | -134 | 23 | -21 | 1 | -2  | OK |
| ④    | -137 | 36 | -45 | 0 | -12 | OK |
| ⑤    | -134 | 23 | -21 | 1 | -2  | OK |
| ⑥    | -137 | 36 | -45 | 0 | -12 | OK |
| ⑦    | -134 | 23 | -21 | 1 | -2  | OK |
| ⑧    | -135 | 27 | -28 | 0 | -5  | OK |
| ⑨    | -134 | 23 | -21 | 1 | -2  | OK |
| ⑩    | -134 | 23 | -21 | 1 | -2  | OK |
| ⑪    | -101 | 17 | -15 | 1 | -2  | OK |
| ⑫    | -101 | 17 | -15 | 1 | -2  | OK |

## SHEAR FORCES Vu (kip)

| Comb |       |      |       |     |     |    |
|------|-------|------|-------|-----|-----|----|
| ①    | -24.1 | 20.2 | -6.9  | 2.6 | 5.4 | OK |
| ②    | -20.8 | 18.2 | -7.5  | 3.4 | 6.0 | OK |
| ③    | -20.6 | 17.3 | -5.9  | 2.2 | 4.6 | OK |
| ④    | -21.1 | 20.3 | -11.0 | 5.9 | 9.0 | OK |
| ⑤    | -20.6 | 17.3 | -5.9  | 2.2 | 4.6 | OK |
| ⑥    | -21.1 | 20.3 | -11.0 | 5.9 | 9.0 | OK |
| ⑦    | -20.6 | 17.3 | -5.9  | 2.2 | 4.6 | OK |
| ⑧    | -20.8 | 18.2 | -7.5  | 3.4 | 6.0 | OK |
| ⑨    | -20.6 | 17.3 | -5.9  | 2.2 | 4.6 | OK |
| ⑩    | -20.6 | 17.3 | -5.9  | 2.2 | 4.6 | OK |
| ⑪    | -15.5 | 13.0 | -4.4  | 1.7 | 3.5 | OK |
| ⑫    | -15.5 | 13.0 | -4.4  | 1.7 | 3.5 | OK |



**BENDING STRENGTH (k-ft)**

|        |              |      |             |      |                      |
|--------|--------------|------|-------------|------|----------------------|
| Bot    | 2#6 Cont     |      | 2#6 Cont    |      |                      |
| Bot    | 0#6x10.66 ft |      | 0#6x4.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0         | 4.0  | 2.0 in               |
| +As    | 0.88         | 0.88 | 0.88        | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.05         | 0.05 | 0.05        | 0.05 | 0.05                 |
| +φMn   | 154          | 154  | 154         | 154  | 154                  |
| Top    | 2#6 Cont     |      | 2#6 Cont    |      |                      |
| Top    | 0#5          |      | 0#5         |      | 0#5                  |
| d'     | 2.0          | 2.0  | 2.0         | 2.0  | 2.0 in               |
| -As    | 0.88         | 0.88 | 0.88        | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.03         | 0.03 | 0.03        | 0.03 | 0.03                 |
| -φMn   | -162         | -162 | -162        | -162 | -162                 |
| As min | 1.07         | 0.28 | 0.18        | 0.00 | 0.02 in <sup>2</sup> |

**DEFLECTIONS**

|                     |        |        |        |                 |
|---------------------|--------|--------|--------|-----------------|
| Comb                |        |        |        |                 |
| D                   | 0.01   | 0.00   | 0.00   | in              |
| L                   | 0.00   | 0.00   | 0.00   | in              |
| Lr, S               | 0.00   | 0.00   | 0.00   | in              |
| LS                  | 0.00   | 0.00   | 0.00   | in              |
| LT                  | 0.02   | 0.00   | 0.00   | in              |
| I <sub>eff</sub> D  | 89,536 | 64,568 | 59,218 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 89,536 | 64,568 | 59,218 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 89,536 | 64,568 | 59,218 | in <sup>4</sup> |
| λ                   | 2.00   | 1.76   | 1.76   |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |       |       |             |
|----------|-------|-------|-------|-------|-------------|
| φVc      | -30.4 | 30.4  | -30.4 | 30.4  | -30.4       |
| φVs      | -33.0 | 33.0  | -33.0 | 33.0  | -33.0       |
| φVn      | -63.4 | 63.4  | -63.4 | 63.4  | -63.4       |
| Av/s     | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 OK    |
| Min Av/s | N.A   | 0.007 | N.A   | N.A   | N.A         |
| s        | 12.0  | 12.0  | 12.0  | 12.0  | 6.0 12.0 OK |
| s max    | N.A   | 20.0  | N.A   | N.A   | N.A         |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 1.21 | NG |
| Max. Steel Area As max Ratio ....   | 0.13 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio .....  | 0.60 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.19 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 90     | 0.00  | OK |
| B    | Live Load | 9999 | 180    | 0.00  | OK |
| C    | Long-Term | 3349 | 240    | 0.07  | OK |
| D    | Long-Term | 3349 | 120    | 0.04  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM E

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM G

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 48.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 22.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 34.3 | 48.0 | 26.1 | 36.6 |
| ②    | ② | 39.4 | 43.7 | 30.4 | 33.5 |
| ③    | ③ | 34.3 | 41.1 | 26.1 | 31.3 |
| ④    | ④ | 38.2 | 49.4 | 29.3 | 38.1 |
| ⑤    | ⑤ | 34.3 | 41.1 | 26.1 | 31.3 |
| ⑥    | ⑥ | 34.3 | 49.4 | 26.1 | 38.1 |
| ⑦    | ⑦ | 34.3 | 41.1 | 26.1 | 31.3 |
| ⑧    | ⑧ | 38.2 | 43.7 | 29.3 | 33.5 |
| ⑨    | ⑨ | 34.3 | 41.1 | 26.1 | 31.3 |
| ⑩    | ⑩ | 34.3 | 41.1 | 26.1 | 31.3 |
| ⑪    | ⑪ | 20.6 | 30.9 | 15.7 | 23.5 |
| ⑫    | ⑫ | 20.6 | 30.9 | 15.7 | 23.5 |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |     |   |    |  |
|------|---|-----|---|----|--|
| ①    | 0 | 392 | 0 | OK |  |
| ②    | 0 | 355 | 0 | OK |  |
| ③    | 0 | 336 | 0 | OK |  |
| ④    | 0 | 398 | 0 | OK |  |
| ⑤    | 0 | 336 | 0 | OK |  |
| ⑥    | 0 | 398 | 0 | OK |  |
| ⑦    | 0 | 336 | 0 | OK |  |
| ⑧    | 0 | 355 | 0 | OK |  |
| ⑨    | 0 | 336 | 0 | OK |  |
| ⑩    | 0 | 336 | 0 | OK |  |
| ⑪    | 0 | 252 | 0 | OK |  |
| ⑫    | 0 | 252 | 0 | OK |  |

**SHEAR FORCES Vu (kip)**

| Comb |      |       |    |  |  |
|------|------|-------|----|--|--|
| ①    | 43.9 | -32.5 | OK |  |  |
| ②    | 39.8 | -29.5 | OK |  |  |
| ③    | 37.6 | -27.8 | OK |  |  |
| ④    | 44.6 | -33.3 | OK |  |  |
| ⑤    | 37.6 | -27.8 | OK |  |  |
| ⑥    | 44.6 | -33.3 | OK |  |  |
| ⑦    | 37.6 | -27.8 | OK |  |  |
| ⑧    | 39.8 | -29.5 | OK |  |  |
| ⑨    | 37.6 | -27.8 | OK |  |  |
| ⑩    | 37.6 | -27.8 | OK |  |  |
| ⑪    | 28.2 | -20.9 | OK |  |  |
| ⑫    | 28.2 | -20.9 | OK |  |  |



**BENDING STRENGTH (k-ft)**

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#7 Cont     |      |                      |
| Bot    | 2#6x22.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 1.20         | 2.08 | 1.20 in <sup>2</sup> |
| c/d    | 0.07         | 0.09 | 0.07                 |
| +φMn   | 245          | 406  | 245                  |
| Top    | 2#6 Cont     |      |                      |
| Top    | 2#6          |      |                      |
| d'     | 4.0          | 2.0  | 4.0 in               |
| -As    | 1.76         | 0.88 | 1.76 in <sup>2</sup> |
| c/d    | 0.07         | 0.06 | 0.07                 |
| -φMn   | -344         | -183 | -344                 |
| As min | 0.00         | 1.23 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |        |  |                 |
|---------------------|--------|--|-----------------|
| Comb                |        |  |                 |
| D                   | 0.18   |  | in              |
| L                   | 0.00   |  | in              |
| Lr, S               | 0.04   |  | in              |
| LS                  | 0.01   |  | in              |
| LT                  | 0.35   |  | in              |
| I <sub>eff</sub> D  | 30,583 |  | in <sup>4</sup> |
| I <sub>eff</sub> L  | 30,583 |  | in <sup>4</sup> |
| I <sub>eff</sub> LS | 29,787 |  | in <sup>4</sup> |
| λ                   | 1.79   |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |            |
|----------|-------|------------|
| φVc      | 34.9  | -34.9      |
| φVs      | 91.1  | -91.1      |
| φVn      | 126.0 | -126.0     |
| Av/s     | 0.044 | 0.044 OK   |
| Min Av/s | 0.007 | N.A.       |
| s        | 5.0   | 5.0 5.0 OK |
| s max    | 23.0  | 23.0 N.A.  |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.59 | OK |
| Max. Steel Area As max Ratio ....   | 0.28 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.57 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.65 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.15 | OK |
| Stirrups Spacing s max Ratio .....  | 0.22 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.19 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 6198 | 180    | 0.03  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 756  | 480    | 0.64  | OK |
| D    | Long-Term | 756  | 240    | 0.32  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM G

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

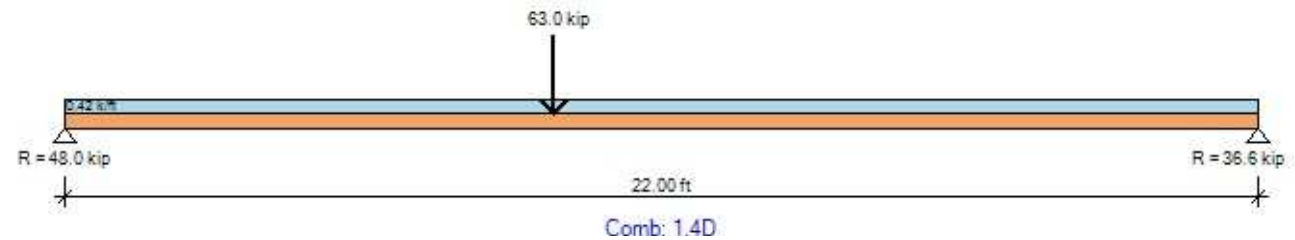
www.asdipsoft.com

**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 36.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 14.50 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 10.9 | 15.2 | 10.9 | 15.2 |
| ②    | ② | 13.8 | 14.5 | 13.8 | 14.5 |
| ③    | ③ | 10.9 | 13.0 | 10.9 | 13.1 |
| ④    | ④ | 13.0 | 17.7 | 13.1 | 17.7 |
| ⑤    | ⑤ | 10.9 | 13.0 | 10.9 | 13.1 |
| ⑥    | ⑥ | 10.9 | 17.7 | 10.9 | 17.7 |
| ⑦    | ⑦ | 10.9 | 13.0 | 10.9 | 13.1 |
| ⑧    | ⑧ | 13.0 | 14.5 | 13.1 | 14.5 |
| ⑨    | ⑨ | 10.9 | 13.0 | 10.9 | 13.1 |
| ⑩    | ⑩ | 10.9 | 13.0 | 10.9 | 13.1 |
| ⑪    | ⑪ | 6.5  | 9.8  | 6.5  | 9.8  |
| ⑫    | ⑫ | 6.5  | 9.8  | 6.5  | 9.8  |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 55 | 0 | OK |  |
| ②    | 0 | 53 | 0 | OK |  |
| ③    | 0 | 47 | 0 | OK |  |
| ④    | 0 | 64 | 0 | OK |  |
| ⑤    | 0 | 47 | 0 | OK |  |
| ⑥    | 0 | 64 | 0 | OK |  |
| ⑦    | 0 | 47 | 0 | OK |  |
| ⑧    | 0 | 53 | 0 | OK |  |
| ⑨    | 0 | 47 | 0 | OK |  |
| ⑩    | 0 | 47 | 0 | OK |  |
| ⑪    | 0 | 35 | 0 | OK |  |
| ⑫    | 0 | 35 | 0 | OK |  |

## SHEAR FORCES Vu (kip)

| Comb |      |       |    |  |  |
|------|------|-------|----|--|--|
| ①    | 8.6  | -8.6  | OK |  |  |
| ②    | 8.2  | -8.2  | OK |  |  |
| ③    | 7.3  | -7.4  | OK |  |  |
| ④    | 10.0 | -10.0 | OK |  |  |
| ⑤    | 7.3  | -7.4  | OK |  |  |
| ⑥    | 10.0 | -10.0 | OK |  |  |
| ⑦    | 7.3  | -7.4  | OK |  |  |
| ⑧    | 8.2  | -8.2  | OK |  |  |
| ⑨    | 7.3  | -7.4  | OK |  |  |
| ⑩    | 7.3  | -7.4  | OK |  |  |
| ⑪    | 5.5  | -5.5  | OK |  |  |
| ⑫    | 5.5  | -5.5  | OK |  |  |



**BENDING STRENGTH (k-ft)**

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#6 Cont     |      |                      |
| Bot    | 0#6x12.50 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.06         | 0.06 | 0.06                 |
| +φMn   | 131          | 131  | 131                  |
| Top    | 2#5 Cont     |      |                      |
| Top    | 0#5          |      |                      |
| d'     | 2.0          | 2.0  | 2.0 in               |
| -As    | 0.62         | 0.62 | 0.62 in <sup>2</sup> |
| c/d    | 0.06         | 0.06 | 0.06                 |
| -φMn   | -93          | -93  | -93                  |
| As min | 0.00         | 0.58 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|         |        |  |                 |
|---------|--------|--|-----------------|
| Comb    |        |  |                 |
| D       | 0.01   |  | in              |
| L       | 0.00   |  | in              |
| Lr, S   | 0.00   |  | in              |
| LS      | 0.00   |  | in              |
| LT      | 0.02   |  | in              |
| Ieff D  | 33,809 |  | in <sup>4</sup> |
| Ieff L  | 33,809 |  | in <sup>4</sup> |
| Ieff LS | 33,809 |  | in <sup>4</sup> |
| λ       | 1.80   |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |             |
|----------|-------|-------------|
| φVc      | 25.8  | -25.8       |
| φVs      | 21.0  | -21.0       |
| φVn      | 46.8  | -46.8       |
| Av/s     | 0.014 | 0.014 OK    |
| Min Av/s | N.A.  | N.A.        |
| s        | 16.0  | 6.0 16.0 OK |
| s max    | N.A.  | N.A.        |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.66 | OK |
| Max. Steel Area As max Ratio ....   | 0.16 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | N.A. |    |
| Min. Stirrups Area Av/s Ratio ..... | N.A. |    |
| Stirrups Spacing s max Ratio .....  | N.A. |    |
| Stirrups Min. # of Legs Ratio ..... | N.A. |    |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 7331 | 480    | 0.07  | OK |
| D    | Long-Term | 7331 | 240    | 0.03  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM H

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |

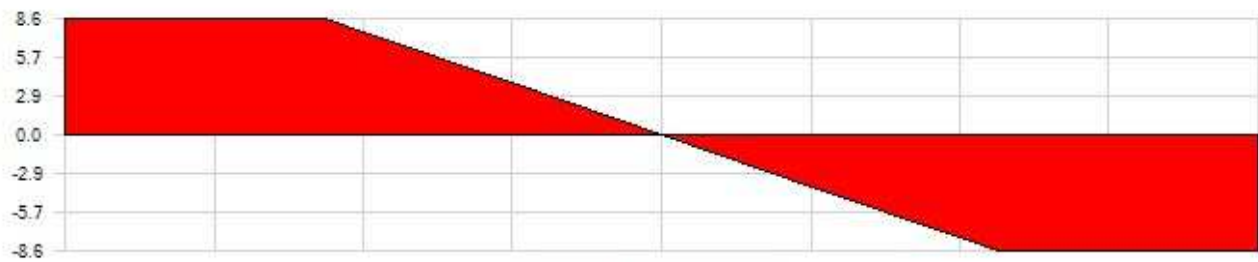
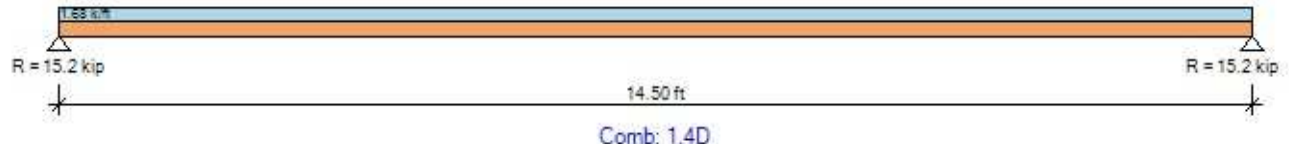
Project: CASA PA' FERNANDZ  
Engineer:  
Descrip: MAIN ROOF BEAM H

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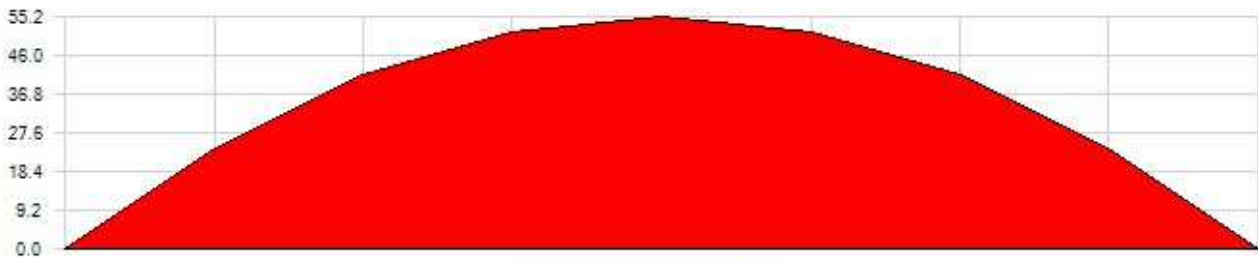
ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

[www.asdipsoft.com](http://www.asdipsoft.com)



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ

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10/17/2024

Descrip: MAIN ROOF BEAM J

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |             |               |    |
|------------------------|-------------|---------------|----|
| Type ...               | Rectangular | Not deep beam | OK |
| Total Height h         | 12.0        | in            |    |
| Beam Width b           | 24.0        | in            |    |
| Flange Thickness tf    | N.A.        |               |    |
| Left Flange Width bfl  | N.A.        |               |    |
| Right Flange Width bfr | N.A.        |               |    |
| Left Cantilever        | 0.00        | ft            |    |
| Right Cantilever       | 0.00        | ft            |    |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 4       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 6.00 ft  | ①       | Pinned |
| ②                        | 20.00 ft | ②       | Pinned |
| ③                        | 7.00 ft  | ③       | Pinned |
| ④                        | N.A.     | ④       | Pinned |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |      |      |      |      |
|------|---|------|------|------|------|------|------|------|------|
| ①    | ① | -3.6 | -5.0 | 35.7 | 49.9 | 34.9 | 48.9 | -1.0 | -1.4 |
| ②    | ② | -4.5 | -4.7 | 44.6 | 47.2 | 43.6 | 46.3 | -1.2 | -1.3 |
| ③    | ③ | -3.6 | -4.3 | 35.7 | 42.8 | 34.9 | 41.9 | -1.0 | -1.2 |
| ④    | ④ | -4.3 | -5.7 | 42.3 | 57.0 | 41.5 | 55.9 | -1.2 | -1.6 |
| ⑤    | ⑤ | -3.6 | -4.3 | 35.7 | 42.8 | 34.9 | 41.9 | -1.0 | -1.2 |
| ⑥    | ⑥ | -3.6 | -5.7 | 35.7 | 57.0 | 34.9 | 55.9 | -1.0 | -1.6 |
| ⑦    | ⑦ | -3.6 | -4.3 | 35.7 | 42.8 | 34.9 | 41.9 | -1.0 | -1.2 |
| ⑧    | ⑧ | -4.3 | -4.7 | 42.3 | 47.2 | 41.5 | 46.3 | -1.2 | -1.3 |
| ⑨    | ⑨ | -3.6 | -4.3 | 35.7 | 42.8 | 34.9 | 41.9 | -1.0 | -1.2 |
| ⑩    | ⑩ | -3.6 | -4.3 | 35.7 | 42.8 | 34.9 | 41.9 | -1.0 | -1.2 |
| ⑪    | ⑪ | -2.1 | -3.2 | 21.4 | 32.1 | 21.0 | 31.4 | -0.6 | -0.9 |
| ⑫    | ⑫ | -2.1 | -3.2 | 21.4 | 32.1 | 21.0 | 31.4 | -0.6 | -0.9 |

**BENDING MOMENTS Mu (k-ft)**

| Comb |     |   |     |    |     |   |     |    |
|------|-----|---|-----|----|-----|---|-----|----|
| ①    | -18 | 0 | -80 | 61 | -78 | 0 | -22 | OK |
| ②    | -17 | 0 | -76 | 57 | -74 | 0 | -21 | OK |
| ③    | -16 | 0 | -69 | 52 | -67 | 0 | -19 | OK |
| ④    | -21 | 0 | -92 | 69 | -90 | 0 | -25 | OK |
| ⑤    | -16 | 0 | -69 | 52 | -67 | 0 | -19 | OK |
| ⑥    | -21 | 0 | -92 | 69 | -90 | 0 | -25 | OK |
| ⑦    | -16 | 0 | -69 | 52 | -67 | 0 | -19 | OK |
| ⑧    | -17 | 0 | -76 | 57 | -74 | 0 | -21 | OK |
| ⑨    | -16 | 0 | -69 | 52 | -67 | 0 | -19 | OK |
| ⑩    | -16 | 0 | -69 | 52 | -67 | 0 | -19 | OK |
| ⑪    | -12 | 0 | -52 | 39 | -50 | 0 | -14 | OK |
| ⑫    | -12 | 0 | -52 | 39 | -50 | 0 | -14 | OK |



**SHEAR FORCES  $V_u$  (kip)**

| Comb |      |       |      |       |      |     |    |
|------|------|-------|------|-------|------|-----|----|
| ①    | -8.3 | -18.5 | 24.8 | -24.6 | 17.7 | 4.7 | OK |
| ②    | -7.8 | -17.6 | 23.5 | -23.3 | 16.8 | 4.4 | OK |
| ③    | -7.1 | -15.9 | 21.3 | -21.1 | 15.2 | 4.0 | OK |
| ④    | -9.5 | -21.2 | 28.4 | -28.1 | 20.3 | 5.3 | OK |
| ⑤    | -7.1 | -15.9 | 21.3 | -21.1 | 15.2 | 4.0 | OK |
| ⑥    | -9.5 | -21.2 | 28.4 | -28.1 | 20.3 | 5.3 | OK |
| ⑦    | -7.1 | -15.9 | 21.3 | -21.1 | 15.2 | 4.0 | OK |
| ⑧    | -7.8 | -17.6 | 23.5 | -23.3 | 16.8 | 4.4 | OK |
| ⑨    | -7.1 | -15.9 | 21.3 | -21.1 | 15.2 | 4.0 | OK |
| ⑩    | -7.1 | -15.9 | 21.3 | -21.1 | 15.2 | 4.0 | OK |
| ⑪    | -5.3 | -11.9 | 16.0 | -15.8 | 11.4 | 3.0 | OK |
| ⑫    | -5.3 | -11.9 | 16.0 | -15.8 | 11.4 | 3.0 | OK |

**BENDING STRENGTH (k-ft)**

| Bot         | 7#6 Cont    |      | 7#6 Cont    |      | 7#6 Cont    |      |                      |
|-------------|-------------|------|-------------|------|-------------|------|----------------------|
| Bot         | 0#6x4.00 ft |      | 0#6x4.00 ft |      | 0#6x4.00 ft |      |                      |
| d           | 2.0         | 4.0  | 2.0         | 4.0  | 2.0         | 4.0  | 2.0 in               |
| +As         | 3.08        | 3.08 | 3.08        | 3.08 | 3.08        | 3.08 | 3.08 in <sup>2</sup> |
| c/d         | 0.23        | 0.23 | 0.23        | 0.23 | 0.23        | 0.23 | 0.23                 |
| + $\phi$ Mn | 123         | 123  | 123         | 123  | 123         | 123  | 123                  |
| Top         | 7#6 Cont    |      | 7#6 Cont    |      | 7#6 Cont    |      |                      |
| Top         | 0#5         |      | 0#5         |      | 0#5         |      |                      |
| d'          | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | 2.0 in               |
| -As         | 3.08        | 3.08 | 3.08        | 3.08 | 3.08        | 3.08 | 3.08 in <sup>2</sup> |
| c/d         | 0.23        | 0.23 | 0.23        | 0.23 | 0.23        | 0.23 | 0.23                 |
| - $\phi$ Mn | -123        | -123 | -123        | -123 | -123        | -123 | -123                 |
| As min      | 0.63        | 0.00 | 0.80        | 0.80 | 0.80        | 0.00 | 0.76 in <sup>2</sup> |

**SHEAR STRENGTH (kip, in)**

| $\phi V_c$ | 22.8  | -22.8 | 22.8  | -22.8 | 22.8  | -22.8 |              |
|------------|-------|-------|-------|-------|-------|-------|--------------|
| $\phi V_s$ | 59.4  | -59.4 | 59.4  | -59.4 | 59.4  | -59.4 |              |
| $\phi V_n$ | 82.2  | -82.2 | 82.2  | -82.2 | 82.2  | -82.2 |              |
| Av/s       | 0.132 | 0.132 | 0.132 | 0.132 | 0.132 | 0.132 | OK           |
| Min Av/s   | N.A.  | N.A.  | 0.020 | N.A.  | 0.020 | N.A.  |              |
| s          | 5.0   | 6.0   | 5.0   | 5.0   | 5.0   | 5.0   | 4.0 5.0 NG   |
| s max      | N.A.  | 5.0   | N.A.  | 5.0   | 5.0   | N.A.  | 5.0 5.0 N.A. |

**DEFLECTIONS**

| Comb      |       |       |       |     |
|-----------|-------|-------|-------|-----|
| D         | 0.00  | 0.32  | 0.00  | in  |
| L         | 0.00  | 0.00  | 0.00  | in  |
| Lr, S     | 0.00  | 0.14  | 0.00  | in  |
| LS        | 0.00  | 0.04  | 0.00  | in  |
| LT        | 0.00  | 0.44  | 0.00  | in  |
| Ieff D    | 3,787 | 2,006 | 3,791 | in4 |
| Ieff L    | 3,787 | 2,006 | 3,791 | in4 |
| Ieff LS   | 3,778 | 1,895 | 3,781 | in4 |
| $\lambda$ | 1.22  | 1.22  | 1.22  |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.26 | OK |
| Max. Steel Area As max Ratio ....   | 0.50 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.44 | OK |
| Rebars Max Spacing Smax Ratio       | 0.29 | OK |
| Shear Vs/Vs max Ratio .....         | 0.65 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.15 | OK |
| Stirrups Spacing s max Ratio .....  | 1.00 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.41 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 1673       | 180    | 0.11  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 544        | 480    | 0.88  | OK |
| D    | Long-Term | 544        | 240    | 0.44  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: MAIN ROOF BEAM J

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

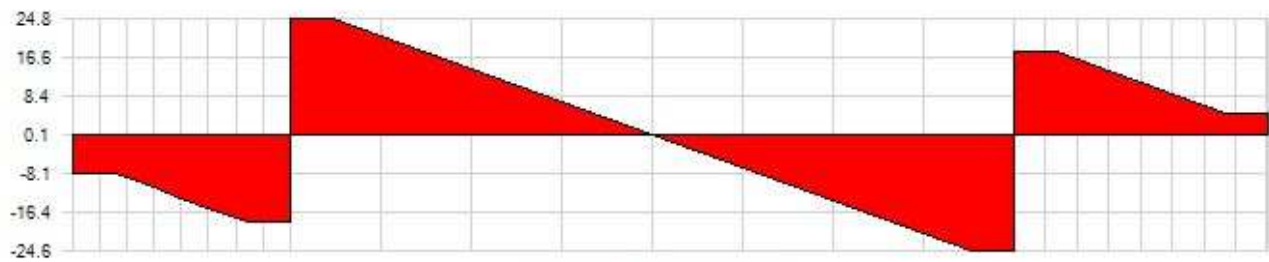
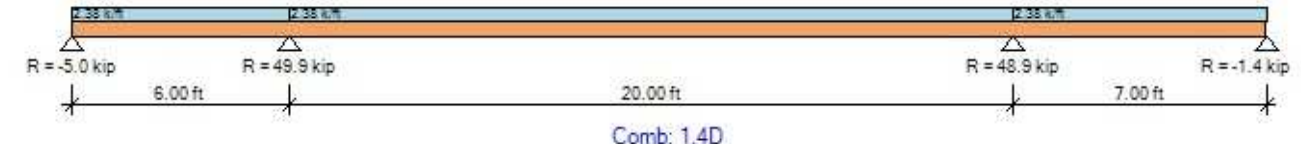
www.asdipsoft.com

**TORSION MOMENTS  $T_u$  (k-ft)**

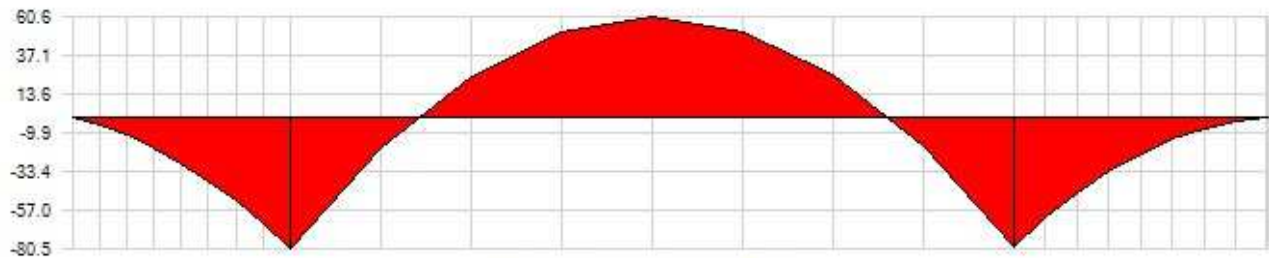
| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM K

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                              |           |    |
|------------------------------|-----------|----|
| Type ...Rectangular          | Deep beam | NG |
| Total Height h .....         | 24.0      | in |
| Beam Width b .....           | 8.0       | in |
| Flange Thickness tf .....    | N.A.      |    |
| Left Flange Width bfl .....  | N.A.      |    |
| Right Flange Width bfr ..... | N.A.      |    |
| Left Cantilever .....        | 0.00      | ft |
| Right Cantilever .....       | 0.00      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 4       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 7.00 ft  | ①       | Pinned |
| ②                        | 22.00 ft | ②       | Pinned |
| ③                        | 9.00 ft  | ③       | Pinned |
| ④                        | N.A.     | ④       | Pinned |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |      |      |     |     |
|------|---|------|------|------|------|------|------|-----|-----|
| ①    | ① | -5.1 | -7.1 | 44.9 | 62.8 | 46.1 | 64.6 | 1.8 | 2.5 |
| ②    | ② | -5.5 | -6.3 | 50.7 | 56.8 | 51.9 | 58.2 | 2.0 | 2.3 |
| ③    | ③ | -5.1 | -6.1 | 44.9 | 53.8 | 46.1 | 55.4 | 1.8 | 2.2 |
| ④    | ④ | -5.4 | -6.8 | 49.3 | 63.2 | 50.4 | 64.6 | 2.0 | 2.5 |
| ⑤    | ⑤ | -5.1 | -6.1 | 44.9 | 53.8 | 46.1 | 55.4 | 1.8 | 2.2 |
| ⑥    | ⑥ | -5.1 | -6.8 | 44.9 | 63.2 | 46.1 | 64.6 | 1.8 | 2.5 |
| ⑦    | ⑦ | -5.1 | -6.1 | 44.9 | 53.8 | 46.1 | 55.4 | 1.8 | 2.2 |
| ⑧    | ⑧ | -5.4 | -6.3 | 49.3 | 56.8 | 50.4 | 58.2 | 2.0 | 2.3 |
| ⑨    | ⑨ | -5.1 | -6.1 | 44.9 | 53.8 | 46.1 | 55.4 | 1.8 | 2.2 |
| ⑩    | ⑩ | -5.1 | -6.1 | 44.9 | 53.8 | 46.1 | 55.4 | 1.8 | 2.2 |
| ⑪    | ⑪ | -3.1 | -4.6 | 26.9 | 40.4 | 27.7 | 41.5 | 1.1 | 1.6 |
| ⑫    | ⑫ | -3.1 | -4.6 | 26.9 | 40.4 | 27.7 | 41.5 | 1.1 | 1.6 |

**BENDING MOMENTS Mu (k-ft)**

| Comb |     |   |      |    |      |   |     |    |
|------|-----|---|------|----|------|---|-----|----|
| ①    | -28 | 0 | -115 | 89 | -113 | 1 | -23 | NG |
| ②    | -25 | 0 | -104 | 80 | -102 | 1 | -20 | NG |
| ③    | -24 | 0 | -99  | 76 | -97  | 1 | -19 | NG |
| ④    | -27 | 0 | -115 | 89 | -113 | 1 | -23 | NG |
| ⑤    | -24 | 0 | -99  | 76 | -97  | 1 | -19 | NG |
| ⑥    | -27 | 0 | -115 | 89 | -113 | 1 | -23 | NG |
| ⑦    | -24 | 0 | -99  | 76 | -97  | 1 | -19 | NG |
| ⑧    | -25 | 0 | -104 | 80 | -102 | 1 | -20 | NG |
| ⑨    | -24 | 0 | -99  | 76 | -97  | 1 | -19 | NG |
| ⑩    | -24 | 0 | -99  | 76 | -97  | 1 | -19 | NG |
| ⑪    | -18 | 0 | -74  | 57 | -73  | 0 | -15 | OK |
| ⑫    | -18 | 0 | -74  | 57 | -73  | 0 | -15 | OK |

SHEAR FORCES  $V_u$  (kip)

| Comb |       |       |      |       |      |     |    |
|------|-------|-------|------|-------|------|-----|----|
| ①    | -12.9 | -20.0 | 29.8 | -29.6 | 20.4 | 4.7 | OK |
| ②    | -11.6 | -18.1 | 26.8 | -26.7 | 18.4 | 4.3 | OK |
| ③    | -11.1 | -17.1 | 25.5 | -25.4 | 17.5 | 4.1 | OK |
| ④    | -12.8 | -20.2 | 29.8 | -29.6 | 20.4 | 4.7 | OK |
| ⑤    | -11.1 | -17.1 | 25.5 | -25.4 | 17.5 | 4.1 | OK |
| ⑥    | -12.8 | -20.2 | 29.8 | -29.6 | 20.4 | 4.7 | OK |
| ⑦    | -11.1 | -17.1 | 25.5 | -25.4 | 17.5 | 4.1 | OK |
| ⑧    | -11.6 | -18.1 | 26.8 | -26.7 | 18.4 | 4.3 | OK |
| ⑨    | -11.1 | -17.1 | 25.5 | -25.4 | 17.5 | 4.1 | OK |
| ⑩    | -11.1 | -17.1 | 25.5 | -25.4 | 17.5 | 4.1 | OK |
| ⑪    | -8.3  | -12.9 | 19.1 | -19.0 | 13.1 | 3.1 | OK |
| ⑫    | -8.3  | -12.9 | 19.1 | -19.0 | 13.1 | 3.1 | OK |

## BENDING STRENGTH (k-ft)

|             |             |      |              |      |             |      |                      |
|-------------|-------------|------|--------------|------|-------------|------|----------------------|
| Bot         | 2#6 Cont    |      | 2#6 Cont     |      | 2#6 Cont    |      |                      |
| Bot         | 0#6x4.00 ft |      | 2#6x18.00 ft |      | 0#6x4.00 ft |      |                      |
| d           | 2.0         | 4.0  | 2.0          | 4.0  | 2.0         | 4.0  | 2.0 in               |
| +As         | 0.88        | 0.88 | 0.88         | 1.76 | 0.88        | 0.88 | 0.88 in <sup>2</sup> |
| c/d         | 0.10        | 0.10 | 0.13         | 0.15 | 0.13        | 0.10 | 0.10                 |
| + $\phi$ Mn | 83          | 83   | 88           | 154  | 88          | 83   | 83                   |
| Top         | 2#6 Cont    |      | 2#6 Cont     |      | 2#6 Cont    |      |                      |
| Top         | 0#5         |      | 2#6          |      | 2#6         |      | 0#5                  |
| d'          | 2.0         | 2.0  | 4.0          | 2.0  | 4.0         | 2.0  | 2.0 in               |
| -As         | 0.88        | 0.88 | 1.76         | 0.88 | 1.76        | 0.88 | 0.88 in <sup>2</sup> |
| c/d         | 0.10        | 0.10 | 0.15         | 0.13 | 0.15        | 0.10 | 0.10                 |
| - $\phi$ Mn | -83         | -83  | -154         | -88  | -154        | -83  | -83                  |
| As min      | 0.40        | 0.00 | 0.59         | 0.59 | 0.59        | 0.01 | 0.32 in <sup>2</sup> |

## SHEAR STRENGTH (kip, in)

|            |       |       |       |       |       |       |        |
|------------|-------|-------|-------|-------|-------|-------|--------|
| $\phi V_c$ | 16.7  | -16.7 | 16.7  | -16.7 | 16.7  | -16.7 |        |
| $\phi V_s$ | 66.8  | -66.8 | 66.8  | -66.8 | 66.8  | -66.8 |        |
| $\phi V_n$ | 83.5  | -83.5 | 83.5  | -83.5 | 83.5  | -83.5 |        |
| Av/s       | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | OK     |
| Min Av/s   | N.A.  | N.A.  | 0.007 | N.A.  | 0.007 | N.A.  |        |
| s          | 8.0   | 6.0   | 8.0   | 8.0   | 6.0   | 8.0   | 8.0 OK |
| s max      | N.A.  | 11.0  | N.A.  | 11.0  | 11.0  | N.A.  |        |

**DEFLECTIONS**

| Comb      |       |       |       |     |
|-----------|-------|-------|-------|-----|
| D         | 0.00  | 0.23  | 0.00  | in  |
| L         | 0.00  | 0.00  | 0.00  | in  |
| Lr, S     | 0.00  | 0.05  | 0.00  | in  |
| LS        | 0.00  | 0.01  | 0.00  | in  |
| LT        | 0.00  | 0.40  | 0.00  | in  |
| Ieff D    | 9,551 | 4,895 | 9,345 | in4 |
| Ieff L    | 9,551 | 4,895 | 9,345 | in4 |
| Ieff LS   | 9,542 | 4,786 | 9,336 | in4 |
| $\lambda$ | 1.60  | 1.60  | 1.60  |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.67 | OK |
| Max. Steel Area As max Ratio ....   | 0.44 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 1.00 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.08 | OK |
| Stirrups Spacing s max Ratio .....  | 0.73 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.04 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 5643       | 180    | 0.03  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 666        | 480    | 0.72  | OK |
| D    | Long-Term | 666        | 240    | 0.36  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM K

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

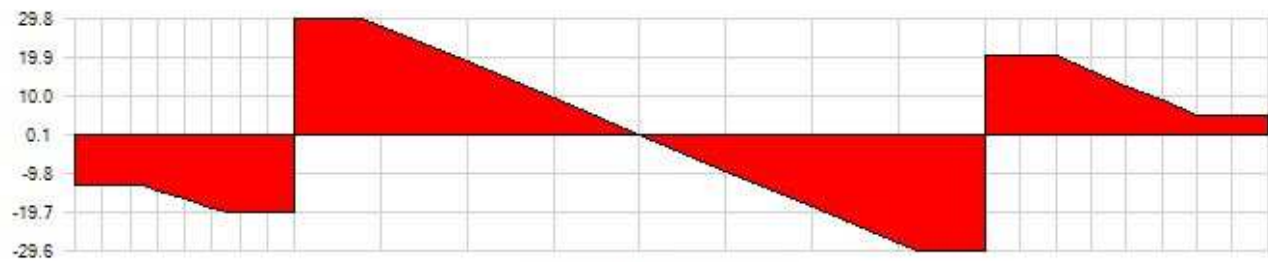
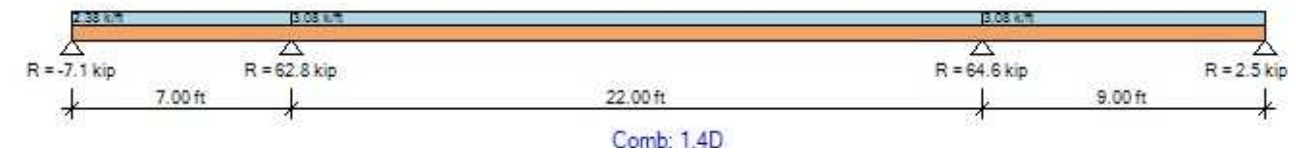
**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

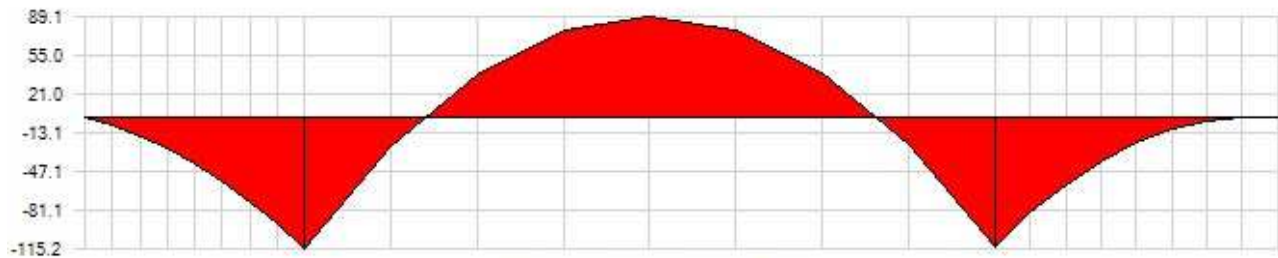
**TORSION STRENGTH (k-ft)**

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |

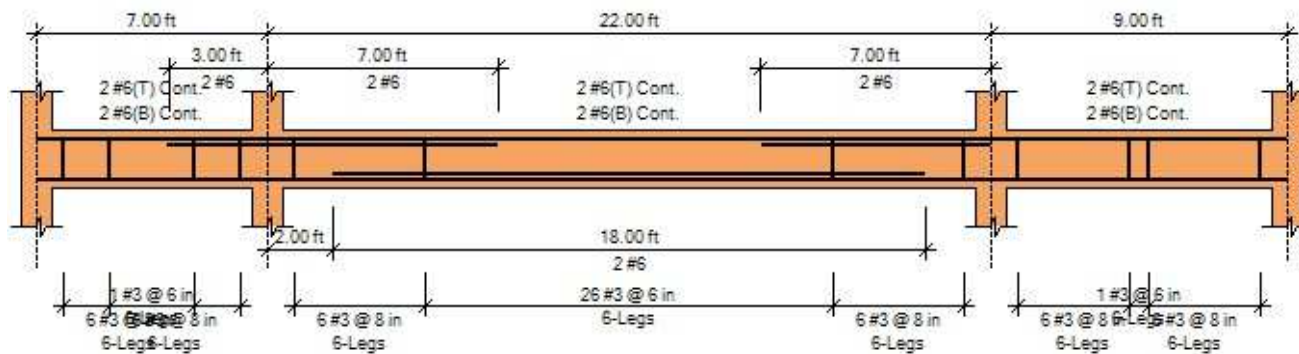




SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM L

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                              |           |    |
|------------------------------|-----------|----|
| Type ...Rectangular          | Deep beam | NG |
| Total Height h .....         | 24.0      | in |
| Beam Width b .....           | 8.0       | in |
| Flange Thickness tf .....    | N.A.      |    |
| Left Flange Width bfl .....  | N.A.      |    |
| Right Flange Width bfr ..... | N.A.      |    |
| Left Cantilever .....        | 0.00      | ft |
| Right Cantilever .....       | 0.00      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 4       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 6.00 ft  | ①       | Pinned |
| ②                        | 21.00 ft | ②       | Pinned |
| ③                        | 6.00 ft  | ③       | Pinned |
| ④                        | N.A.     | ④       | Pinned |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |      |      |      |      |
|------|---|------|------|------|------|------|------|------|------|
| ①    | ① | -2.3 | -3.2 | 18.8 | 26.3 | 18.8 | 26.3 | -2.3 | -3.2 |
| ②    | ② | -2.8 | -3.0 | 23.5 | 24.9 | 23.5 | 24.9 | -2.8 | -3.0 |
| ③    | ③ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ④    | ④ | -2.7 | -3.6 | 22.3 | 30.0 | 22.3 | 30.0 | -2.7 | -3.6 |
| ⑤    | ⑤ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ⑥    | ⑥ | -2.3 | -3.6 | 18.8 | 30.0 | 18.8 | 30.0 | -2.3 | -3.6 |
| ⑦    | ⑦ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ⑧    | ⑧ | -2.7 | -3.0 | 22.3 | 24.9 | 22.3 | 24.9 | -2.7 | -3.0 |
| ⑨    | ⑨ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ⑩    | ⑩ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ⑪    | ⑪ | -1.4 | -2.0 | 11.3 | 16.9 | 11.3 | 16.9 | -1.4 | -2.0 |
| ⑫    | ⑫ | -1.4 | -2.0 | 11.3 | 16.9 | 11.3 | 16.9 | -1.4 | -2.0 |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |     |   |     |    |     |   |     |    |
|------|---|-----|---|-----|----|-----|---|-----|----|
| ①    | ① | -11 | 0 | -44 | 33 | -44 | 0 | -16 | OK |
| ②    | ② | -10 | 0 | -42 | 31 | -42 | 0 | -15 | OK |
| ③    | ③ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ④    | ④ | -12 | 0 | -51 | 38 | -51 | 0 | -18 | OK |
| ⑤    | ⑤ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ⑥    | ⑥ | -12 | 0 | -51 | 38 | -51 | 0 | -18 | OK |
| ⑦    | ⑦ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ⑧    | ⑧ | -10 | 0 | -42 | 31 | -42 | 0 | -15 | OK |
| ⑨    | ⑨ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ⑩    | ⑩ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ⑪    | ⑪ | -7  | 0 | -28 | 21 | -28 | 0 | -10 | OK |
| ⑫    | ⑫ | -7  | 0 | -28 | 21 | -28 | 0 | -10 | OK |

SHEAR FORCES  $V_u$  (kip)

| Comb |      |      |      |       |     |     |    |
|------|------|------|------|-------|-----|-----|----|
| ①    | -6.2 | -8.5 | 11.7 | -11.7 | 8.5 | 6.2 | OK |
| ②    | -5.9 | -8.1 | 11.0 | -11.0 | 8.1 | 5.9 | OK |
| ③    | -5.3 | -7.3 | 10.0 | -10.0 | 7.3 | 5.3 | OK |
| ④    | -7.1 | -9.8 | 13.3 | -13.3 | 9.8 | 7.1 | OK |
| ⑤    | -5.3 | -7.3 | 10.0 | -10.0 | 7.3 | 5.3 | OK |
| ⑥    | -7.1 | -9.8 | 13.3 | -13.3 | 9.8 | 7.1 | OK |
| ⑦    | -5.3 | -7.3 | 10.0 | -10.0 | 7.3 | 5.3 | OK |
| ⑧    | -5.9 | -8.1 | 11.0 | -11.0 | 8.1 | 5.9 | OK |
| ⑨    | -5.3 | -7.3 | 10.0 | -10.0 | 7.3 | 5.3 | OK |
| ⑩    | -5.3 | -7.3 | 10.0 | -10.0 | 7.3 | 5.3 | OK |
| ⑪    | -4.0 | -5.5 | 7.5  | -7.5  | 5.5 | 4.0 | OK |
| ⑫    | -4.0 | -5.5 | 7.5  | -7.5  | 5.5 | 4.0 | OK |

## BENDING STRENGTH (k-ft)

| Bot         | 2#5 Cont    |      | 2#5 Cont    |      | 2#5 Cont    |      |                      |
|-------------|-------------|------|-------------|------|-------------|------|----------------------|
| Bot         | 0#6x4.00 ft |      | 0#6x4.00 ft |      | 0#6x4.00 ft |      |                      |
| d           | 2.0         | 4.0  | 2.0         | 4.0  | 2.0         | 4.0  | in                   |
| +As         | 0.62        | 0.62 | 0.62        | 0.62 | 0.62        | 0.62 | in <sup>2</sup>      |
| c/d         | 0.08        | 0.08 | 0.08        | 0.08 | 0.08        | 0.08 |                      |
| + $\phi$ Mn | 60          | 60   | 60          | 60   | 60          | 60   |                      |
| Top         | 2#5 Cont    |      | 2#5 Cont    |      | 2#5 Cont    |      |                      |
| Top         | 0#5         |      | 0#5         |      | 0#5         |      |                      |
| d'          | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | in                   |
| -As         | 0.62        | 0.62 | 0.62        | 0.62 | 0.62        | 0.62 | in <sup>2</sup>      |
| c/d         | 0.08        | 0.08 | 0.08        | 0.08 | 0.08        | 0.08 |                      |
| - $\phi$ Mn | -60         | -60  | -60         | -60  | -60         | -60  |                      |
| As min      | 0.17        | 0.00 | 0.59        | 0.54 | 0.59        | 0.00 | 0.25 in <sup>2</sup> |

## SHEAR STRENGTH (kip, in)

| $\phi V_c$ | 16.7  | -16.7 | 16.7  | -16.7 | 16.7  | -16.7 |    |
|------------|-------|-------|-------|-------|-------|-------|----|
| $\phi V_s$ | 21.8  | -21.8 | 21.8  | -21.8 | 21.8  | -21.8 |    |
| $\phi V_n$ | 38.5  | -38.5 | 38.5  | -38.5 | 38.5  | -38.5 |    |
| Av/s       | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | OK |
| Min Av/s   | N.A.  | N.A.  | 0.007 | N.A.  | 0.007 | N.A.  |    |
| s          | 10.0  | 6.0   | 10.0  | 10.0  | 6.0   | 10.0  | OK |
| s max      | N.A.  | N.A.  | N.A.  | 11.0  | N.A.  | N.A.  |    |

**DEFLECTIONS**

| Comb      |        |        |        |     |
|-----------|--------|--------|--------|-----|
| D         | 0.00   | 0.04   | 0.00   | in  |
| L         | 0.00   | 0.00   | 0.00   | in  |
| Lr, S     | 0.00   | 0.01   | 0.00   | in  |
| LS        | 0.00   | 0.00   | 0.00   | in  |
| LT        | 0.00   | 0.07   | 0.00   | in  |
| Ieff D    | 10,090 | 10,090 | 10,090 | in4 |
| Ieff L    | 10,090 | 10,090 | 10,090 | in4 |
| Ieff LS   | 10,012 | 9,934  | 10,012 | in4 |
| $\lambda$ | 1.70   | 1.70   | 1.70   |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.95 | OK |
| Max. Steel Area As max Ratio ....   | 0.17 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.26 | OK |
| Shear Vs/Vs max Ratio .....         | 0.33 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.30 | OK |
| Stirrups Spacing s max Ratio .....  | 0.91 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 9999       | 180    | 0.01  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 3612       | 480    | 0.13  | OK |
| D    | Long-Term | 3612       | 240    | 0.07  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM L

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

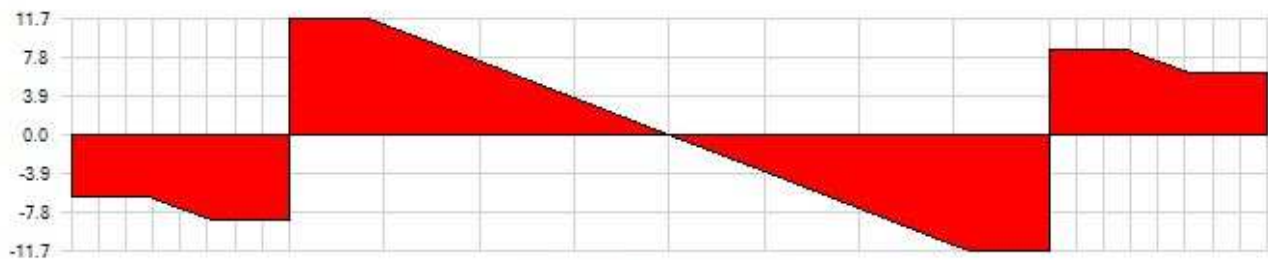
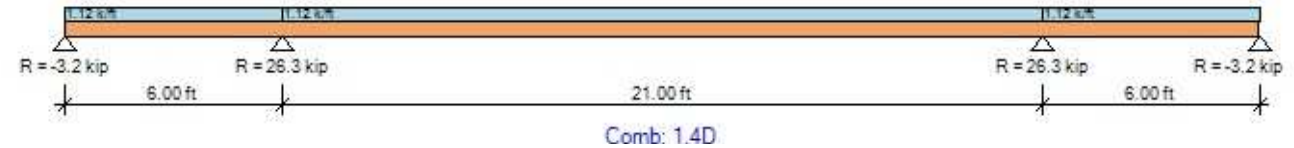
www.asdipsoft.com

**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

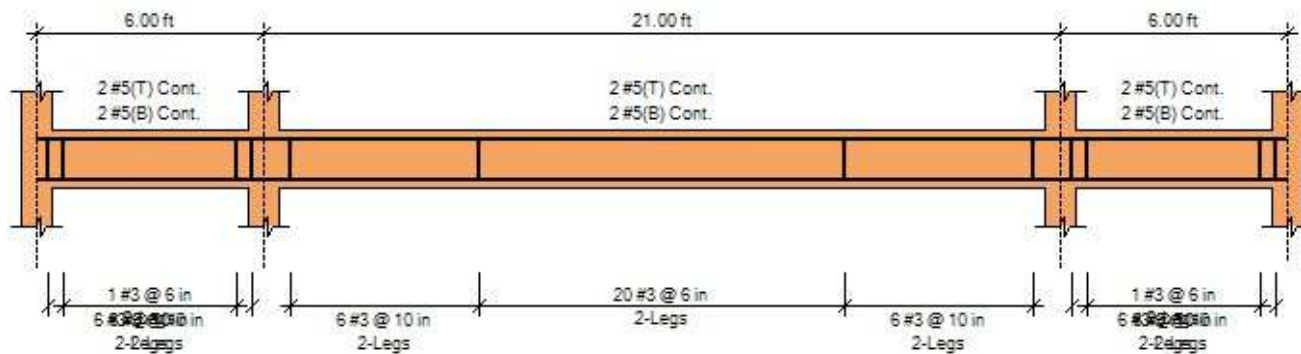
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| Al (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

## GEOMETRY

|                        |             |               |    |
|------------------------|-------------|---------------|----|
| Type ...               | Rectangular | Not deep beam | OK |
| Total Height h         | 24.0        | in            |    |
| Beam Width b           | 8.0         | in            |    |
| Flange Thickness tf    | N.A.        |               |    |
| Left Flange Width bfl  | N.A.        |               |    |
| Right Flange Width bfr | N.A.        |               |    |
| Left Cantilever        | 0.00        | ft            |    |
| Right Cantilever       | 0.00        | ft            |    |

## BEAM SUPPORTS

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 9.00 ft  | ①       | Pinned |
| ②                        | 13.00 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |     |     |     |      |     |     |
|------|---|-----|-----|-----|------|-----|-----|
| ①    | ① | 1.6 | 2.2 | 8.5 | 11.9 | 3.1 | 4.4 |
| ②    | ② | 1.9 | 2.0 | 9.9 | 10.9 | 3.7 | 4.0 |
| ③    | ③ | 1.6 | 1.9 | 8.5 | 10.2 | 3.1 | 3.8 |
| ④    | ④ | 1.8 | 2.3 | 9.5 | 12.4 | 3.5 | 4.6 |
| ⑤    | ⑤ | 1.6 | 1.9 | 8.5 | 10.2 | 3.1 | 3.8 |
| ⑥    | ⑥ | 1.6 | 2.3 | 8.5 | 12.4 | 3.1 | 4.6 |
| ⑦    | ⑦ | 1.6 | 1.9 | 8.5 | 10.2 | 3.1 | 3.8 |
| ⑧    | ⑧ | 1.8 | 2.0 | 9.5 | 10.9 | 3.5 | 4.0 |
| ⑨    | ⑨ | 1.6 | 1.9 | 8.5 | 10.2 | 3.1 | 3.8 |
| ⑩    | ⑩ | 1.6 | 1.9 | 8.5 | 10.2 | 3.1 | 3.8 |
| ⑪    | ⑪ | 1.0 | 1.4 | 5.1 | 7.6  | 1.9 | 2.8 |
| ⑫    | ⑫ | 1.0 | 1.4 | 5.1 | 7.6  | 1.9 | 2.8 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |   |     |    |   |    |
|------|---|---|-----|----|---|----|
| ①    | 0 | 3 | -14 | 11 | 0 | OK |
| ②    | 0 | 3 | -13 | 10 | 0 | OK |
| ③    | 0 | 2 | -12 | 10 | 0 | OK |
| ④    | 0 | 3 | -15 | 12 | 0 | OK |
| ⑤    | 0 | 2 | -12 | 10 | 0 | OK |
| ⑥    | 0 | 3 | -15 | 12 | 0 | OK |
| ⑦    | 0 | 2 | -12 | 10 | 0 | OK |
| ⑧    | 0 | 3 | -13 | 10 | 0 | OK |
| ⑨    | 0 | 2 | -12 | 10 | 0 | OK |
| ⑩    | 0 | 2 | -12 | 10 | 0 | OK |
| ⑪    | 0 | 2 | -9  | 7  | 0 | OK |
| ⑫    | 0 | 2 | -9  | 7  | 0 | OK |

## SHEAR FORCES Vu (kip)

| Comb |     |      |     |      |    |
|------|-----|------|-----|------|----|
| ①    | 0.4 | -3.5 | 4.7 | -2.6 | OK |
| ②    | 0.4 | -3.2 | 4.3 | -2.4 | OK |
| ③    | 0.3 | -3.0 | 4.0 | -2.2 | OK |
| ④    | 0.4 | -3.7 | 4.9 | -2.7 | OK |
| ⑤    | 0.3 | -3.0 | 4.0 | -2.2 | OK |
| ⑥    | 0.4 | -3.7 | 4.9 | -2.7 | OK |
| ⑦    | 0.3 | -3.0 | 4.0 | -2.2 | OK |
| ⑧    | 0.4 | -3.2 | 4.3 | -2.4 | OK |
| ⑨    | 0.3 | -3.0 | 4.0 | -2.2 | OK |
| ⑩    | 0.3 | -3.0 | 4.0 | -2.2 | OK |
| ⑪    | 0.3 | -2.3 | 3.0 | -1.6 | OK |
| ⑫    | 0.3 | -2.3 | 3.0 | -1.6 | OK |

**BENDING STRENGTH (k-ft)**

|        |             |      |             |      |                      |
|--------|-------------|------|-------------|------|----------------------|
| Bot    | 2#5 Cont    |      | 2#5 Cont    |      |                      |
| Bot    | 0#6x4.00 ft |      | 0#6x4.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0         | 4.0  | 2.0 in               |
| +As    | 0.62        | 0.62 | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d    | 0.08        | 0.08 | 0.08        | 0.08 | 0.08                 |
| +φMn   | 60          | 60   | 60          | 60   | 60                   |
| Top    | 2#5 Cont    |      | 2#5 Cont    |      |                      |
| Top    | 0#5         |      | 0#6         |      | 0#6                  |
| d'     | 2.0         | 2.0  | 4.0         | 2.0  | 4.0 in               |
| -As    | 0.62        | 0.62 | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d    | 0.08        | 0.08 | 0.08        | 0.08 | 0.08                 |
| -φMn   | -60         | -60  | -60         | -60  | -60                  |
| As min | 0.00        | 0.04 | 0.21        | 0.17 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |        |        |                 |
|---------------------|--------|--------|-----------------|
| Comb                |        |        |                 |
| D                   | 0.00   | 0.01   | in              |
| L                   | 0.00   | 0.00   | in              |
| Lr, S               | 0.00   | 0.00   | in              |
| LS                  | 0.00   | 0.00   | in              |
| LT                  | 0.00   | 0.01   | in              |
| I <sub>eff</sub> D  | 10,090 | 10,090 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 10,090 | 10,090 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 10,090 | 10,090 | in <sup>4</sup> |
| λ                   | 1.70   | 1.70   |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |       |                  |
|----------|-------|-------|-------|------------------|
| φVc      | 16.7  | -16.7 | 16.7  | -16.7            |
| φVs      | 65.3  | -65.3 | 65.3  | -65.3            |
| φVn      | 82.0  | -82.0 | 82.0  | -82.0            |
| Av/s     | 0.066 | 0.066 | 0.066 | 0.066 OK         |
| Min Av/s | N.A.  | N.A.  | N.A.  | N.A.             |
| s        | 10.0  | 6.0   | 10.0  | 10.0 6.0 10.0 OK |
| s max    | N.A.  | N.A.  | N.A.  | N.A.             |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.34 | OK |
| Max. Steel Area As max Ratio ....   | 0.17 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.26 | OK |
| Shear Vs/Vs max Ratio .....         | N.A. |    |
| Min. Stirrups Area Av/s Ratio ..... | N.A. |    |
| Stirrups Spacing s max Ratio .....  | N.A. |    |
| Stirrups Min. # of Legs Ratio ..... | N.A. |    |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 9999 | 480    | 0.03  | OK |
| D    | Long-Term | 9999 | 240    | 0.02  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF BEAM M

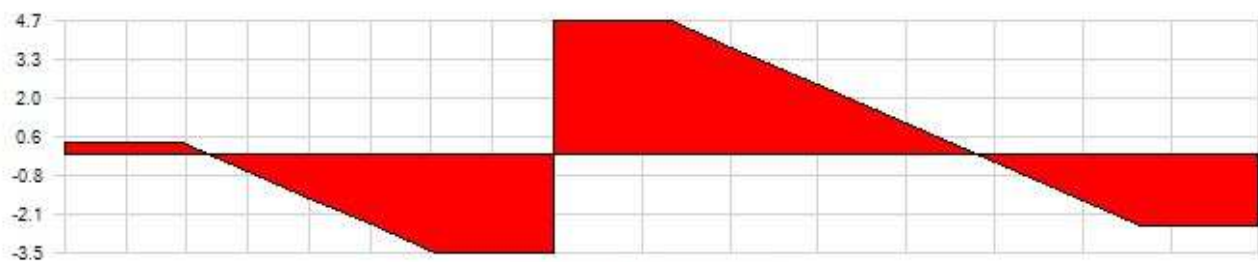
ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

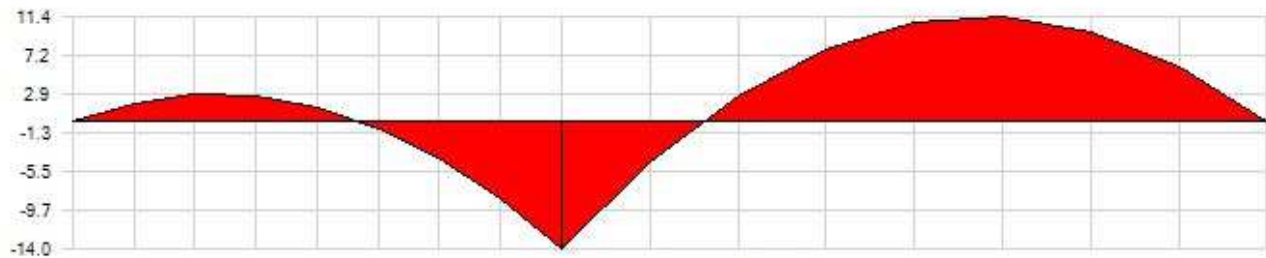
| Comb |     |     |     |     |    |
|------|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

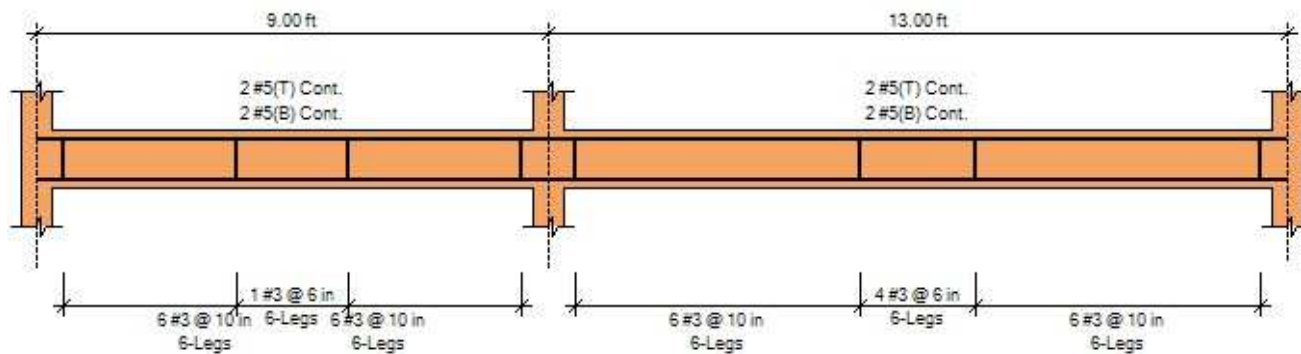
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF TB3

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 48.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 0.00      | ft |
| Right Cantilever       | 0.00      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |         | 5       |        |
|--------------------------|---------|---------|--------|
| Span                     | Length  | Support | Type   |
| ①                        | 5.00 ft | ①       | Pinned |
| ②                        | 5.00 ft | ②       | Pinned |
| ③                        | 5.00 ft | ③       | Pinned |
| ④                        | 5.00 ft | ④       | Pinned |
| ⑤                        | N.A.    | ⑤       | Pinned |
|                          |         | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |     |     |     |     |     |     |     |     |     |     |
|------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ①    | ① | 2.2 | 3.0 | 6.3 | 8.8 | 5.1 | 7.2 | 6.3 | 8.8 | 2.2 | 3.0 |
| ②    | ② | 2.4 | 2.7 | 7.1 | 7.9 | 5.8 | 6.5 | 7.1 | 7.9 | 2.4 | 2.7 |
| ③    | ③ | 2.2 | 2.6 | 6.3 | 7.5 | 5.1 | 6.1 | 6.3 | 7.5 | 2.2 | 2.6 |
| ④    | ④ | 2.4 | 3.0 | 6.9 | 8.8 | 5.6 | 7.2 | 6.9 | 8.8 | 2.4 | 3.0 |
| ⑤    | ⑤ | 2.2 | 2.6 | 6.3 | 7.5 | 5.1 | 6.1 | 6.3 | 7.5 | 2.2 | 2.6 |
| ⑥    | ⑥ | 2.2 | 3.0 | 6.3 | 8.8 | 5.1 | 7.2 | 6.3 | 8.8 | 2.2 | 3.0 |
| ⑦    | ⑦ | 2.2 | 2.6 | 6.3 | 7.5 | 5.1 | 6.1 | 6.3 | 7.5 | 2.2 | 2.6 |
| ⑧    | ⑧ | 2.4 | 2.7 | 6.9 | 7.9 | 5.6 | 6.5 | 6.9 | 7.9 | 2.4 | 2.7 |
| ⑨    | ⑨ | 2.2 | 2.6 | 6.3 | 7.5 | 5.1 | 6.1 | 6.3 | 7.5 | 2.2 | 2.6 |
| ⑩    | ⑩ | 2.2 | 2.6 | 6.3 | 7.5 | 5.1 | 6.1 | 6.3 | 7.5 | 2.2 | 2.6 |
| ⑪    | ⑪ | 1.3 | 1.9 | 3.8 | 5.7 | 3.1 | 4.6 | 3.8 | 5.7 | 1.3 | 1.9 |
| ⑫    | ⑫ | 1.3 | 1.9 | 3.8 | 5.7 | 3.1 | 4.6 | 3.8 | 5.7 | 1.3 | 1.9 |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |   |   |    |   |    |   |    |   |   |    |
|------|---|---|---|----|---|----|---|----|---|---|----|
| ①    | ① | 0 | 3 | -4 | 1 | -3 | 1 | -4 | 3 | 0 | OK |
| ②    | ② | 0 | 3 | -4 | 1 | -2 | 1 | -4 | 3 | 0 | OK |
| ③    | ③ | 0 | 3 | -4 | 1 | -2 | 1 | -4 | 3 | 0 | OK |
| ④    | ④ | 0 | 3 | -4 | 1 | -3 | 1 | -4 | 3 | 0 | OK |
| ⑤    | ⑤ | 0 | 3 | -4 | 1 | -2 | 1 | -4 | 3 | 0 | OK |
| ⑥    | ⑥ | 0 | 3 | -4 | 1 | -3 | 1 | -4 | 3 | 0 | OK |
| ⑦    | ⑦ | 0 | 3 | -4 | 1 | -2 | 1 | -4 | 3 | 0 | OK |
| ⑧    | ⑧ | 0 | 3 | -4 | 1 | -2 | 1 | -4 | 3 | 0 | OK |
| ⑨    | ⑨ | 0 | 3 | -4 | 1 | -2 | 1 | -4 | 3 | 0 | OK |
| ⑩    | ⑩ | 0 | 3 | -4 | 1 | -2 | 1 | -4 | 3 | 0 | OK |
| ⑪    | ⑪ | 0 | 2 | -3 | 1 | -2 | 1 | -3 | 2 | 0 | OK |
| ⑫    | ⑫ | 0 | 2 | -3 | 1 | -2 | 1 | -3 | 2 | 0 | OK |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF TB3

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**SHEAR FORCES  $V_u$  (kip)**

| Comb |      |     |      |     |      |     |      |     |    |
|------|------|-----|------|-----|------|-----|------|-----|----|
| ①    | -4.4 | 2.8 | -3.3 | 3.9 | -3.9 | 3.3 | -2.8 | 4.4 | OK |
| ②    | -4.0 | 2.5 | -3.0 | 3.5 | -3.5 | 3.0 | -2.5 | 4.0 | OK |
| ③    | -3.8 | 2.4 | -2.8 | 3.3 | -3.3 | 2.8 | -2.4 | 3.8 | OK |
| ④    | -4.4 | 2.8 | -3.3 | 3.9 | -3.9 | 3.3 | -2.8 | 4.4 | OK |
| ⑤    | -3.8 | 2.4 | -2.8 | 3.3 | -3.3 | 2.8 | -2.4 | 3.8 | OK |
| ⑥    | -4.4 | 2.8 | -3.3 | 3.9 | -3.9 | 3.3 | -2.8 | 4.4 | OK |
| ⑦    | -3.8 | 2.4 | -2.8 | 3.3 | -3.3 | 2.8 | -2.4 | 3.8 | OK |
| ⑧    | -4.0 | 2.5 | -3.0 | 3.5 | -3.5 | 3.0 | -2.5 | 4.0 | OK |
| ⑨    | -3.8 | 2.4 | -2.8 | 3.3 | -3.3 | 2.8 | -2.4 | 3.8 | OK |
| ⑩    | -3.8 | 2.4 | -2.8 | 3.3 | -3.3 | 2.8 | -2.4 | 3.8 | OK |
| ⑪    | -2.8 | 1.8 | -2.1 | 2.5 | -2.5 | 2.1 | -1.8 | 2.8 | OK |
| ⑫    | -2.8 | 1.8 | -2.1 | 2.5 | -2.5 | 2.1 | -1.8 | 2.8 | OK |

**BENDING STRENGTH (k-ft)**

|             |             |      |             |      |             |      |             |      |                 |
|-------------|-------------|------|-------------|------|-------------|------|-------------|------|-----------------|
| Bot         | 2#5 Cont    |      | 2#5 Cont    |      | 2#5 Cont    |      | 2#5 Cont    |      |                 |
| Bot         | 0#5x3.00 ft |      | 0#5x3.00 ft |      | 0#5x3.00 ft |      | 0#5x3.00 ft |      |                 |
| d           | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | in              |
| +As         | 0.32        | 0.32 | 0.32        | 0.32 | 0.32        | 0.32 | 0.32        | 0.32 | in <sup>2</sup> |
| c/d         | 0.03        | 0.03 | 0.03        | 0.03 | 0.03        | 0.03 | 0.03        | 0.03 |                 |
| + $\phi$ Mn | 66          | 66   | 66          | 66   | 66          | 66   | 66          | 66   |                 |
| Top         | 2#5 Cont    |      | 2#5 Cont    |      | 2#5 Cont    |      | 2#5 Cont    |      |                 |
| Top         | 0#5         |      | 0#5         |      | 0#5         |      | 0#5         |      |                 |
| d'          | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | in              |
| -As         | 0.32        | 0.32 | 0.32        | 0.32 | 0.32        | 0.32 | 0.32        | 0.32 | in <sup>2</sup> |
| c/d         | 0.03        | 0.03 | 0.03        | 0.03 | 0.03        | 0.03 | 0.03        | 0.03 |                 |
| - $\phi$ Mn | -66         | -66  | -66         | -66  | -66         | -66  | -66         | -66  |                 |
| As min      | 0.00        | 0.02 | 0.03        | 0.01 | 0.02        | 0.01 | 0.03        | 0.02 | in <sup>2</sup> |

**SHEAR STRENGTH (kip, in)**

|            |       |       |       |       |       |       |       |       |         |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| $\phi V_c$ | 34.9  | -34.9 | 34.9  | -34.9 | 34.9  | -34.9 | 34.9  | -34.9 |         |
| $\phi V_s$ | 27.7  | -27.7 | 27.7  | -27.7 | 27.7  | -27.7 | 27.7  | -27.7 |         |
| $\phi V_n$ | 62.6  | -62.6 | 62.6  | -62.6 | 62.6  | -62.6 | 62.6  | -62.6 |         |
| Av/s       | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | OK      |
| Min Av/s   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  |         |
| s          | 10.0  | 6.0   | 10.0  | 10.0  | 6.0   | 10.0  | 10.0  | 6.0   | 10.0 OK |
| s max      | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  |         |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: MAIN ROOF TB3

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**DEFLECTIONS**

| Comb      |        |        |        |        |     |
|-----------|--------|--------|--------|--------|-----|
| D         | 0.00   | 0.00   | 0.00   | 0.00   | in  |
| L         | 0.00   | 0.00   | 0.00   | 0.00   | in  |
| Lr, S     | 0.00   | 0.00   | 0.00   | 0.00   | in  |
| LS        | 0.00   | 0.00   | 0.00   | 0.00   | in  |
| LT        | 0.00   | 0.00   | 0.00   | 0.00   | in  |
| leff D    | 77,956 | 77,956 | 77,956 | 77,956 | in4 |
| leff L    | 77,956 | 77,956 | 77,956 | 77,956 | in4 |
| leff LS   | 77,956 | 77,956 | 77,956 | 77,956 | in4 |
| $\lambda$ | 1.84   | 1.84   | 1.84   | 1.84   |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.04 | OK |
| Max. Steel Area As max Ratio ....   | 0.09 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.50 | OK |
| Rebars Max Spacing Smax Ratio       | 0.26 | OK |
| Shear Vs/Vs max Ratio .....         | 0.33 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.00 | OK |
| Stirrups Spacing s max Ratio .....  | 0.42 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.19 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 9999       | 180    | 0.00  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 9999       | 480    | 0.00  | OK |
| D    | Long-Term | 9999       | 240    | 0.00  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |



Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: MAIN ROOF TB3

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

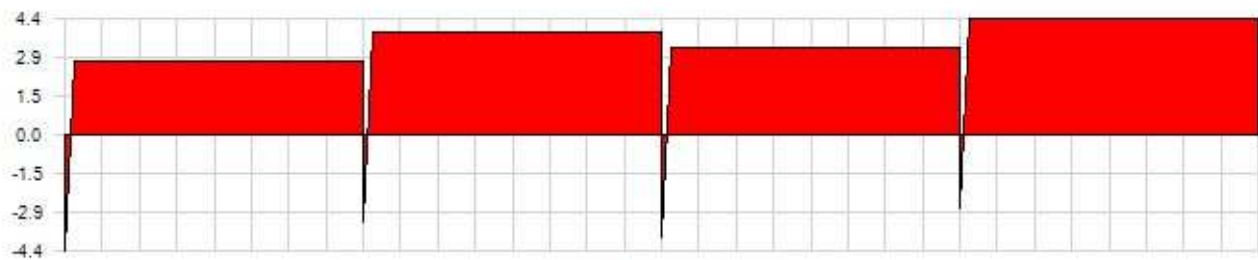
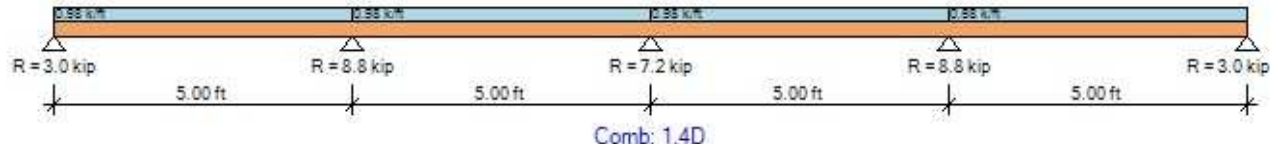
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**TORSION MOMENTS  $T_u$  (k-ft)**

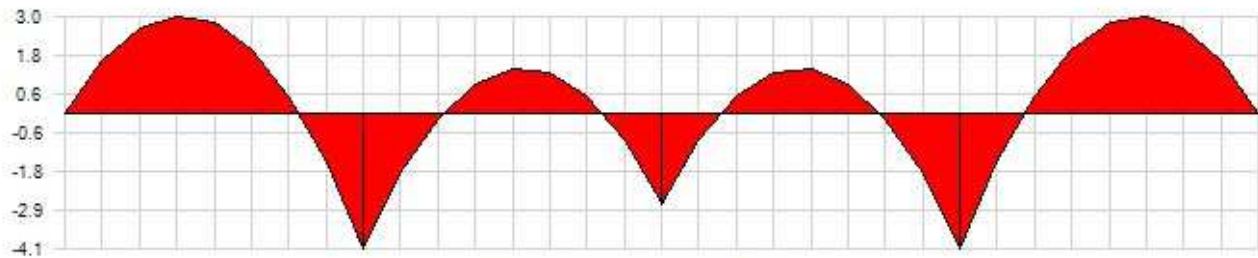
| Comb |     |      |     |      |     |      |     |      |    |
|------|-----|------|-----|------|-----|------|-----|------|----|
| ①    | 8.0 | -8.0 | 8.0 | -8.0 | 8.0 | -8.0 | 8.0 | -8.0 | OK |
| ②    | 7.4 | -7.4 | 7.4 | -7.4 | 7.4 | -7.4 | 7.4 | -7.4 | OK |
| ③    | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | OK |
| ④    | 8.7 | -8.7 | 8.7 | -8.7 | 8.7 | -8.7 | 8.7 | -8.7 | OK |
| ⑤    | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | OK |
| ⑥    | 8.7 | -8.7 | 8.7 | -8.7 | 8.7 | -8.7 | 8.7 | -8.7 | OK |
| ⑦    | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | OK |
| ⑧    | 7.4 | -7.4 | 7.4 | -7.4 | 7.4 | -7.4 | 7.4 | -7.4 | OK |
| ⑨    | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | OK |
| ⑩    | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | 6.9 | -6.9 | OK |
| ⑪    | 0.0 | 0.0  | 0.0 | 0.0  | 0.0 | 0.0  | 0.0 | 0.0  | OK |
| ⑫    | 0.0 | 0.0  | 0.0 | 0.0  | 0.0 | 0.0  | 0.0 | 0.0  | OK |

**TORSION STRENGTH (k-ft)**

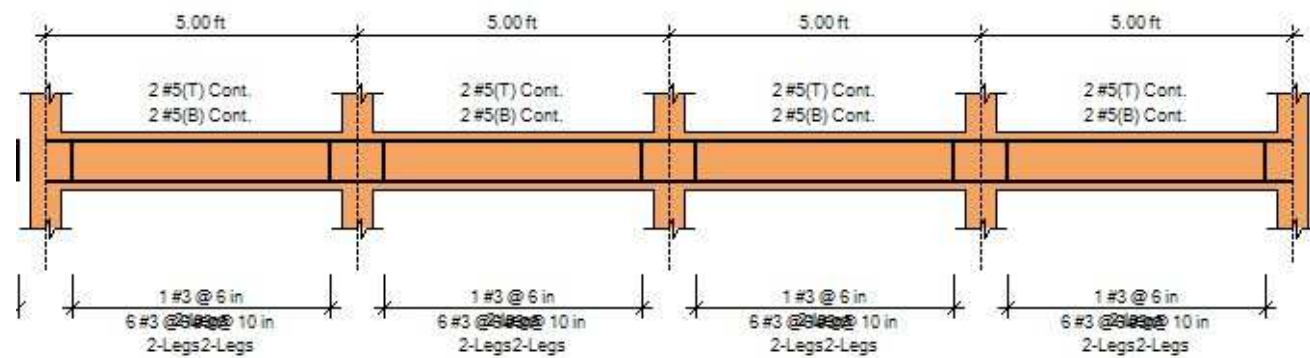
| At/s (in)             | 0.0086 | 0.0086 | 0.0086 | 0.0086 | 0.0086 | 0.0086 | 0.0086 | 0.0086 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 1.21   | 1.21   | 1.21   | 1.21   | 1.21   | 1.21   | 1.21   | 1.21   |    |
| $\phi T_n$ (kip)      | 8.7    | -8.7   | 8.7    | -8.7   | 8.7    | -8.7   | 8.7    | -8.7   |    |
| Stress (psi)          | 264.0  | 264.0  | 264.0  | 264.0  | 264.0  | 264.0  | 264.0  | 264.0  | OK |
| Total At/s (in)       | 0.0153 | 0.0153 | 0.0153 | 0.0153 | 0.0153 | 0.0153 | 0.0153 | 0.0153 | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: RB1

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 8.0           | in |
| Beam Width b           | 144.0         | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 24.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 9.1  | 12.8 | 9.1  | 12.8 |
| ②    | ② | 11.3 | 12.0 | 11.3 | 12.0 |
| ③    | ③ | 9.1  | 10.9 | 9.1  | 10.9 |
| ④    | ④ | 10.7 | 14.4 | 10.7 | 14.4 |
| ⑤    | ⑤ | 9.1  | 10.9 | 9.1  | 10.9 |
| ⑥    | ⑥ | 9.1  | 14.4 | 9.1  | 14.4 |
| ⑦    | ⑦ | 9.1  | 10.9 | 9.1  | 10.9 |
| ⑧    | ⑧ | 10.7 | 12.0 | 10.7 | 12.0 |
| ⑨    | ⑨ | 9.1  | 10.9 | 9.1  | 10.9 |
| ⑩    | ⑩ | 9.1  | 10.9 | 9.1  | 10.9 |
| ⑪    | ⑪ | 5.5  | 8.2  | 5.5  | 8.2  |
| ⑫    | ⑫ | 5.5  | 8.2  | 5.5  | 8.2  |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 77 | 0 | OK |  |
| ②    | 0 | 72 | 0 | OK |  |
| ③    | 0 | 66 | 0 | OK |  |
| ④    | 0 | 86 | 0 | OK |  |
| ⑤    | 0 | 66 | 0 | OK |  |
| ⑥    | 0 | 86 | 0 | OK |  |
| ⑦    | 0 | 66 | 0 | OK |  |
| ⑧    | 0 | 72 | 0 | OK |  |
| ⑨    | 0 | 66 | 0 | OK |  |
| ⑩    | 0 | 66 | 0 | OK |  |
| ⑪    | 0 | 49 | 0 | OK |  |
| ⑫    | 0 | 49 | 0 | OK |  |

**SHEAR FORCES Vu (kip)**

| Comb |      |       |    |  |  |
|------|------|-------|----|--|--|
| ①    | 11.9 | -11.9 | OK |  |  |
| ②    | 11.2 | -11.2 | OK |  |  |
| ③    | 10.2 | -10.2 | OK |  |  |
| ④    | 13.4 | -13.4 | OK |  |  |
| ⑤    | 10.2 | -10.2 | OK |  |  |
| ⑥    | 13.4 | -13.4 | OK |  |  |
| ⑦    | 10.2 | -10.2 | OK |  |  |
| ⑧    | 11.2 | -11.2 | OK |  |  |
| ⑨    | 10.2 | -10.2 | OK |  |  |
| ⑩    | 10.2 | -10.2 | OK |  |  |
| ⑪    | 7.6  | -7.6  | OK |  |  |
| ⑫    | 7.6  | -7.6  | OK |  |  |

**BENDING STRENGTH (k-ft)**

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 6#8 Cont    |      |                      |
| Bot    | 0#5x6.00 ft |      |                      |
| d      | 2.0         | 2.0  | 2.0 in               |
| +As    | 4.74        | 4.74 | 4.74 in <sup>2</sup> |
| c/d    | 0.21        | 0.21 | 0.21                 |
| +φMn   | 142         | 142  | 142                  |
| Top    | 6#8 Cont    |      |                      |
| Top    | 0#5         |      |                      |
| d'     | 2.0         | 2.0  | 2.0 in               |
| -As    | 4.74        | 4.74 | 4.74 in <sup>2</sup> |
| c/d    | 0.21        | 0.21 | 0.21                 |
| -φMn   | -142        | -142 | -142                 |
| As min | 0.00        | 2.88 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|         |       |  |                 |
|---------|-------|--|-----------------|
| Comb    |       |  |                 |
| D       | 0.25  |  | in              |
| L       | 0.00  |  | in              |
| Lr, S   | 0.11  |  | in              |
| LS      | 0.02  |  | in              |
| LT      | 0.41  |  | in              |
| Ieff D  | 6,411 |  | in <sup>4</sup> |
| Ieff L  | 6,411 |  | in <sup>4</sup> |
| Ieff LS | 6,411 |  | in <sup>4</sup> |
| λ       | 1.57  |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |            |
|----------|-------|------------|
| φVc      | 58.8  | -58.8      |
| φVs      | 0.0   | 0.0        |
| φVn      | 58.8  | -58.8      |
| Av/s     | 0.120 | 0.120 OK   |
| Min Av/s | N.A.  | N.A.       |
| s        | 5.0   | 9.0 5.0 OK |
| s max    | N.A.  | N.A.       |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.61 | OK |
| Max. Steel Area As max Ratio ....   | 0.30 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.04 | OK |
| Rebars Max Spacing Smax Ratio       | 2.51 | NG |
| Shear Vs/Vs max Ratio .....         | N.A. |    |
| Min. Stirrups Area Av/s Ratio ..... | N.A. |    |
| Stirrups Spacing s max Ratio .....  | N.A. |    |
| Stirrups Min. # of Legs Ratio ..... | N.A. |    |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 2544 | 180    | 0.07  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 698  | 480    | 0.69  | OK |
| D    | Long-Term | 698  | 240    | 0.34  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: RB1

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

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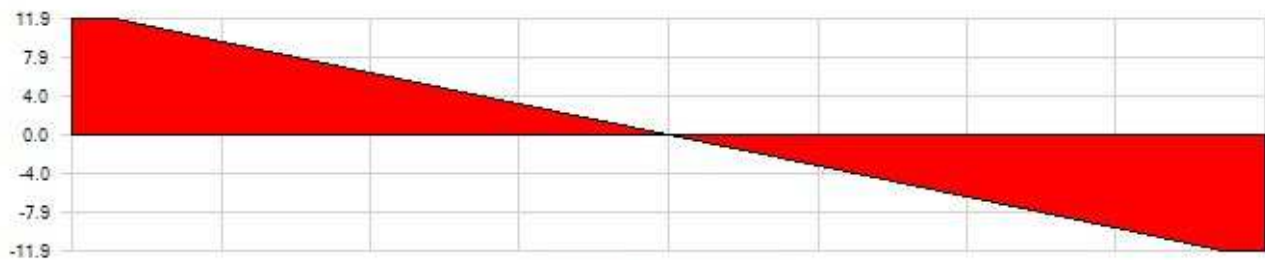
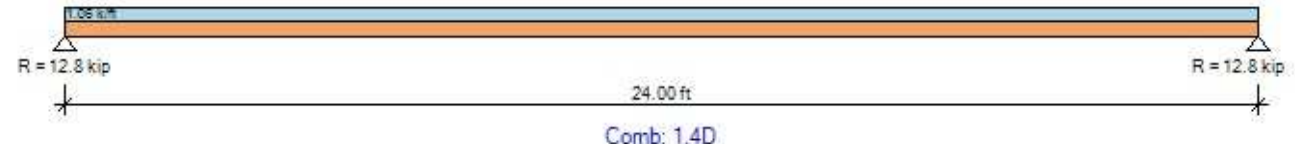
**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

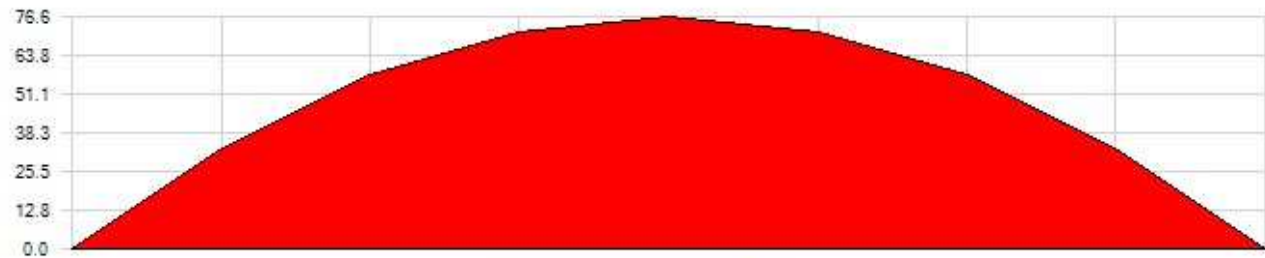
**TORSION STRENGTH (k-ft)**

|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |

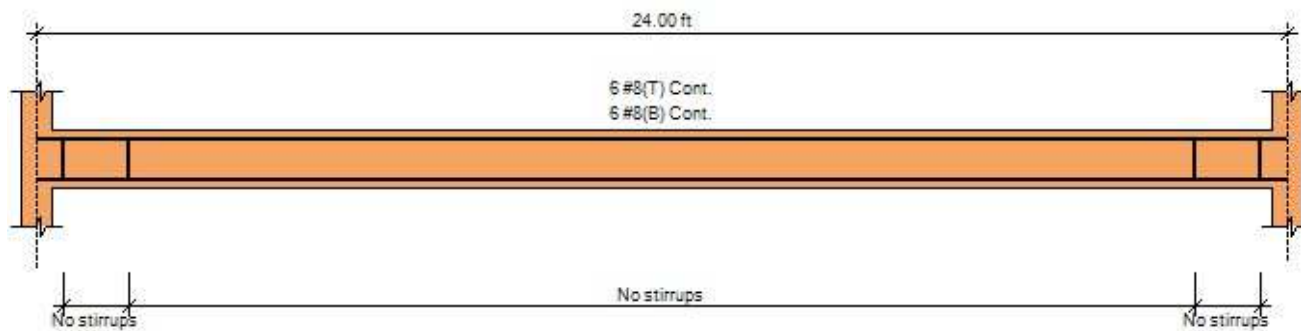




SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: RB2

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...T-beam         | Not deep beam | OK |
| Total Height h         | 16.0 in       |    |
| Beam Width b           | 8.0 in        |    |
| Flange Thickness tf    | 8.0 in        |    |
| Left Flange Width bfl  | 12.0 in       | OK |
| Right Flange Width bfr | 12.0 in       | OK |
| Left Cantilever        | 0.00 ft       |    |
| Right Cantilever       | 3.00 ft       |    |

### BEAM SUPPORTS

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 8.00 ft  | ①       | Pinned |
| ②                        | 16.00 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |     |     |      |      |      |      |
|------|---|-----|-----|------|------|------|------|
| ①    | ① | 3.2 | 4.4 | 42.4 | 59.4 | 26.3 | 36.8 |
| ②    | ② | 3.9 | 4.2 | 52.3 | 55.8 | 32.4 | 34.6 |
| ③    | ③ | 3.2 | 3.8 | 42.4 | 50.9 | 26.3 | 31.5 |
| ④    | ④ | 3.7 | 5.0 | 49.8 | 66.7 | 30.9 | 41.3 |
| ⑤    | ⑤ | 3.2 | 3.8 | 42.4 | 50.9 | 26.3 | 31.5 |
| ⑥    | ⑥ | 3.2 | 5.0 | 42.4 | 66.7 | 26.3 | 41.3 |
| ⑦    | ⑦ | 3.2 | 3.8 | 42.4 | 50.9 | 26.3 | 31.5 |
| ⑧    | ⑧ | 3.7 | 4.2 | 49.8 | 55.8 | 30.9 | 34.6 |
| ⑨    | ⑨ | 3.2 | 3.8 | 42.4 | 50.9 | 26.3 | 31.5 |
| ⑩    | ⑩ | 3.2 | 3.8 | 42.4 | 50.9 | 26.3 | 31.5 |
| ⑪    | ⑪ | 1.9 | 2.8 | 25.4 | 38.2 | 15.8 | 23.6 |
| ⑫    | ⑫ | 1.9 | 2.8 | 25.4 | 38.2 | 15.8 | 23.6 |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |    |   |     |    |     |    |
|------|----|---|-----|----|-----|----|
| ①    | -3 | 3 | -84 | 70 | -17 | OK |
| ②    | -3 | 2 | -79 | 66 | -16 | OK |
| ③    | -3 | 2 | -72 | 60 | -14 | OK |
| ④    | -4 | 3 | -94 | 78 | -19 | OK |
| ⑤    | -3 | 2 | -72 | 60 | -14 | OK |
| ⑥    | -4 | 3 | -94 | 78 | -19 | OK |
| ⑦    | -3 | 2 | -72 | 60 | -14 | OK |
| ⑧    | -3 | 2 | -79 | 66 | -16 | OK |
| ⑨    | -3 | 2 | -72 | 60 | -14 | OK |
| ⑩    | -3 | 2 | -72 | 60 | -14 | OK |
| ⑪    | -2 | 2 | -54 | 45 | -11 | OK |
| ⑫    | -2 | 2 | -54 | 45 | -11 | OK |

### SHEAR FORCES Vu (kip)

| Comb |      |       |      |       |     |    |
|------|------|-------|------|-------|-----|----|
| ①    | -1.8 | -19.2 | 27.8 | -19.4 | 5.0 | OK |
| ②    | -1.7 | -18.0 | 26.1 | -18.2 | 4.7 | OK |
| ③    | -1.5 | -16.4 | 23.8 | -16.6 | 4.3 | OK |
| ④    | -2.0 | -21.5 | 31.2 | -21.8 | 5.6 | OK |
| ⑤    | -1.5 | -16.4 | 23.8 | -16.6 | 4.3 | OK |
| ⑥    | -2.0 | -21.5 | 31.2 | -21.8 | 5.6 | OK |
| ⑦    | -1.5 | -16.4 | 23.8 | -16.6 | 4.3 | OK |
| ⑧    | -1.7 | -18.0 | 26.1 | -18.2 | 4.7 | OK |
| ⑨    | -1.5 | -16.4 | 23.8 | -16.6 | 4.3 | OK |
| ⑩    | -1.5 | -16.4 | 23.8 | -16.6 | 4.3 | OK |
| ⑪    | -1.1 | -12.3 | 17.9 | -12.5 | 3.2 | OK |
| ⑫    | -1.1 | -12.3 | 17.9 | -12.5 | 3.2 | OK |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: RB2

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## CONCRETE BEAM DESIGN

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| BENDING STRENGTH (k-ft) |             |             |      |      |                      |
|-------------------------|-------------|-------------|------|------|----------------------|
| Bot                     | 2#6 Cont    | 2#6 Cont    |      |      |                      |
| Bot                     | 2#6x8.00 ft | 2#6x8.00 ft |      |      |                      |
| d                       | 2.0         | 3.0         | 2.0  | 3.0  | 2.0 in               |
| +As                     | 0.88        | 1.76        | 0.88 | 1.76 | 0.88 in <sup>2</sup> |
| c/d                     | 0.11        | 0.11        | 0.11 | 0.11 | 0.11                 |
| +φMn                    | 65          | 105         | 65   | 105  | 65                   |
| Top                     | 2#6 Cont    | 2#6 Cont    |      |      |                      |
| Top                     | 2#6         | 2#6         | 2#6  |      |                      |
| d'                      | 3.0         | 2.0         | 3.0  | 2.0  | 3.0 in               |
| -As                     | 1.76        | 0.88        | 1.76 | 0.88 | 1.76 in <sup>2</sup> |
| c/d                     | 0.24        | 0.18        | 0.24 | 0.18 | 0.24                 |
| -φMn                    | -94         | -53         | -94  | -53  | -94                  |
| As min                  | 0.09        | 0.06        | 0.75 | 0.37 | 0.42 in <sup>2</sup> |

| DEFLECTIONS         |       |       |       |                 |
|---------------------|-------|-------|-------|-----------------|
| Comb                |       |       |       |                 |
| D                   | 0.00  | 0.22  | -0.10 | in              |
| L                   | 0.00  | 0.00  | 0.00  | in              |
| Lr, S               | 0.00  | 0.07  | 0.00  | in              |
| LS                  | 0.00  | 0.02  | -0.01 | in              |
| LT                  | 0.00  | 0.35  | -0.20 | in              |
| I <sub>eff</sub> D  | 5,752 | 2,409 | 3,332 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 5,752 | 2,409 | 3,332 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 5,751 | 2,358 | 3,332 | in <sup>4</sup> |
| λ                   | 1.44  | 1.44  | 2.00  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

| DESIGN CODES            |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

| SHEAR STRENGTH (kip, in) |       |       |       |       |          |
|--------------------------|-------|-------|-------|-------|----------|
| φVc                      | 10.6  | -10.6 | 10.6  | -10.6 | 10.6     |
| φVs                      | 23.1  | -23.1 | 23.1  | -23.1 | 23.1     |
| φVn                      | 33.7  | -33.7 | 33.7  | -33.7 | 33.7     |
| Av/s                     | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 OK |
| Min Av/s                 | N.A.  | N.A.  | 0.007 | N.A.  | 0.007    |
| s                        | 6.0   | 6.0   | 6.0   | 6.0   | 6.0 OK   |
| s max                    | N.A.  | 7.0   | N.A.  | 7.0   | 7.0      |

| REINFORCEMENT                       |         |
|-------------------------------------|---------|
| Min. Steel Area As min Ratio .....  | 0.42 OK |
| Max. Steel Area As max Ratio ....   | 0.64 OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 OK |
| Rebars Max Spacing Smax Ratio       | 0.25 OK |
| Shear Vs/Vs max Ratio .....         | 0.54 OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.18 OK |
| Stirrups Spacing s max Ratio .....  | 0.86 OK |
| Stirrups Min. # of Legs Ratio ..... | 0.33 OK |

| MAX. DEFLECTIONS L/δ |           |      |        |         |
|----------------------|-----------|------|--------|---------|
| Type                 | Load      | L/δ  | Allow. | Ratio   |
| A                    | Lr, S, W  | 2829 | 180    | 0.06 OK |
| B                    | Live Load | 9999 | 360    | 0.00 OK |
| C                    | Long-Term | 548  | 480    | 0.88 OK |
| D                    | Long-Term | 548  | 240    | 0.44 OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

| MATERIALS                      |                |
|--------------------------------|----------------|
| Concrete Strength f'c .....    | 4.0 ksi        |
| Compression Strain Limit ..... | 0.003          |
| Concrete density .....         | 150 pcf        |
| Concrete Stress-Strain .....   | Hognestad      |
| Rebar Steel Strength fy .....  | 60.0 ksi       |
| Steel Stress-Strain .....      | Elasto-plastic |

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Engineer:

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Descrip: RB2

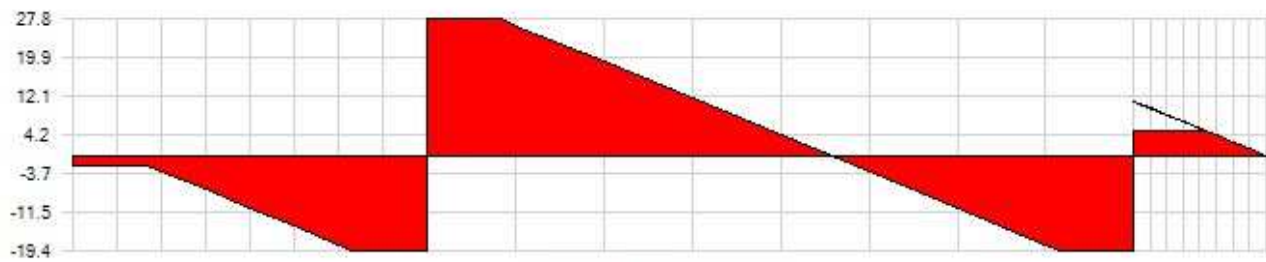
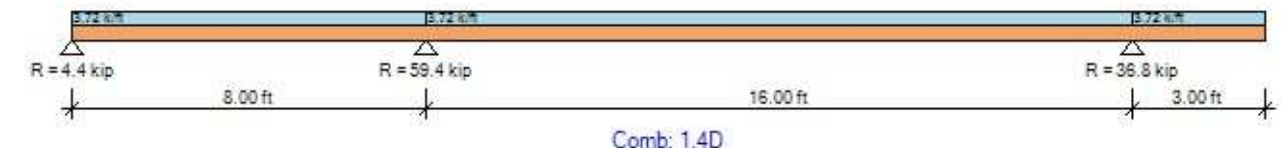
ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

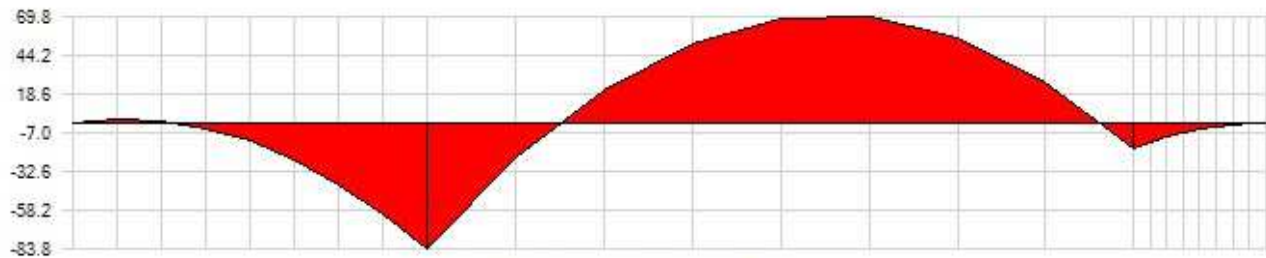
| Comb |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

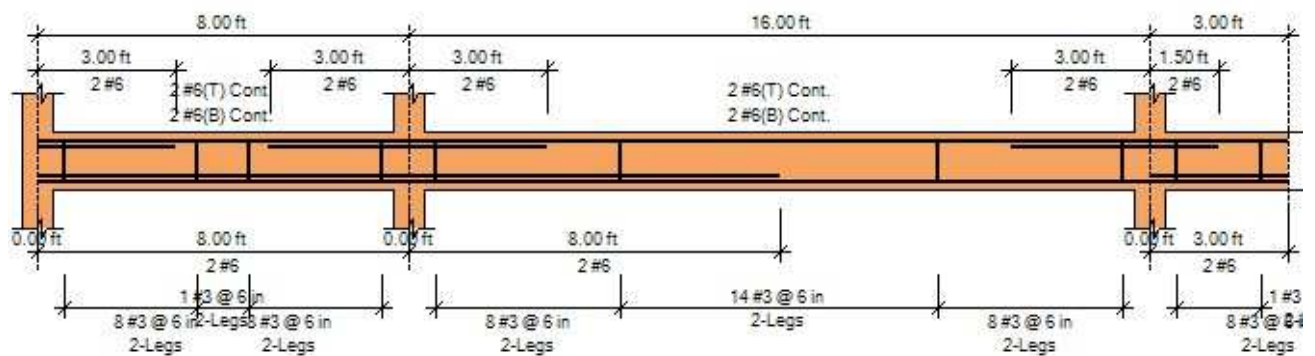
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION



Project: CASA PA' FERNANDZ  
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 Descrip: RB3

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## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 12.0          | in |
| Beam Width b           | 24.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |          | 4       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 22.00 ft | ①       | Pinned |
| ②                        | 9.00 ft  | ②       | Pinned |
| ③                        | 16.00 ft | ③       | Pinned |
| ④                        | N.A.     | ④       | Pinned |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |      |      |      |      |
|------|---|------|------|------|------|------|------|------|------|
| ①    | ① | 19.8 | 27.7 | 46.2 | 64.7 | 18.3 | 25.6 | 12.7 | 17.8 |
| ②    | ② | 23.4 | 25.6 | 54.4 | 59.6 | 22.5 | 24.1 | 15.5 | 16.6 |
| ③    | ③ | 19.8 | 23.8 | 46.2 | 55.5 | 18.3 | 22.0 | 12.7 | 15.2 |
| ④    | ④ | 22.5 | 29.5 | 52.4 | 68.6 | 21.4 | 28.7 | 14.8 | 19.7 |
| ⑤    | ⑤ | 19.8 | 23.8 | 46.2 | 55.5 | 18.3 | 22.0 | 12.7 | 15.2 |
| ⑥    | ⑥ | 19.8 | 29.5 | 46.2 | 68.6 | 18.3 | 28.7 | 12.7 | 19.7 |
| ⑦    | ⑦ | 19.8 | 23.8 | 46.2 | 55.5 | 18.3 | 22.0 | 12.7 | 15.2 |
| ⑧    | ⑧ | 22.5 | 25.6 | 52.4 | 59.6 | 21.4 | 24.1 | 14.8 | 16.6 |
| ⑨    | ⑨ | 19.8 | 23.8 | 46.2 | 55.5 | 18.3 | 22.0 | 12.7 | 15.2 |
| ⑩    | ⑩ | 19.8 | 23.8 | 46.2 | 55.5 | 18.3 | 22.0 | 12.7 | 15.2 |
| ⑪    | ⑪ | 11.9 | 17.8 | 27.7 | 41.6 | 11.0 | 16.5 | 7.6  | 11.4 |
| ⑫    | ⑫ | 11.9 | 17.8 | 27.7 | 41.6 | 11.0 | 16.5 | 7.6  | 11.4 |

### BENDING MOMENTS Mu (k-ft)

| Comb |   |   |     |      |   |     |    |   |    |
|------|---|---|-----|------|---|-----|----|---|----|
| ①    | ① | 0 | 124 | -136 | 0 | -56 | 61 | 0 | OK |
| ②    | ② | 0 | 114 | -125 | 0 | -52 | 57 | 0 | OK |
| ③    | ③ | 0 | 106 | -116 | 0 | -48 | 53 | 0 | OK |
| ④    | ④ | 0 | 132 | -144 | 0 | -61 | 68 | 0 | OK |
| ⑤    | ⑤ | 0 | 106 | -116 | 0 | -48 | 53 | 0 | OK |
| ⑥    | ⑥ | 0 | 132 | -144 | 0 | -61 | 68 | 0 | OK |
| ⑦    | ⑦ | 0 | 106 | -116 | 0 | -48 | 53 | 0 | OK |
| ⑧    | ⑧ | 0 | 114 | -125 | 0 | -52 | 57 | 0 | OK |
| ⑨    | ⑨ | 0 | 106 | -116 | 0 | -48 | 53 | 0 | OK |
| ⑩    | ⑩ | 0 | 106 | -116 | 0 | -48 | 53 | 0 | OK |
| ⑪    | ⑪ | 0 | 80  | -87  | 0 | -36 | 39 | 0 | OK |
| ⑫    | ⑫ | 0 | 80  | -87  | 0 | -36 | 39 | 0 | OK |

SHEAR FORCES  $V_u$  (kip)

| Comb |      |       |      |     |      |       |    |
|------|------|-------|------|-----|------|-------|----|
| ①    | 24.1 | -36.5 | 21.1 | 0.5 | 19.6 | -14.8 | OK |
| ②    | 22.2 | -33.6 | 19.3 | 0.4 | 18.4 | -13.9 | OK |
| ③    | 20.7 | -31.2 | 18.1 | 0.5 | 16.8 | -12.7 | OK |
| ④    | 25.7 | -38.8 | 22.1 | 0.3 | 21.8 | -16.4 | OK |
| ⑤    | 20.7 | -31.2 | 18.1 | 0.5 | 16.8 | -12.7 | OK |
| ⑥    | 25.7 | -38.8 | 22.1 | 0.3 | 21.8 | -16.4 | OK |
| ⑦    | 20.7 | -31.2 | 18.1 | 0.5 | 16.8 | -12.7 | OK |
| ⑧    | 22.2 | -33.6 | 19.3 | 0.4 | 18.4 | -13.9 | OK |
| ⑨    | 20.7 | -31.2 | 18.1 | 0.5 | 16.8 | -12.7 | OK |
| ⑩    | 20.7 | -31.2 | 18.1 | 0.5 | 16.8 | -12.7 | OK |
| ⑪    | 15.5 | -23.4 | 13.6 | 0.4 | 12.6 | -9.5  | OK |
| ⑫    | 15.5 | -23.4 | 13.6 | 0.4 | 12.6 | -9.5  | OK |

## BENDING STRENGTH (k-ft)

| Bot         | 6#8 Cont    |      | 6#8 Cont    |      | 6#8 Cont    |      |                 |
|-------------|-------------|------|-------------|------|-------------|------|-----------------|
| Bot         | 0#5x6.00 ft |      | 0#5x6.00 ft |      | 0#5x6.00 ft |      |                 |
| d           | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | in              |
| +As         | 4.74        | 4.74 | 4.74        | 4.74 | 4.74        | 4.74 | in <sup>2</sup> |
| c/d         | 0.27        | 0.27 | 0.27        | 0.27 | 0.27        | 0.27 |                 |
| + $\phi$ Mn | 182         | 182  | 182         | 182  | 182         | 182  |                 |
| Top         | 6#8 Cont    |      | 6#8 Cont    |      | 6#8 Cont    |      |                 |
| Top         | 0#5         |      | 0#5         |      | 0#5         |      |                 |
| d'          | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | in              |
| -As         | 4.74        | 4.74 | 4.74        | 4.74 | 4.74        | 4.74 | in <sup>2</sup> |
| c/d         | 0.27        | 0.27 | 0.27        | 0.27 | 0.27        | 0.27 |                 |
| - $\phi$ Mn | -182        | -182 | -182        | -182 | -182        | -182 |                 |
| As min      | 0.00        | 0.80 | 0.80        | 0.00 | 0.80        | 0.80 | in <sup>2</sup> |

## SHEAR STRENGTH (kip, in)

| $\phi V_c$ | 22.8  | -22.8 | 24.9  | -24.9 | 24.9  | -24.9 |      |
|------------|-------|-------|-------|-------|-------|-------|------|
| $\phi V_s$ | 39.6  | -39.6 | 0.0   | 0.0   | 0.0   | 0.0   |      |
| $\phi V_n$ | 62.4  | -62.4 | 24.9  | -24.9 | 24.9  | -24.9 |      |
| Av/s       | 0.088 | 0.088 | 0.020 | 0.020 | 0.020 | 0.020 | OK   |
| Min Av/s   | 0.020 | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  |      |
| s          | 5.0   | 9.0   | 5.0   | 5.0   | N.A.  | 5.0   | NG   |
| s max      | 5.0   | 5.0   | N.A.  | N.A.  | N.A.  | N.A.  | N.A. |

**DEFLECTIONS**

| Comb      |       |       |       |     |
|-----------|-------|-------|-------|-----|
| D         | 0.86  | 0.00  | 0.17  | in  |
| L         | 0.00  | 0.00  | 0.00  | in  |
| Lr, S     | 0.18  | 0.00  | 0.07  | in  |
| LS        | 0.05  | 0.00  | 0.02  | in  |
| LT        | 0.92  | 0.00  | 0.19  | in  |
| Ieff D    | 2,106 | 4,159 | 3,059 | in4 |
| Ieff L    | 2,106 | 4,159 | 3,059 | in4 |
| Ieff LS   | 2,092 | 4,157 | 2,943 | in4 |
| $\lambda$ | 1.01  | 1.01  | 1.01  |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.17 | OK |
| Max. Steel Area As max Ratio ....   | 0.66 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.38 | OK |
| Rebars Max Spacing Smax Ratio       | 0.37 | OK |
| Shear Vs/Vs max Ratio .....         | 0.43 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.23 | OK |
| Stirrups Spacing s max Ratio .....  | 1.00 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.69 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 1501       | 180    | 0.12  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 287        | 480    | 1.67  | NG |
| D    | Long-Term | 287        | 240    | 0.84  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: RB3

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

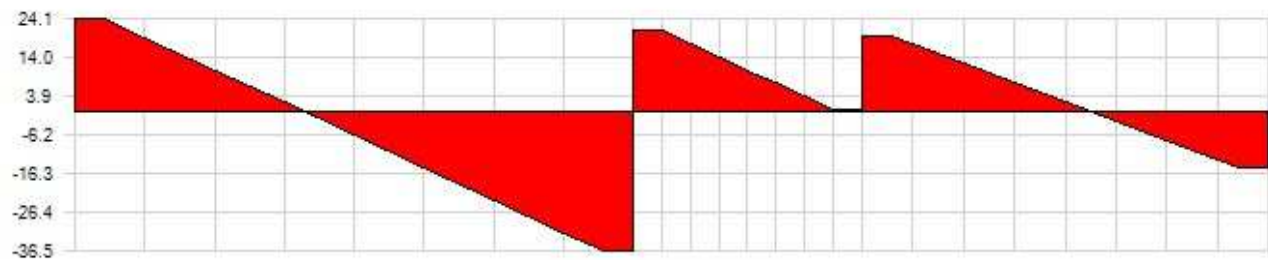
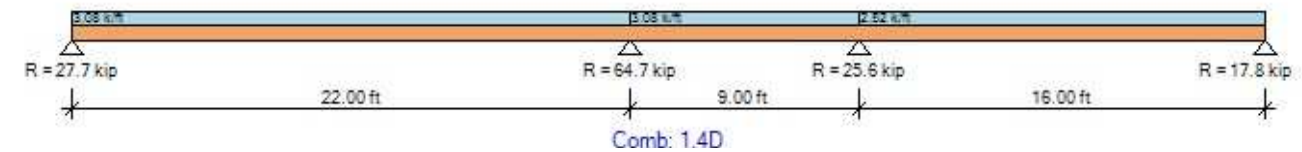
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**TORSION MOMENTS  $T_u$  (k-ft)**

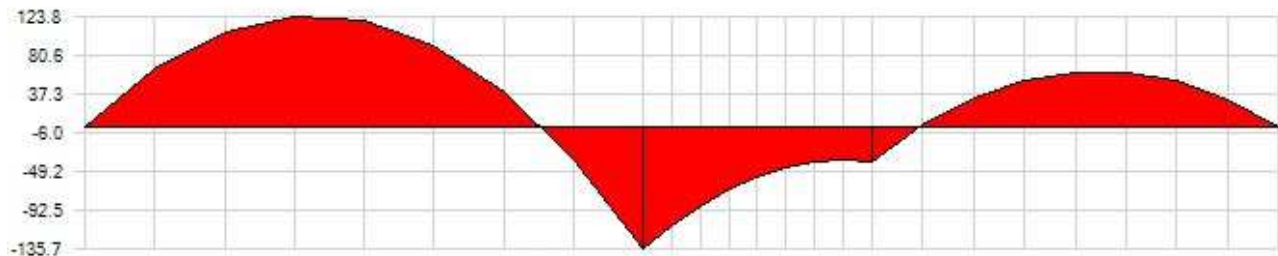
| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

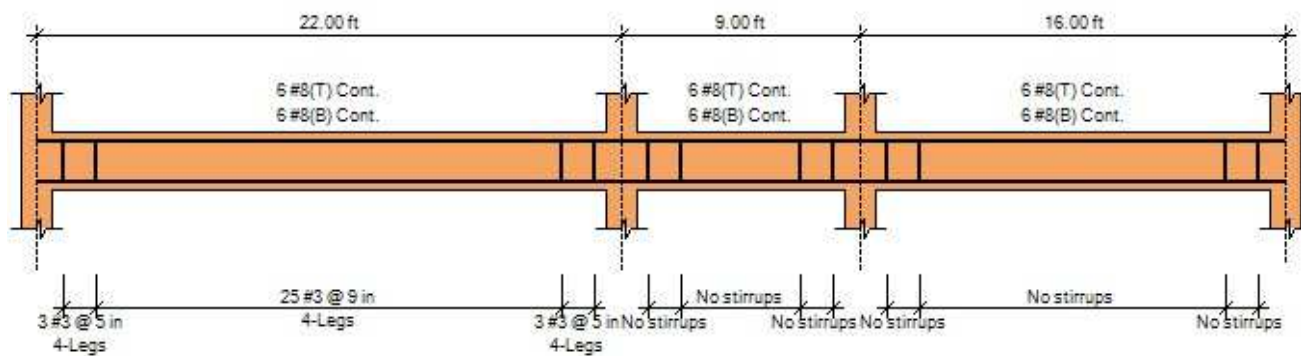
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION



## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 12.0          | in |
| Beam Width b           | 36.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 24.00 ft | ①       | Pinned |
| ②                        | 24.00 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |      |      |
|------|---|------|------|------|------|------|------|
| ①    | ① | 11.7 | 16.4 | 39.0 | 54.6 | 11.7 | 16.4 |
| ②    | ② | 13.3 | 14.9 | 44.4 | 49.5 | 13.3 | 14.9 |
| ③    | ③ | 11.7 | 14.0 | 39.0 | 46.8 | 11.7 | 14.0 |
| ④    | ④ | 12.9 | 16.6 | 43.1 | 55.4 | 12.9 | 16.6 |
| ⑤    | ⑤ | 11.7 | 14.0 | 39.0 | 46.8 | 11.7 | 14.0 |
| ⑥    | ⑥ | 11.7 | 16.6 | 39.0 | 55.4 | 11.7 | 16.6 |
| ⑦    | ⑦ | 11.7 | 14.0 | 39.0 | 46.8 | 11.7 | 14.0 |
| ⑧    | ⑧ | 12.9 | 14.9 | 43.1 | 49.5 | 12.9 | 14.9 |
| ⑨    | ⑨ | 11.7 | 14.0 | 39.0 | 46.8 | 11.7 | 14.0 |
| ⑩    | ⑩ | 11.7 | 14.0 | 39.0 | 46.8 | 11.7 | 14.0 |
| ⑪    | ⑪ | 7.0  | 10.5 | 23.4 | 35.1 | 7.0  | 10.5 |
| ⑫    | ⑫ | 7.0  | 10.5 | 23.4 | 35.1 | 7.0  | 10.5 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |    |      |    |   |    |
|------|---|----|------|----|---|----|
| ①    | 0 | 74 | -131 | 74 | 0 | OK |
| ②    | 0 | 67 | -119 | 67 | 0 | OK |
| ③    | 0 | 63 | -112 | 63 | 0 | OK |
| ④    | 0 | 75 | -133 | 75 | 0 | OK |
| ⑤    | 0 | 63 | -112 | 63 | 0 | OK |
| ⑥    | 0 | 75 | -133 | 75 | 0 | OK |
| ⑦    | 0 | 63 | -112 | 63 | 0 | OK |
| ⑧    | 0 | 67 | -119 | 67 | 0 | OK |
| ⑨    | 0 | 63 | -112 | 63 | 0 | OK |
| ⑩    | 0 | 63 | -112 | 63 | 0 | OK |
| ⑪    | 0 | 47 | -84  | 47 | 0 | OK |
| ⑫    | 0 | 47 | -84  | 47 | 0 | OK |

## SHEAR FORCES Vu (kip)

| Comb |      |       |      |       |    |
|------|------|-------|------|-------|----|
| ①    | 14.3 | -25.2 | 25.2 | -14.3 | OK |
| ②    | 12.9 | -22.8 | 22.8 | -12.9 | OK |
| ③    | 12.2 | -21.6 | 21.6 | -12.2 | OK |
| ④    | 14.5 | -25.6 | 25.6 | -14.5 | OK |
| ⑤    | 12.2 | -21.6 | 21.6 | -12.2 | OK |
| ⑥    | 14.5 | -25.6 | 25.6 | -14.5 | OK |
| ⑦    | 12.2 | -21.6 | 21.6 | -12.2 | OK |
| ⑧    | 12.9 | -22.8 | 22.8 | -12.9 | OK |
| ⑨    | 12.2 | -21.6 | 21.6 | -12.2 | OK |
| ⑩    | 12.2 | -21.6 | 21.6 | -12.2 | OK |
| ⑪    | 9.2  | -16.2 | 16.2 | -9.2  | OK |
| ⑫    | 9.2  | -16.2 | 16.2 | -9.2  | OK |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: RB4

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

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### BENDING STRENGTH (k-ft)

|        |             |      |             |      |                      |
|--------|-------------|------|-------------|------|----------------------|
| Bot    | 5#8 Cont    |      | 5#8 Cont    |      |                      |
| Bot    | 0#5x6.00 ft |      | 0#5x6.00 ft |      |                      |
| d      | 2.0         | 2.0  | 2.0         | 2.0  | 2.0 in               |
| +As    | 3.95        | 3.95 | 3.95        | 3.95 | 3.95 in <sup>2</sup> |
| c/d    | 0.21        | 0.21 | 0.21        | 0.21 | 0.21                 |
| +φMn   | 160         | 160  | 160         | 160  | 160                  |
| Top    | 6#8 Cont    |      | 5#8 Cont    |      |                      |
| Top    | 0#5         |      | 0#5         |      | 0#5                  |
| d'     | 2.0         | 2.0  | 2.0         | 2.0  | 2.0 in               |
| -As    | 4.74        | 4.74 | 4.74        | 3.95 | 3.95 in <sup>2</sup> |
| c/d    | 0.24        | 0.24 | 0.24        | 0.21 | 0.21                 |
| -φMn   | -189        | -189 | -189        | -160 | -160                 |
| As min | 0.00        | 1.20 | 1.20        | 1.20 | 0.00 in <sup>2</sup> |

### DEFLECTIONS

|         |       |       |                 |
|---------|-------|-------|-----------------|
| Comb    |       |       |                 |
| D       | 0.30  | 0.31  | in              |
| L       | 0.00  | 0.00  | in              |
| Lr, S   | 0.10  | 0.11  | in              |
| LS      | 0.03  | 0.03  | in              |
| LT      | 0.40  | 0.45  | in              |
| Ieff D  | 3,658 | 3,508 | in <sup>4</sup> |
| Ieff L  | 3,658 | 3,508 | in <sup>4</sup> |
| Ieff LS | 3,462 | 3,324 | in <sup>4</sup> |
| λ       | 1.21  | 1.29  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### DESIGN CODES

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

### SHEAR STRENGTH (kip, in)

|          |       |       |       |                 |
|----------|-------|-------|-------|-----------------|
| φVc      | 32.7  | -32.7 | 30.8  | -30.8           |
| φVs      | 0.0   | 0.0   | 0.0   | 0.0             |
| φVn      | 32.7  | -32.7 | 30.8  | -30.8           |
| Av/s     | 0.030 | 0.030 | 0.030 | 0.030 OK        |
| Min Av/s | N.A.  | N.A.  | N.A.  | N.A.            |
| s        | 5.0   | N.A.  | 5.0   | 5.0 N.A. 5.0 OK |
| s max    | N.A.  | N.A.  | N.A.  | N.A. N.A. N.A.  |

### REINFORCEMENT

|                               |       |      |    |
|-------------------------------|-------|------|----|
| Min. Steel Area As min Ratio  | ..... | 0.30 | OK |
| Max. Steel Area As max Ratio  | ....  | 0.51 | OK |
| Rebars Min Spacing Smin Ratio | ..    | 0.18 | OK |
| Rebars Max Spacing Smax Ratio |       | 0.73 | OK |
| Shear Vs/Vs max Ratio         | ..... | 0.00 | OK |
| Min. Stirrups Area Av/s Ratio | ..... | 0.00 | OK |
| Stirrups Spacing s max Ratio  | ..... | 0.00 | OK |
| Stirrups Min. # of Legs Ratio | ..... | 0.20 | OK |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 2728 | 180    | 0.07  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 644  | 480    | 0.74  | OK |
| D    | Long-Term | 644  | 240    | 0.37  | OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

### MATERIALS

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: RB4

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

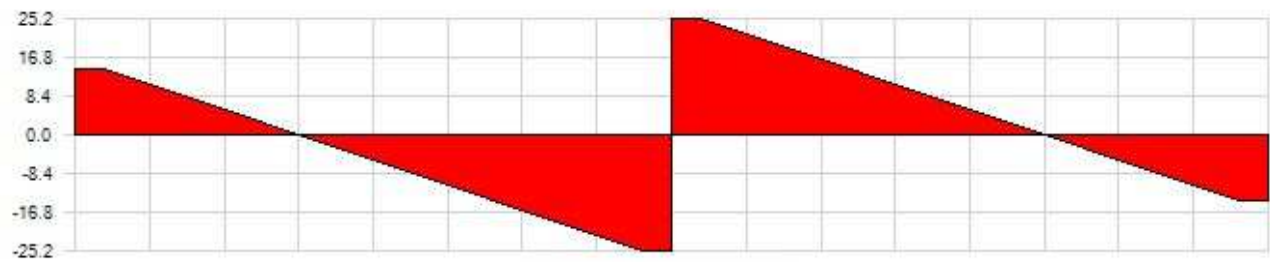
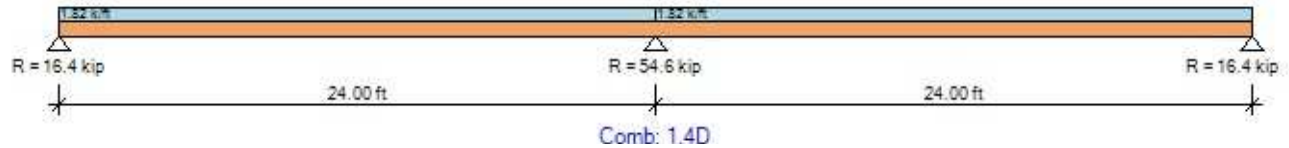
www.asdipsoft.com

**TORSION MOMENTS  $T_u$  (k-ft)**

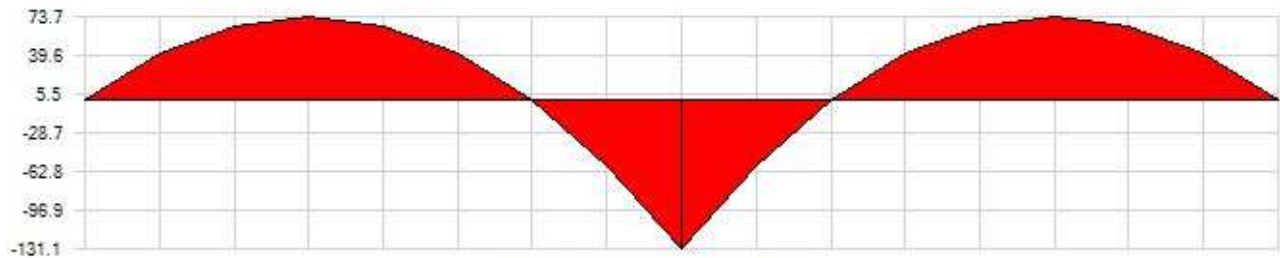
| Comb |     |     |     |     |    |
|------|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

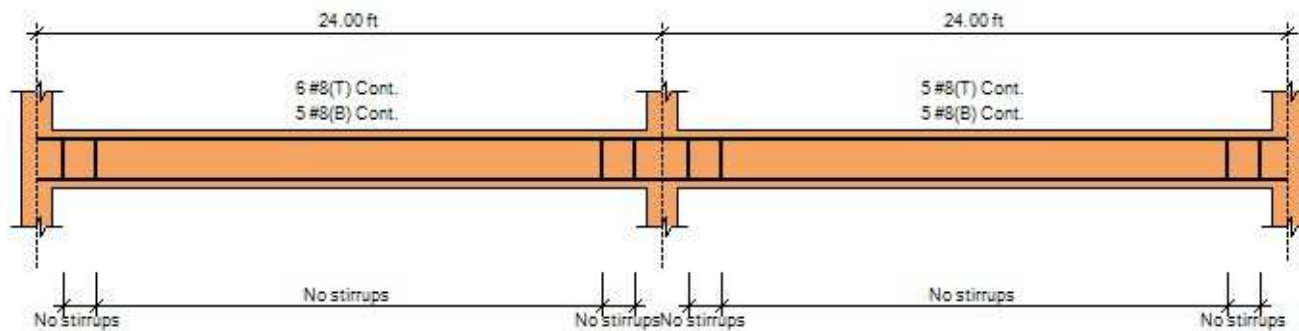
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

www.asdipsoft.com

### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...T-beam         | Not deep beam | OK |
| Total Height h         | 16.0 in       |    |
| Beam Width b           | 8.0 in        |    |
| Flange Thickness tf    | 6.0 in        |    |
| Left Flange Width bfl  | 12.0 in       | OK |
| Right Flange Width bfr | 12.0 in       | OK |
| Left Cantilever        | 0.00 ft       |    |
| Right Cantilever       | 0.00 ft       |    |

### BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 24.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |     |      |     |      |
|------|---|-----|------|-----|------|
| ①    | ① | 6.7 | 9.4  | 6.7 | 9.4  |
| ②    | ② | 8.3 | 8.8  | 8.3 | 8.8  |
| ③    | ③ | 6.7 | 8.1  | 6.7 | 8.1  |
| ④    | ④ | 7.9 | 10.6 | 7.9 | 10.6 |
| ⑤    | ⑤ | 6.7 | 8.1  | 6.7 | 8.1  |
| ⑥    | ⑥ | 6.7 | 10.6 | 6.7 | 10.6 |
| ⑦    | ⑦ | 6.7 | 8.1  | 6.7 | 8.1  |
| ⑧    | ⑧ | 7.9 | 8.8  | 7.9 | 8.8  |
| ⑨    | ⑨ | 6.7 | 8.1  | 6.7 | 8.1  |
| ⑩    | ⑩ | 6.7 | 8.1  | 6.7 | 8.1  |
| ⑪    | ⑪ | 4.0 | 6.0  | 4.0 | 6.0  |
| ⑫    | ⑫ | 4.0 | 6.0  | 4.0 | 6.0  |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 56 | 0 | OK |  |
| ②    | 0 | 53 | 0 | OK |  |
| ③    | 0 | 48 | 0 | OK |  |
| ④    | 0 | 63 | 0 | OK |  |
| ⑤    | 0 | 48 | 0 | OK |  |
| ⑥    | 0 | 63 | 0 | OK |  |
| ⑦    | 0 | 48 | 0 | OK |  |
| ⑧    | 0 | 53 | 0 | OK |  |
| ⑨    | 0 | 48 | 0 | OK |  |
| ⑩    | 0 | 48 | 0 | OK |  |
| ⑪    | 0 | 36 | 0 | OK |  |
| ⑫    | 0 | 36 | 0 | OK |  |

### SHEAR FORCES Vu (kip)

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 8.2 | -8.2 | OK |  |  |
| ②    | 7.7 | -7.7 | OK |  |  |
| ③    | 7.0 | -7.0 | OK |  |  |
| ④    | 9.2 | -9.2 | OK |  |  |
| ⑤    | 7.0 | -7.0 | OK |  |  |
| ⑥    | 9.2 | -9.2 | OK |  |  |
| ⑦    | 7.0 | -7.0 | OK |  |  |
| ⑧    | 7.7 | -7.7 | OK |  |  |
| ⑨    | 7.0 | -7.0 | OK |  |  |
| ⑩    | 7.0 | -7.0 | OK |  |  |
| ⑪    | 5.3 | -5.3 | OK |  |  |
| ⑫    | 5.3 | -5.3 | OK |  |  |



**BENDING STRENGTH (k-ft)**

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#6 Cont     |      |                      |
| Bot    | 2#6x20.00 ft |      |                      |
| d      | 1.5          | 2.5  | 1.5 in               |
| +As    | 0.88         | 1.76 | 0.88 in <sup>2</sup> |
| c/d    | 0.12         | 0.14 | 0.12                 |
| +φMn   | 72           | 116  | 72                   |
| Top    | 4#6 Cont     |      |                      |
| Top    | 0#5          |      |                      |
| d'     | 2.0          | 3.0  | 2.0 in               |
| -As    | 1.76         | 1.76 | 1.76 in <sup>2</sup> |
| c/d    | 0.24         | 0.22 | 0.24                 |
| -φMn   | -92          | -92  | -92                  |
| As min | 0.00         | 0.39 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |  |                 |
|---------------------|-------|--|-----------------|
| Comb                |       |  |                 |
| D                   | 0.44  |  | in              |
| L                   | 0.00  |  | in              |
| Lr, S               | 0.17  |  | in              |
| LS                  | 0.05  |  | in              |
| LT                  | 0.54  |  | in              |
| I <sub>eff</sub> D  | 2,618 |  | in <sup>4</sup> |
| I <sub>eff</sub> L  | 2,618 |  | in <sup>4</sup> |
| I <sub>eff</sub> LS | 2,506 |  | in <sup>4</sup> |
| λ                   | 1.08  |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |            |
|----------|-------|------------|
| φVc      | 11.0  | -11.0      |
| φVs      | 23.9  | -23.9      |
| φVn      | 34.9  | -34.9      |
| Av/s     | 0.037 | 0.037 OK   |
| Min Av/s | 0.007 | N.A.       |
| s        | 6.0   | 6.0 6.0 OK |
| s max    | 7.0   | 7.0 N.A.   |

**REINFORCEMENT**

|                                     |       |    |
|-------------------------------------|-------|----|
| Min. Steel Area As min Ratio .....  | 0.22  | OK |
| Max. Steel Area As max Ratio ....   | 0.47  | OK |
| Rebars Min Spacing Smin Ratio ..    | 10.00 | NG |
| Rebars Max Spacing Smax Ratio       | 0.23  | OK |
| Shear Vs/Vs max Ratio .....         | 0.54  | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.18  | OK |
| Stirrups Spacing s max Ratio .....  | 0.86  | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.33  | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 1698 | 180    | 0.11  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 537  | 480    | 0.89  | OK |
| D    | Long-Term | 537  | 240    | 0.45  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: RB4-REV

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

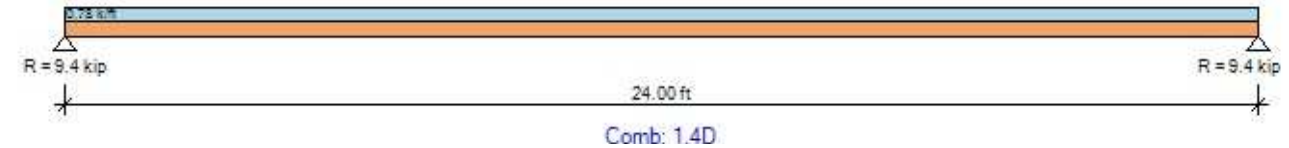
www.asdipsoft.com

**TORSION MOMENTS  $T_u$  (k-ft)**

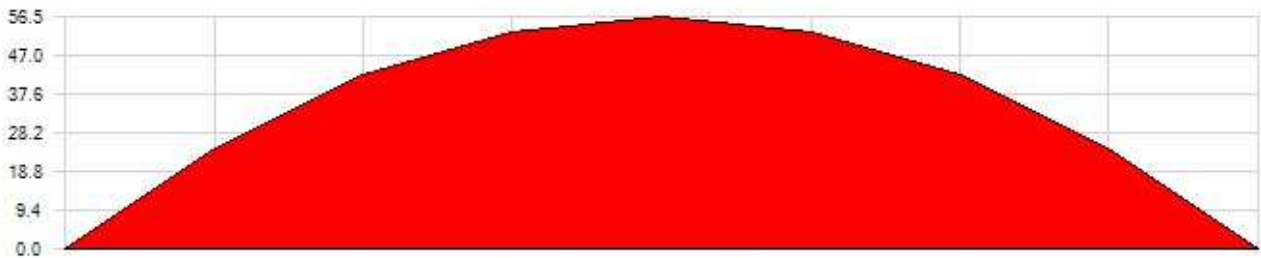
| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

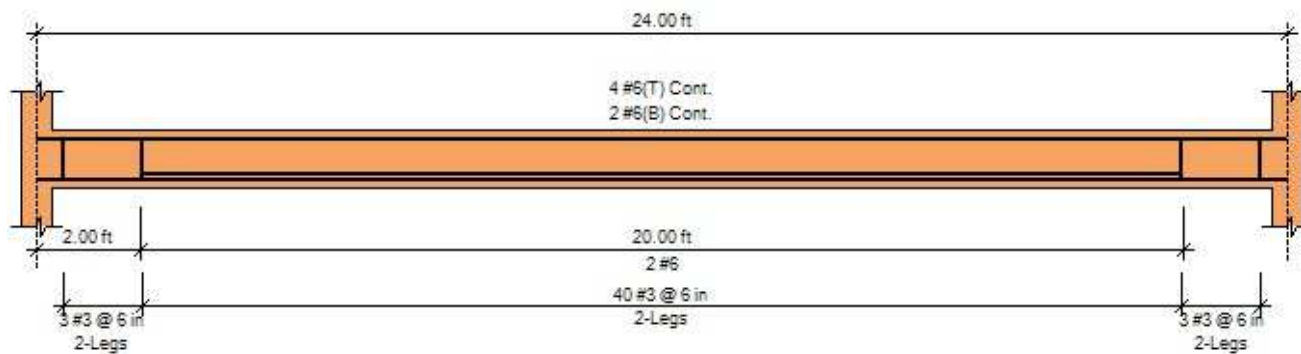
| At/s (in)             | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|----|
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

## GEOMETRY

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 48.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 0.00      | ft |
| Right Cantilever       | 0.00      | ft |

## BEAM SUPPORTS

| Number of Supports ..... |         | 3       |        |
|--------------------------|---------|---------|--------|
| Span                     | Length  | Support | Type   |
| ①                        | 8.00 ft | ①       | Fixed  |
| ②                        | 8.00 ft | ②       | Pinned |
| ③                        | N.A.    | ③       | Fixed  |
| ④                        | N.A.    | ④       | N.A.   |
| ⑤                        | N.A.    | ⑤       | N.A.   |
|                          |         | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |     |      |      |      |     |      |
|------|---|-----|------|------|------|-----|------|
| ①    | ① | 8.1 | 10.2 | 16.3 | 20.4 | 8.1 | 10.2 |
| ②    | ② | 7.3 | 10.1 | 14.6 | 20.2 | 7.3 | 10.1 |
| ③    | ③ | 7.3 | 10.1 | 14.6 | 20.2 | 7.3 | 10.1 |
| ④    | ④ | 7.9 | 9.2  | 15.9 | 18.3 | 7.9 | 9.2  |
| ⑤    | ⑤ | 7.9 | 9.2  | 15.9 | 18.3 | 7.9 | 9.2  |
| ⑥    | ⑥ | 7.3 | 8.7  | 14.6 | 17.5 | 7.3 | 8.7  |
| ⑦    | ⑦ | 7.3 | 8.7  | 14.6 | 17.5 | 7.3 | 8.7  |
| ⑧    | ⑧ | 7.9 | 9.2  | 15.9 | 18.3 | 7.9 | 9.2  |
| ⑨    | ⑨ | 7.9 | 9.2  | 15.9 | 18.3 | 7.9 | 9.2  |
| ⑩    | ⑩ | 7.9 | 9.2  | 15.9 | 18.3 | 7.9 | 9.2  |
| ⑪    | ⑪ | 4.4 | 6.6  | 8.7  | 13.1 | 4.4 | 6.6  |
| ⑫    | ⑫ | 4.4 | 6.6  | 8.7  | 13.1 | 4.4 | 6.6  |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |     |   |     |   |     |    |
|------|-----|---|-----|---|-----|----|
| ①    | -14 | 7 | -14 | 7 | -14 | OK |
| ②    | -13 | 7 | -13 | 7 | -13 | OK |
| ③    | -13 | 7 | -13 | 7 | -13 | OK |
| ④    | -12 | 6 | -12 | 6 | -12 | OK |
| ⑤    | -12 | 6 | -12 | 6 | -12 | OK |
| ⑥    | -12 | 6 | -12 | 6 | -12 | OK |
| ⑦    | -12 | 6 | -12 | 6 | -12 | OK |
| ⑧    | -12 | 6 | -12 | 6 | -12 | OK |
| ⑨    | -12 | 6 | -12 | 6 | -12 | OK |
| ⑩    | -12 | 6 | -12 | 6 | -12 | OK |
| ⑪    | -9  | 4 | -9  | 4 | -9  | OK |
| ⑫    | -9  | 4 | -9  | 4 | -9  | OK |

## SHEAR FORCES Vu (kip)

| Comb |      |     |      |     |    |
|------|------|-----|------|-----|----|
| ①    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ②    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ③    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ④    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ⑤    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ⑥    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ⑦    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ⑧    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ⑨    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ⑩    | -0.4 | 0.4 | -0.4 | 0.4 | OK |
| ⑪    | -0.3 | 0.3 | -0.3 | 0.3 | OK |
| ⑫    | -0.3 | 0.3 | -0.3 | 0.3 | OK |

**BENDING STRENGTH (k-ft)**

|        |             |      |             |      |                 |
|--------|-------------|------|-------------|------|-----------------|
| Bot    | 2#5 Cont    |      | 2#5 Cont    |      |                 |
| Bot    | 0#5x6.00 ft |      | 0#5x6.00 ft |      |                 |
| d      | 2.0         | 2.0  | 2.0         | 2.0  | in              |
| +As    | 0.62        | 0.62 | 0.62        | 0.62 | in <sup>2</sup> |
| c/d    | 0.04        | 0.04 | 0.04        | 0.04 |                 |
| +φMn   | 127         | 127  | 127         | 127  |                 |
| Top    | 2#5 Cont    |      | 2#5 Cont    |      |                 |
| Top    | 0#5         |      | 0#5         |      |                 |
| d'     | 2.0         | 2.0  | 2.0         | 2.0  | in              |
| -As    | 0.62        | 0.62 | 0.62        | 0.62 | in <sup>2</sup> |
| c/d    | 0.04        | 0.04 | 0.04        | 0.04 |                 |
| -φMn   | -127        | -127 | -127        | -127 |                 |
| As min | 0.09        | 0.04 | 0.09        | 0.04 | in <sup>2</sup> |

**DEFLECTIONS**

|                     |        |        |                 |
|---------------------|--------|--------|-----------------|
| Comb                |        |        |                 |
| D                   | 0.00   | 0.00   | in              |
| L                   | 0.00   | 0.00   | in              |
| Lr, S               | 0.00   | 0.00   | in              |
| LS                  | 0.00   | 0.00   | in              |
| LT                  | 0.00   | 0.00   | in              |
| I <sub>eff</sub> D  | 77,956 | 77,956 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 77,956 | 77,956 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 77,956 | 77,956 | in <sup>4</sup> |
| λ                   | 1.84   | 1.84   |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|                 |       |       |       |       |
|-----------------|-------|-------|-------|-------|
| φV <sub>c</sub> | 34.9  | -34.9 | 34.9  | -34.9 |
| φV <sub>s</sub> | 28.5  | -28.5 | 28.5  | -28.5 |
| φV <sub>n</sub> | 63.4  | -63.4 | 63.4  | -63.4 |
| Av/s            | 0.014 | 0.014 | 0.014 | 0.014 |
| Min Av/s        | N.A.  | N.A.  | N.A.  | N.A.  |
| s               | 16.0  | 6.0   | 16.0  | 16.0  |
| s max           | N.A.  | N.A.  | N.A.  | N.A.  |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.14 | OK |
| Max. Steel Area As max Ratio ....   | 0.09 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.50 | OK |
| Rebars Max Spacing Smax Ratio       | 0.26 | OK |
| Shear Vs/Vs max Ratio .....         | N.A. |    |
| Min. Stirrups Area Av/s Ratio ..... | N.A. |    |
| Stirrups Spacing s max Ratio .....  | N.A. |    |
| Stirrups Min. # of Legs Ratio ..... | N.A. |    |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 9999 | 480    | 0.00  | OK |
| D    | Long-Term | 9999 | 240    | 0.00  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                           |                |     |
|-------------------------------------------|----------------|-----|
| Concrete Strength f' <sub>c</sub> .....   | 4.0            | ksi |
| Compression Strain Limit .....            | 0.003          |     |
| Concrete density .....                    | 150            | pcf |
| Concrete Stress-Strain .....              | Hognestad      |     |
| Rebar Steel Strength f <sub>y</sub> ..... | 60.0           | ksi |
| Steel Stress-Strain .....                 | Elasto-plastic |     |



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: TB3 FOR EYEBROW

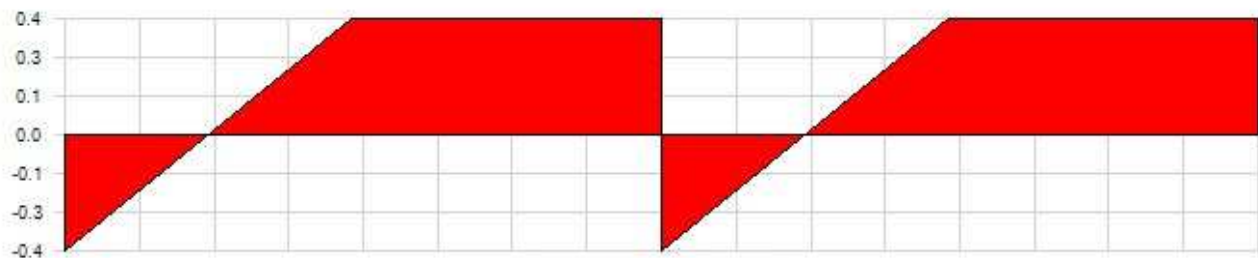
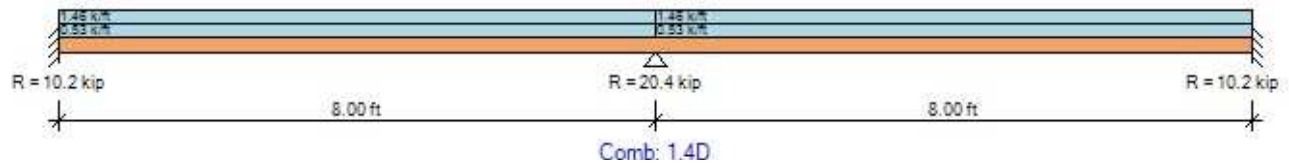
ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

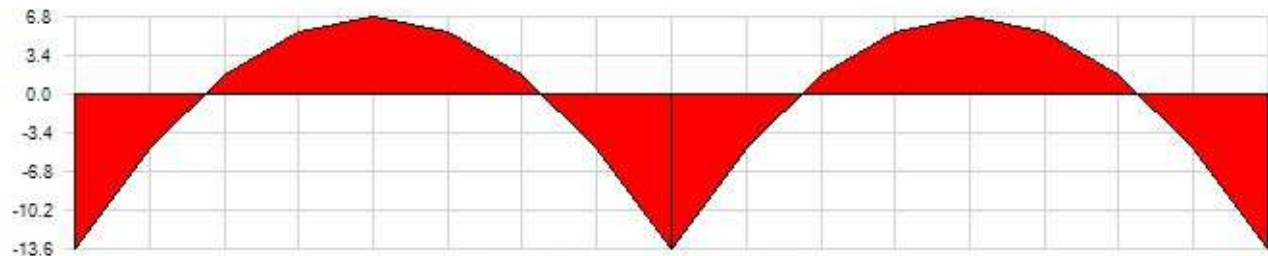
| Comb |     |     |     |     |    |
|------|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

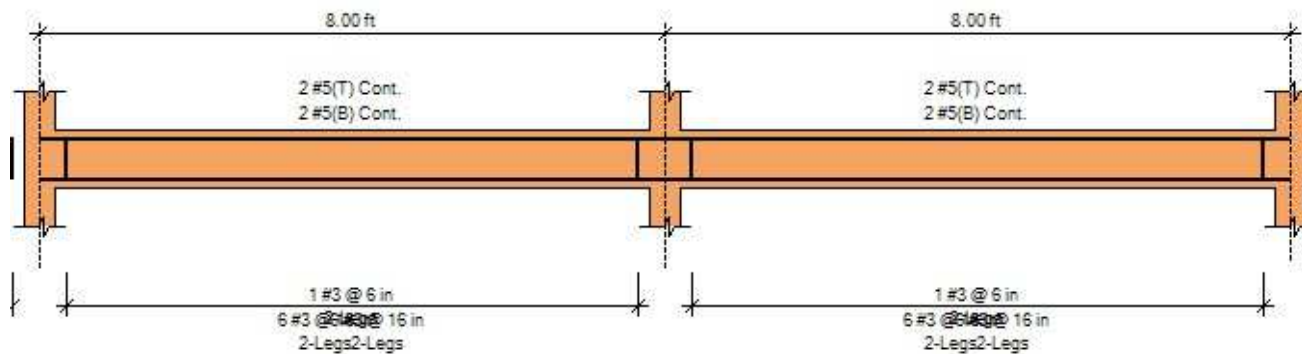
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)

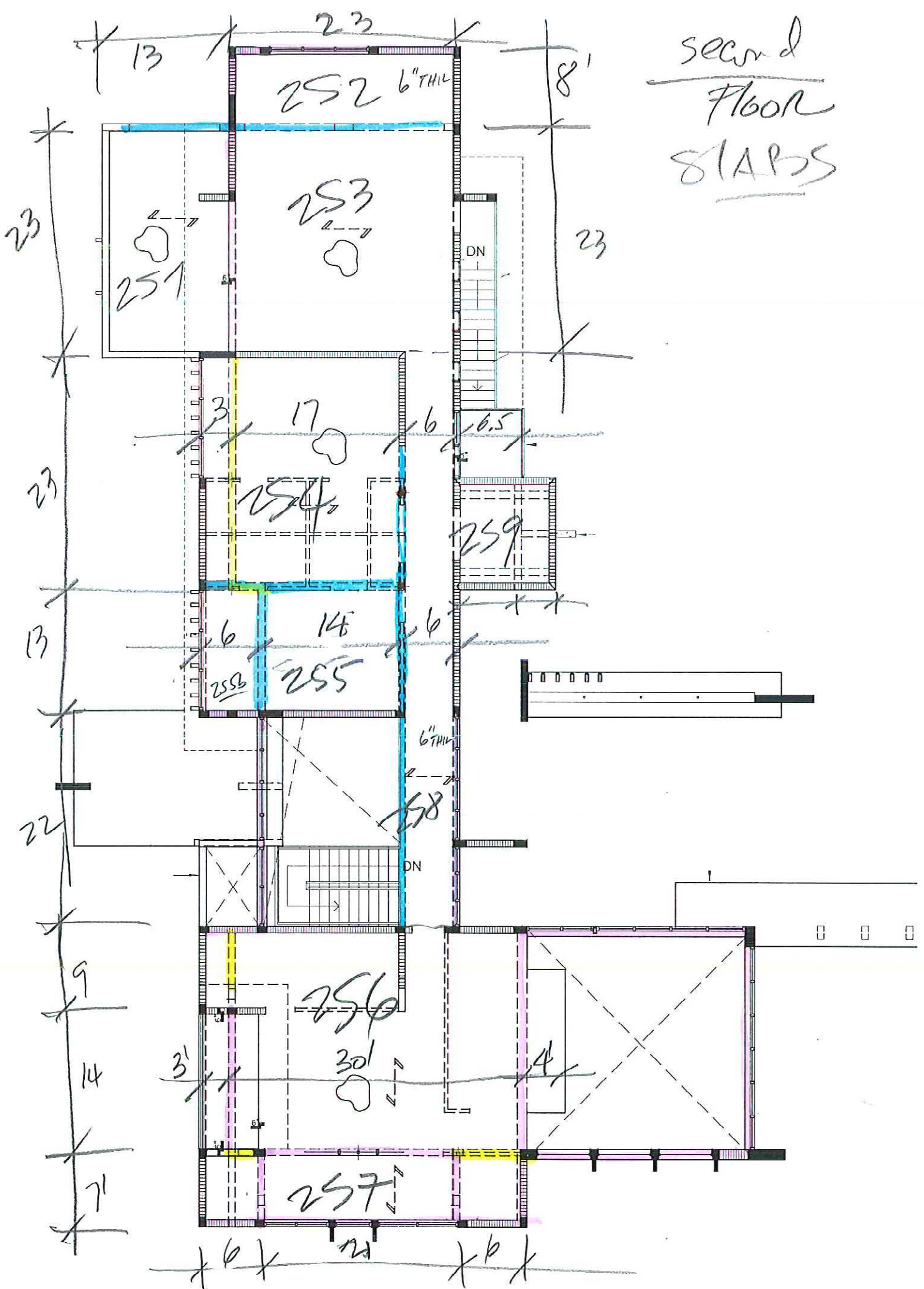


BEAM ELEVATION



## ***Second Floor Slabs***

second  
Floor  
STAIRS





## Second Floor Slab

251  
 $e_y = 13$

$h = \frac{23 \times 1.1}{3.6 + 5 \frac{23}{13}} = 0.56 \rightarrow 7''$   
 $\epsilon = \frac{B}{22} = 0.57$

DL = 88  
 40L = 30  
 LL = 60  
 UTL = 240 psf  
 $q_u l^2 = 40.6$

$M_x = 0.0892 \times 40.6 = 3.62 \text{ K/F}$   
 $M_y = 0.021 \times 40.6 = 0.85 \text{ K/F}$

$\rightarrow \#4 @ 12''$

$R_{11}^D = 0.139 \times 35.9 / 23 = 0.22 \text{ K/F}$   
 $R_{22}^D = 0.139 \times 35.9 / 23 = 0.22 \text{ K/F}$   
 $R_{34}^D = 0.361 \times 35.9 / 13 = 1.00 \text{ K/F}$

$R_{11}^L = 0.11 \text{ K/F}$   
 $R_{22}^L = 0.11 \text{ K/F}$   
 $R_{34}^L = 0.50 \text{ K/F}$

$D = 120 \times 13 \times 23 = 35.9 \text{ K}$   
 $L = 60 \times 13 \times 23 = 17.9 \text{ K}$

253  
 $q_u l^2 = 127$   
 $D = 63.5 \text{ K}$   
 $L = 15.9 \text{ K}$   
 UTL = 210 psf

$M_e = 0.0698 \times 127 = 8.86 \text{ K/F}$   
 $h = \frac{1.1 \times 23}{4.1} = 7 \frac{1}{2}$

$M_x = 0.0158 \times 127 = 2.01 \text{ K/F}$   
 $M_y = 0.0285 \times 127 = 3.62 \text{ K/F}$

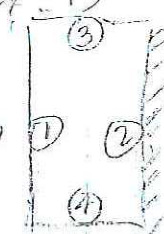
$\rightarrow A_s = \frac{8.86}{4 \times 5.5} = 0.40 \text{ K/F}$   
 $\rightarrow \#5 @ 9''$   
 $\rightarrow 2 \#4 @ 6''$

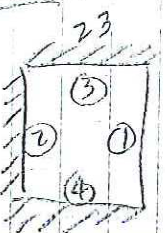
$R_{11}^D = 0.144 \times 63.5 / 23 = 0.40 \text{ K/F}$   
 $R_{22}^D = 0.144 \times 63.5 / 23 = 0.40 \text{ K/F}$   
 $R_{34}^D = 0.356 \times 63.5 / 23 = 1.00 \text{ K/F}$

$R_{11}^L = 0.10 \text{ K/F}$   
 $R_{22}^L = 0.10 \text{ K/F}$   
 $R_{34}^L = 0.25 \text{ K/F}$

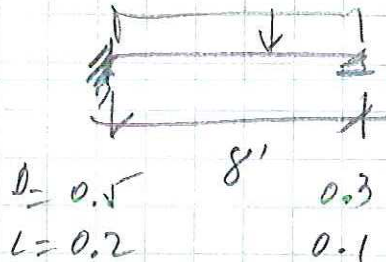


# Second Floor Slab

2S1  
 $l_y = 13$   
  
 $h = \frac{23 \times 1.1}{36 + 5 \frac{23}{13}} = 0.52 \rightarrow 7"$   
 $g = \frac{D}{h} = 0.57$   
 $DL = 88$   
 $10L = 30$   
 $LL = 60$   
 $UTL = 240 \text{ psf}$   
 $q_u^2 = 426$   
 $M_x = 0.1188 \times 40.6 = 4.82 \text{ k/F}$   
 $M_y = 0.0562 \times 40.6 = 2.28 \text{ k/F}$   
 $M_y = 0.0083 \times 40.6 = 0.34 \text{ k/F}$   
 $R_{11}^D = 0.292 \times 35.9 / 23 = 0.46 \text{ k/F}$   
 $R_{22}^D = 0.506 \times 35.9 / 23 = 0.79 \text{ k/F}$   
 $R_{34}^D = 0.101 \times 35.9 / 13 = 0.28 \text{ k/F}$   
 $R_{11}^L = 0.23 \text{ k/F}$   
 $R_{22}^L = 0.39 \text{ k/F}$   
 $R_{34}^L = 0.14 \text{ k/F}$   
 $b = 120 \times 13 \times 23 = 35.9 \text{ k}$   
 $L = 60 \times 13 \times 23 = 17.9 \text{ k}$   
 $\rightarrow \#4 @ 10" T$

2S3  
 $q_u^2 = 127$   
 $D = 63.5 \text{ k}$   
 $L = 15.9 \text{ k}$   
 $UTL = 210 \text{ psf}$   
  
 $M_x^E = 0.0596 \times 127 = 7.6 \text{ k/F}$   
 $M_y^E = 0.0551 \times 127 = 7.0 \text{ k/F}$   
 $M_x = 0.0228 \times 127 = 2.90 \text{ k/F}$   
 $M_y = 0.0167 \times 127 = 2.12 \text{ k/F}$   
 $A_s = \frac{7.6}{4 \times 11.7} = 0.35 \text{ in}^2/\text{F}$   
 $\#5 @ 12" T$   
 $\#4 @ 6"$   
 $R_{11}^D = 0.144 \times 63.5 / 23 = 0.40 \text{ k/F}$   
 $R_{22}^D = 0.25 \times 63.5 / 23 = 0.70 \text{ k/F}$   
 $R_{34}^D = 0.303 \times 63.5 / 23 = 0.84 \text{ k/F}$   
 $R_{11}^L = 0.10 \text{ k/F}$   
 $R_{22}^L = 0.17 \text{ k/F}$   
 $R_{34}^L = 0.21 \text{ k/F}$

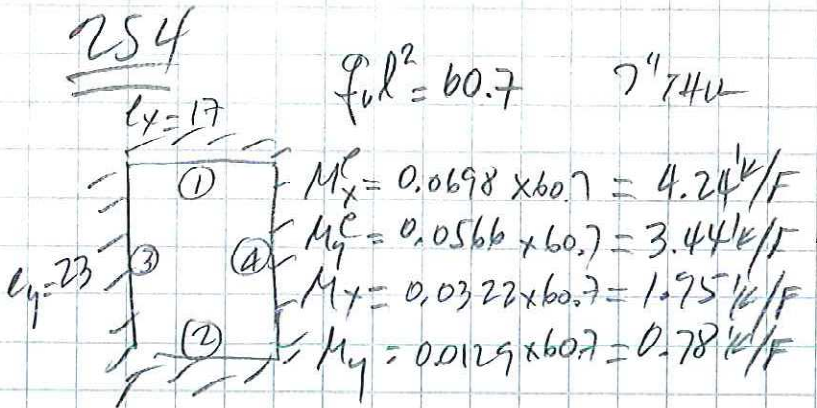
252



DL=100  
 LL=40  
 UTL=185

#4 @ 12" on BOT  
 Top Steel Per 253

254



$f_u l^2 = 60.7$  7' 7 1/2"

$M_x^e = 0.0698 \times 60.7 = 4.24 \text{ k/F}$   
 $M_y^e = 0.0566 \times 60.7 = 3.44 \text{ k/F}$   
 $M_x = 0.0322 \times 60.7 = 1.95 \text{ k/F}$   
 $M_y = 0.0129 \times 60.7 = 0.78 \text{ k/F}$

D = 120  
 L = 40 } UTL = 210

D = 120 x 17 x 23 = 46.9 k  
 L = 40 x 17 x 23 = 15.7 k

$A_s = \frac{4.24}{4 \times 5.5} = 0.19 \text{ in}^2/\text{F}$   
 use  $A_s$  Per 253

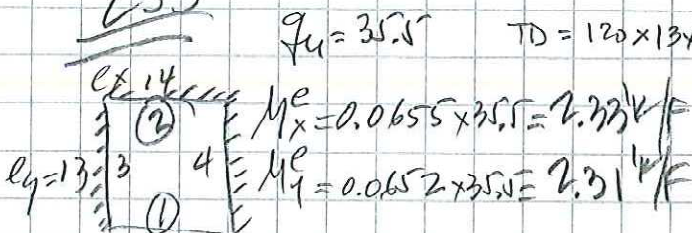
$R_{12}^D = 0.186 \times 46.9 \div 17 = 0.52 \text{ k/F}$

$R_{12}^L = 0.18 \text{ k/F}$

$R_{34}^D = 0.315 \times 46.9 \div 23 = 0.64 \text{ k/F}$

$R_{34}^L = 0.22 \text{ k/F}$

255



$f_u = 35.5$

TD = 120 x 13 x 14 = 21.8 k

TL = 40 x 13 x 14 = 7.3 k

$M_x^e = 0.0655 \times 35.5 = 2.33 \text{ k/F}$   
 $M_y^e = 0.0652 \times 35.5 = 2.31 \text{ k/F}$

$M_x = 0.0230 \times 35.5 = 0.82 \text{ k/F}$   
 $M_y = 0.0222 \times 35.5 = 0.79 \text{ k/F}$   
 $A_s \rightarrow \#2 @ 12" / c$

$R_{12}^D = 0.156 \times 21.8 \div 14 = 0.25 \text{ k/F}$

$R_{12}^L = 0.100 \text{ k/F}$

$R_{23}^D = 0.271 \times 21.8 \div 14 = 0.42 \text{ k/F}$

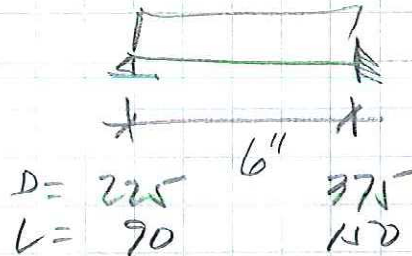
$R_{23}^L = 0.150$

$R_{34}^D = 0.286 \times 21.8 \div 13 = 0.48 \text{ k/F}$   
 3 4

$R_{34}^L = 0.16$   
 3 4



256



$$\begin{aligned} DL &= 75 \\ AOL &= 25 \end{aligned} \Bigg) 100$$

$$U = 40$$

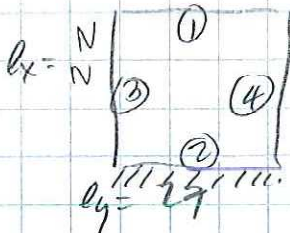
$$UTL = 180$$

256

$$h = \frac{6.1 \times 27}{36 + 5 \frac{27}{12}} = 0.7 \rightarrow 8"$$

$$\begin{aligned} DL &= 100 \\ AOL &= 40 \\ U &= 40 \end{aligned}$$

$$VTL = 240 \text{ psf}$$



$$q_u = 117$$

$$TD = 83.2 \text{ k}$$

$$TL = 23.8 \text{ k}$$

$$\begin{aligned} M^e &= -0.1008 \times 117 = 11.8 \text{ k/F} \rightarrow A_s^- = \frac{11.8}{4 \times 6.5} = 0.45 \text{ in}^2/\text{F} \quad \#2 @ 8" \\ M_x &= 0.0428 \times 117 = 5.0 \text{ k/F} \rightarrow A_s^+ = \frac{5}{4 \times 6.5} = 0.19 \text{ in}^2/\text{F} \quad \#4 @ 10" \text{ on BT} \\ M_y &= 0.0187 \times 117 = 2.19 \text{ k/F} \end{aligned}$$

$$R_{D1} = 0.259 \times 83.2 \div 27 = 0.80 \text{ k/F}$$

$$R_{D2} = 0.449 \times 83.2 \div 27 = 1.40 \text{ k/F}$$

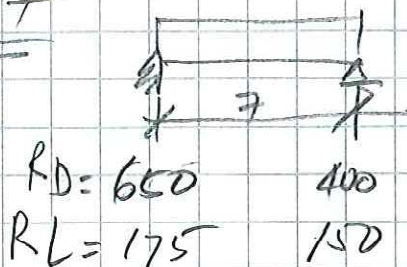
$$R_{D3(4)} = 0.146 \times 83.2 \div 27 = 0.55 \text{ k/F}$$

$$R_{D1}^L = 0.23 \text{ k/F}$$

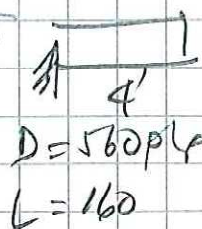
$$R_{D2}^L = 0.40 \text{ k/F}$$

$$R_{D3(4)}^L = 0.16 \text{ k/F}$$

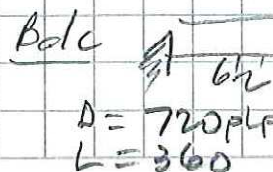
257



Calc

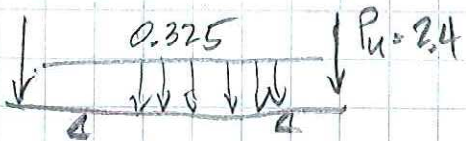
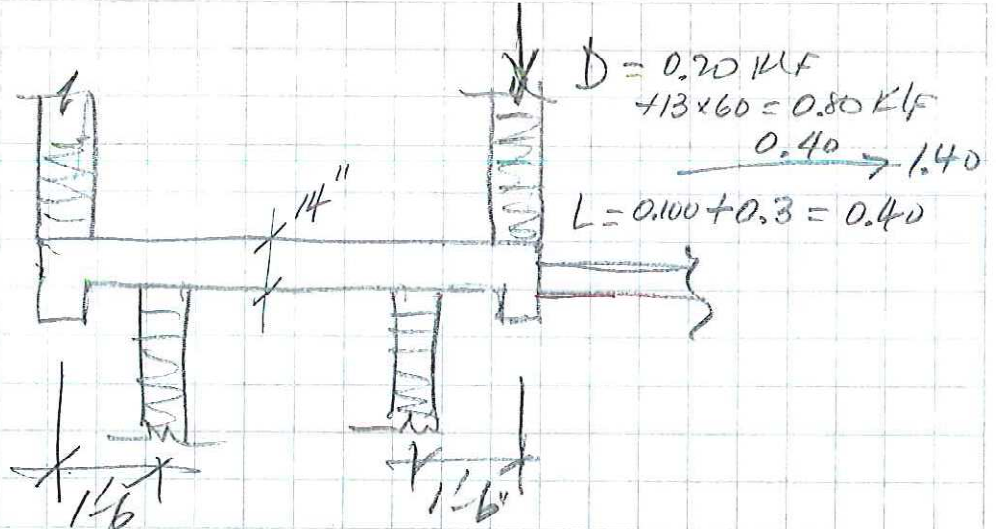


$$\begin{aligned} M &= \frac{.240 \times 4^2}{2} = 1.92 \text{ k/F} \\ A_s &= \frac{1.92}{4 \times 6} = 0.1 \end{aligned}$$



$$\begin{aligned} M &= \frac{.240 \times 6^2}{2} = 4.32 \\ A_s &= \frac{4.32}{4 \times 4} = 0.18 \text{ in}^2/\text{F} \end{aligned}$$

259



$$M_u = 2.4 \times 1.5 + 0.325 \times \frac{1.5^2}{2}$$

$$\approx 4 \text{ K/F}$$

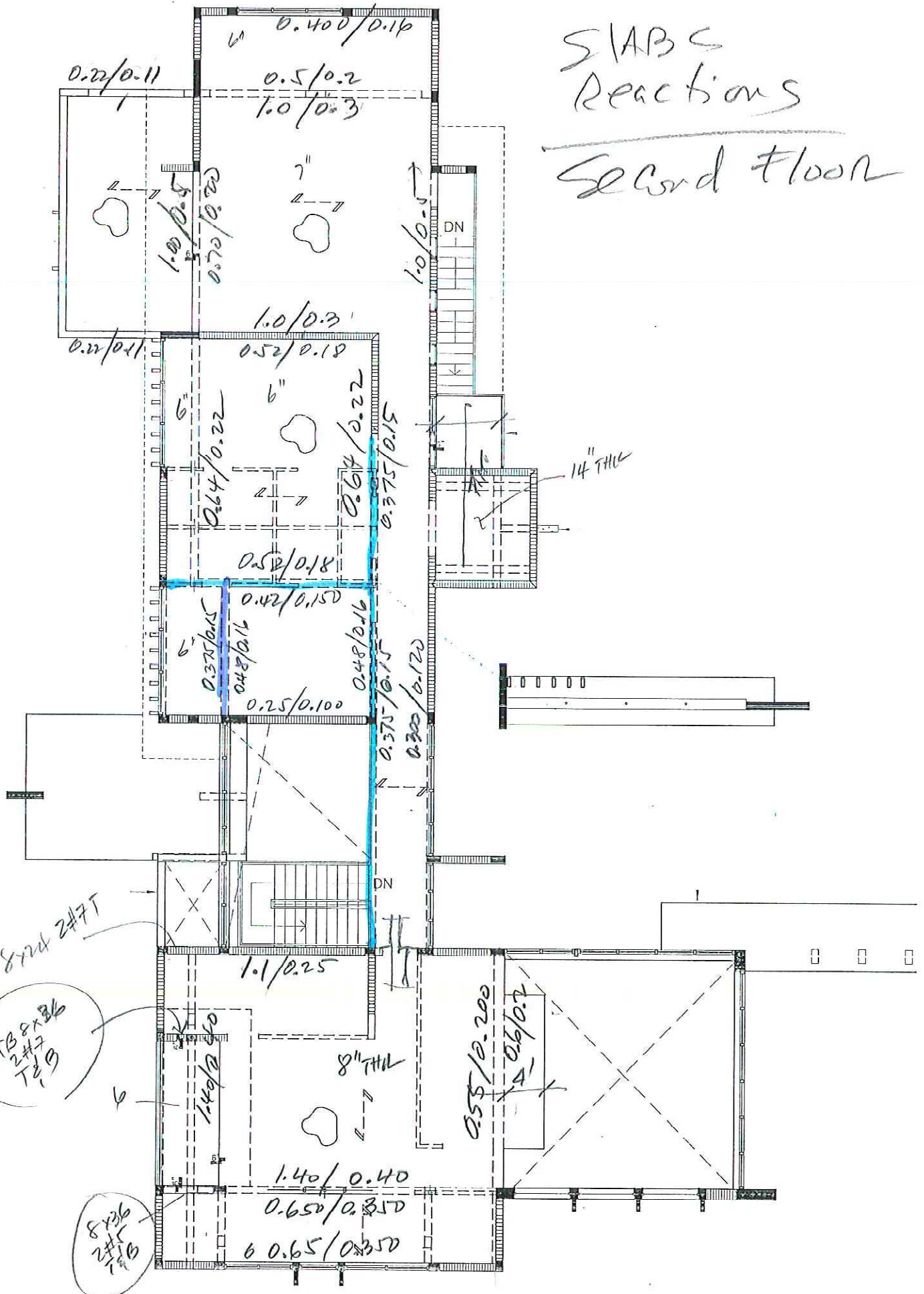
$$A_s = \frac{4}{4 \times 12} = 0.08 \text{ in}^2$$

#5 @ 12" o/c  
( $A_{smin}$ )

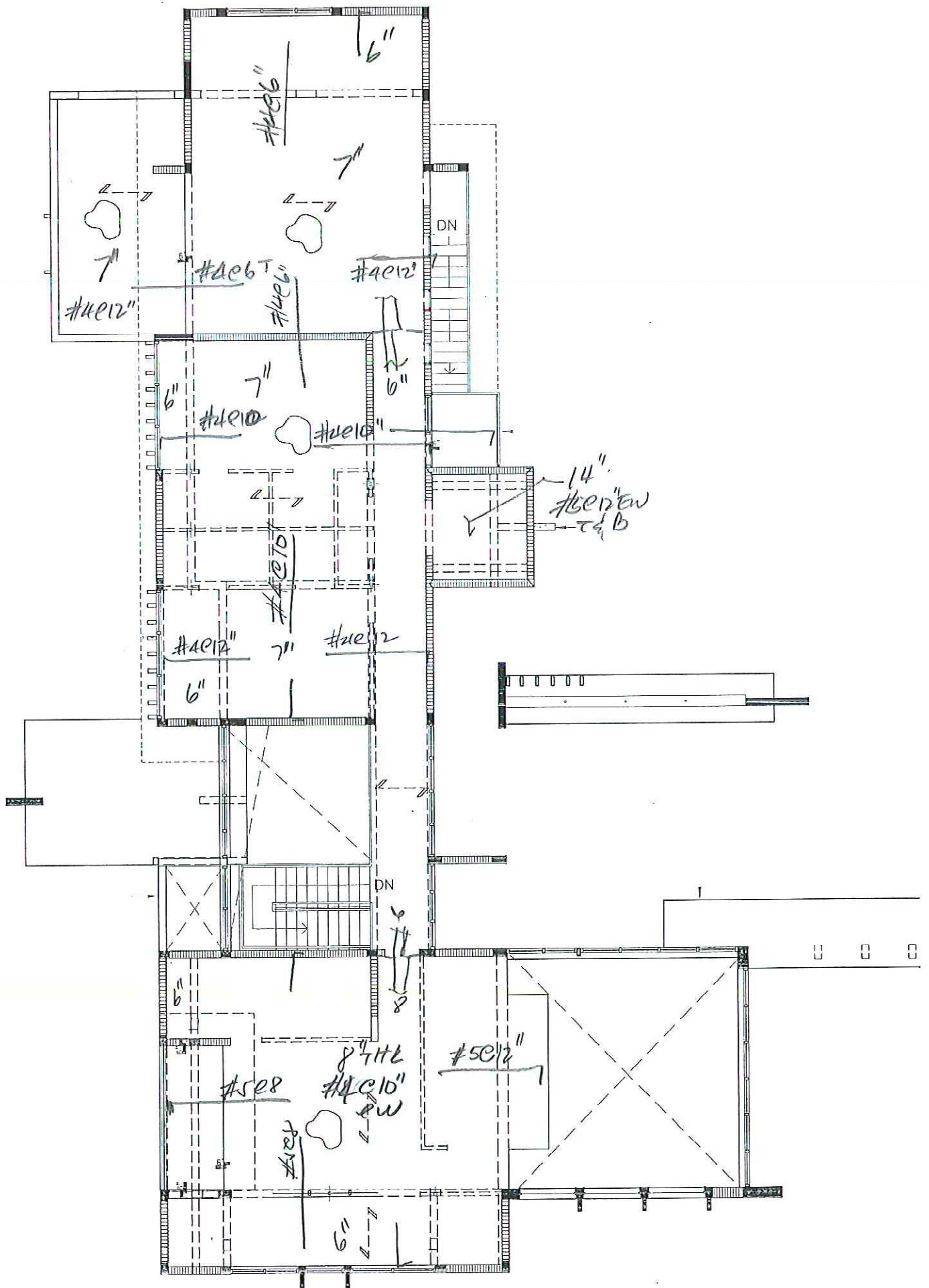


# SLABS Reactions

## Second Floor



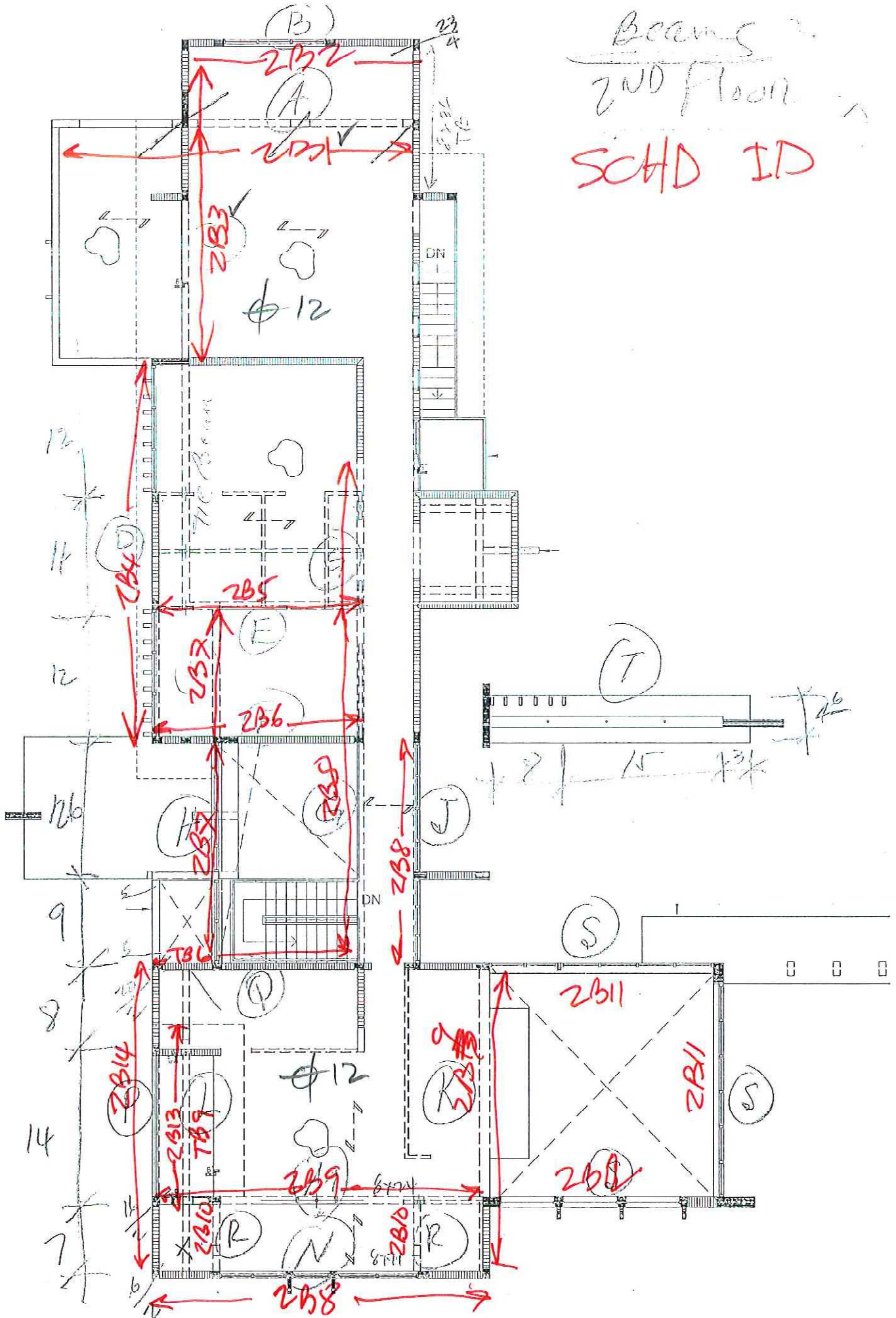






## ***Second Floor Beams***

Beams  
2ND Floor  
SCHD ID

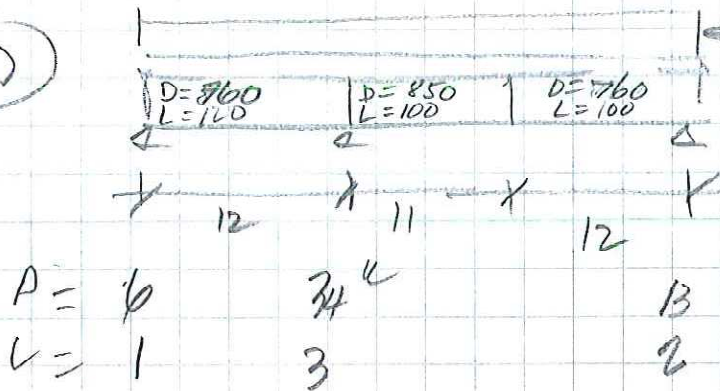




## Second Floor Beams

(D)

✓



$$D = 100 \times 4.5 = 450 \text{ plf} \left[ \text{Roof} \right]$$

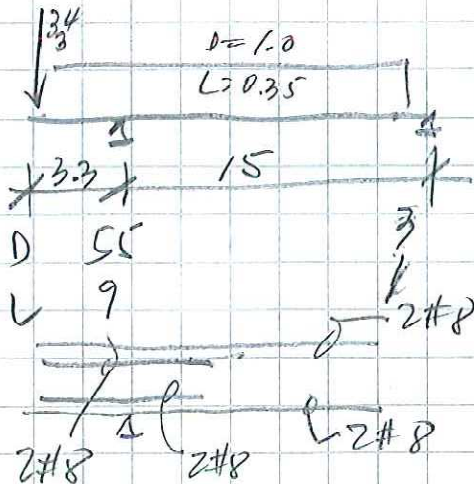
$$L = 20 \times 4.5 = 100 \text{ plf}$$

Glass 40psf

$$\left[ \begin{array}{l} 8 \times 24 \\ 4 \#6 \text{ T \& B} \\ \#3 @ 10 \end{array} \right]$$

2B4

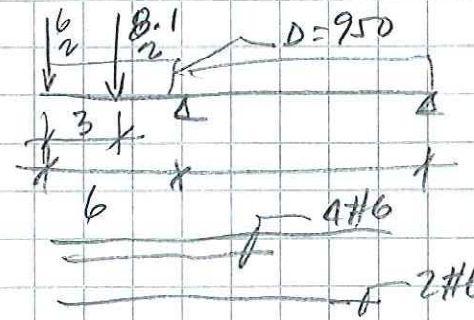
(E)



$$\left[ \begin{array}{l} 12 \times 24 \\ 4 \#8 \text{ T \& B} \\ \#3 @ 8 \end{array} \right]$$

2B5

(F)



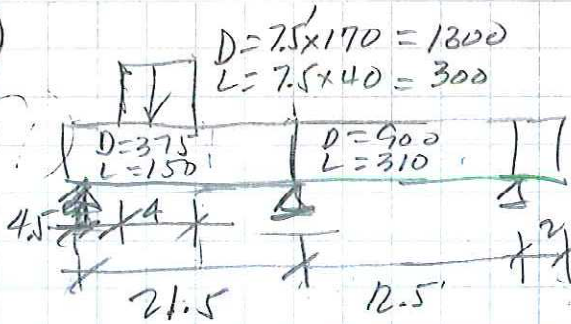
$$\left[ \begin{array}{l} 8 \times 40 \\ 4 \#6 \text{ T} \\ 2 \#6 \text{ B} \\ \#3 @ 8 \end{array} \right]$$

T O B  
13'-4"

2B6

D 31  
L 10

(G)

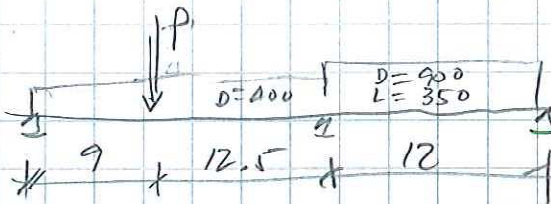


|   |    |     |   |
|---|----|-----|---|
| D | 8K | 19" | 6 |
| L | 3  | 7   | 3 |

8x24  
2#6 T & B  
#3 @ 8"  
2#8

(H)

$P = 17 \times 700 = 12K$



Wind  $50 \times 1.6 \times 12 = 1K4$

$M_u = \frac{1 \times 21^2}{8} = 55'1K$

$A_s = \frac{55}{4 \times 9} = 1.53 i^2$

$V_u = 10.5K$

|   |      |    |   |
|---|------|----|---|
| L | → 2  | 5  | 2 |
| D | → 11 | 27 | 7 |

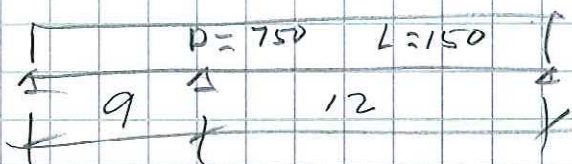
$\phi V_c = 0.25 \times \sqrt{4000} \times 24 \times 9 = 10.2K$

Provide 8#3 @ 4" EE  
Balance @ 10"

12x24  
3#6 T & B  
add 2#8 EF  
(3#7)

2#8

(J)

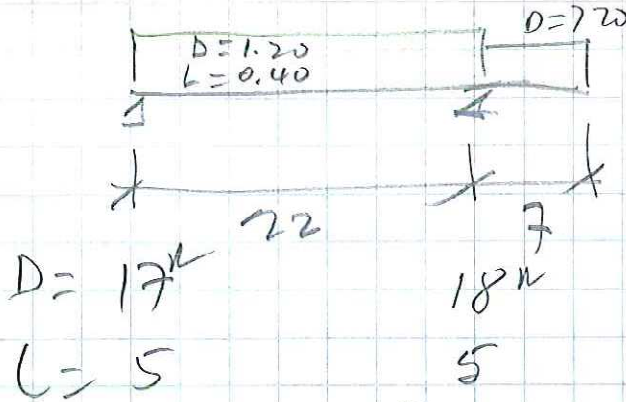


|   |   |    |    |
|---|---|----|----|
| D | 2 | 30 | 13 |
| L | 1 | 5  | 2  |

8x24  
2#5 T & B  
#3 @ 10"  
2#8



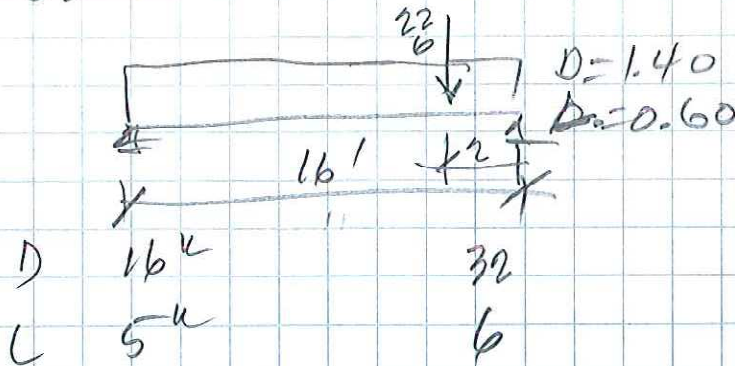
(K)



12x24  
4#7 T & B  
#3 @ 8"

2B9

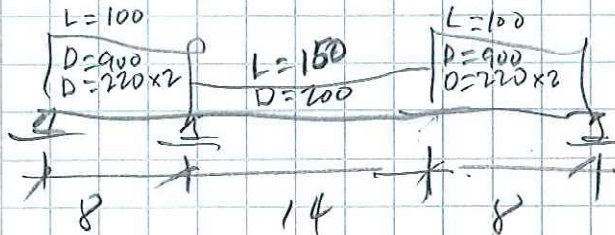
(L)



8x3.2  
4#6 B  
2#6 T  
6#3 @ 8" EE  
Bal @ 12

2B13

(P)



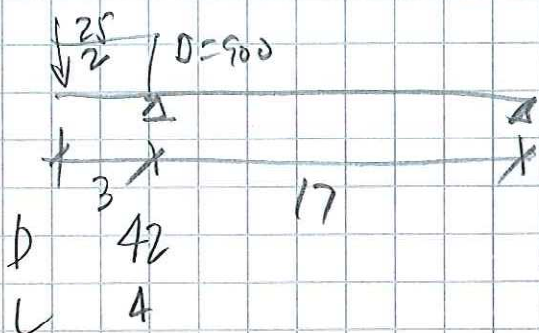
check slab for load yn' lieu

D' 6 16 10  
L 2 5 2

8x18  
2#6 T & B  
#3 @ 8"  
(4#5 T & B  
#3 @ 8"

2B14

(Q)



8x24  
4#6 T  
2#6 B  
#3 @ 8" @ cant.

TB6

NOTE: S5

#### INPUT DATA:

La=length of clear span in short direction 22 ft  
 Lb=length of clear span in long direction 27 ft  
 D1=Super imposed dead load 20 psf  
 L=live load 30 psf  
 cover 1 in  
 t=slab thickness 7 in

$\phi$  0.9  
 $f_c'$  3000 psi  
 $f_y$  60000 psi  
 $\beta$  0.85  
 d=t-cover 7 in

| $f_c'$ | $\beta$ |
|--------|---------|
| 3000   | 0.85    |
| 4000   | 0.85    |
| 5000   | 0.8     |
| 6000   | 0.75    |

D2=self weight of slab=150\*t 87.5 psf  
 D=total dead load=D1+D2 107.5 psf  
 Wd=1.2D 129 psf  
 Wl=1.6L 48 psf  
 Wu=Wd+Wl 177 psf  
 m=La/Lb 0.81

case Two Short Edges Discontinuous (select from drop down list) 5

#### CALCULATION OF NEGATIVE MOMENTS:

##### At continuous end:

Ca,neg 0.0828  
 Cb,neg 0  
 Ma,neg 85119.72 lb-in  
 Mb,neg 0 lb-in

##### At discontinuous end:

Ma,neg=Ma,pos/3 11974.93 lb-in  
 Mb,neg=Mb,pos/3 5859.41 lb-in

#### CALCULATION OF POSITIVE MOMENTS:

##### MOMENT IN SHORT DIRECTION:

Ca,pos,d 0.0318  
 Ca,pos,l 0.0434  
 Ma,pos,d 23825.58 lb-in  
 Ma,pos,l 12099.23 lb-in  
 Ma,pos 35924.8 lb-in

##### MOMENT IN LONG DIRECTION:

Cb,pos,d 0.0094  
 Cb,pos,l 0.0166  
 Mb,pos,d 10607.82 lb-in  
 Mb,pos,l 6970.406 lb-in  
 Mb,pos 17578.23 lb-in

#### CALCULATION OF REINFORCEMENT:

##### CONTINUOUS EDGE:

###### SHORT DIRECTION:

Ma,neg 85119.72 lb-in  
 Rn 160.846 psi  
 row=p 0.002771

$\rho$  max 0.016035  $\rho$  min 0.0018

$\rho$  used 0.002771 OK

As 0.232773 in<sup>2</sup>

bar # 4

spacing 10 in c/c

OK

As= 0.2 in<sup>2</sup>  
 max spacing=2h= 14 in

###### LONG DIRECTION:

Ma,neg 0 lb-in  
 Rn 0 psi  
 row=p 0

$\rho$  max 0.016035  $\rho$  min 0.0018

$\rho$  used 0.0018 OK

As 0.1512 in<sup>2</sup>

bar # 4

spacing 12 in c/c

OK

As= 0.2 in<sup>2</sup>  
 max spacing=2h= 14 in

##### DISCONTINUOUS EDGE:

###### SHORT DIRECTION:

Ma,neg 11974.93 lb-in  
 Rn 22.62837 psi  
 row=p 0.000379

$\rho$  max 0.016035  $\rho$  min 0.0018

$\rho$  used 0.0018 OK

As 0.1512 in<sup>2</sup>

bar # 4

spacing 12 in c/c

OK

As= 0.2 in<sup>2</sup>  
 max spacing=2h= 14 in

###### LONG DIRECTION:

Ma,neg 5859.41 lb-in  
 Rn 11.0722 psi  
 row=p 0.000185

$\rho$  max 0.016035  $\rho$  min 0.0018

$\rho$  used 0.0018 OK

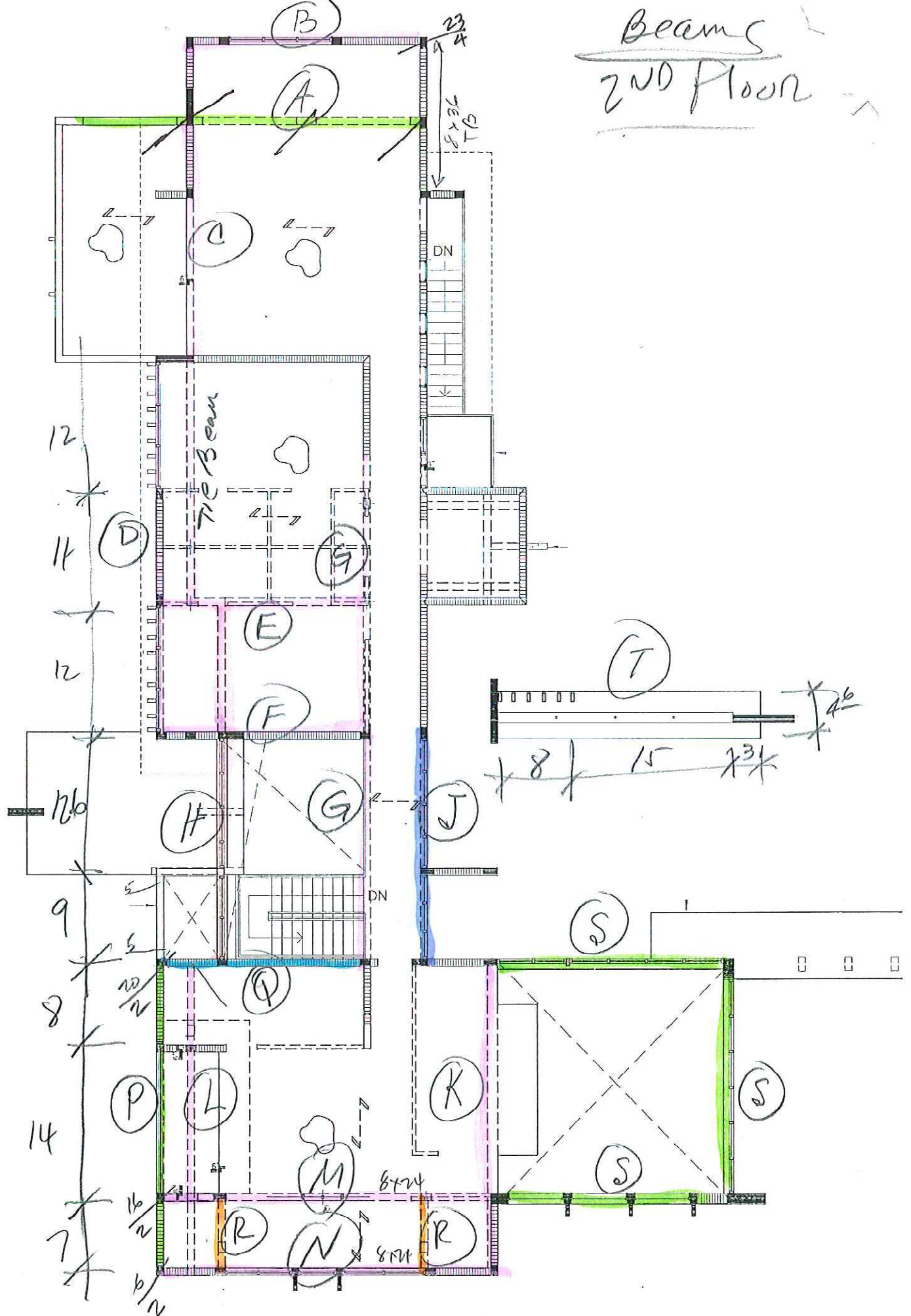
As 0.1512 in<sup>2</sup>

| $f_y$ (psi) | $\rho$ min |
|-------------|------------|
| ≤40000      | 0.002      |
| 50000       | 0.002      |
| 60000       | 0.0018     |
| >60000      | 0.0018     |

TABLE 5

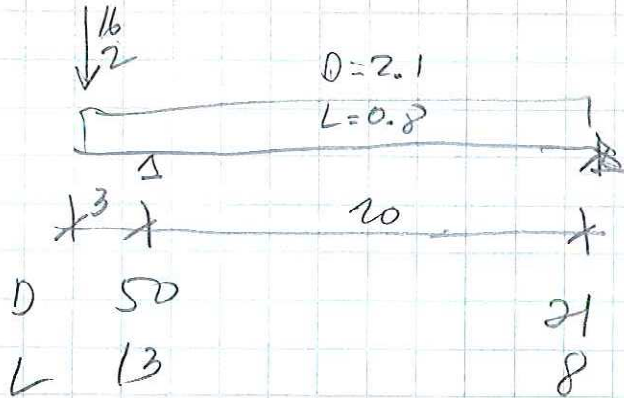
| Bar # | area in <sup>2</sup> |
|-------|----------------------|
| 3     | 0.11                 |
| 4     | 0.2                  |
| 5     | 0.31                 |
| 6     | 0.44                 |
| 7     | 0.6                  |
| 8     | 0.79                 |
| 9     | 1                    |
| 18    | 4                    |
| 10    | 1.27                 |
| 11    | 1.56                 |
| 14    | 2.25                 |

# Beams 2ND Floor



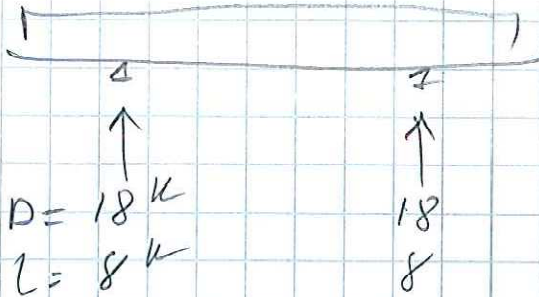


(M)



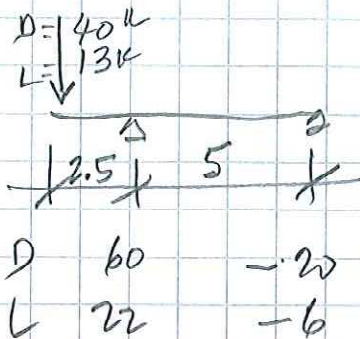
12x24  
4#7 T & B  
#3 @ 8"  
2B9

(N)



8x24  
2#6 T & B  
#3 @ 8"  
2B8

(R)

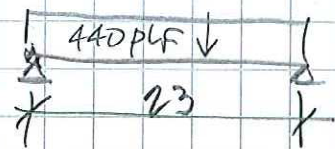


12x24  
4#7 T  
2#6 B  
#3 @ 4" @ cant  
#3 @ 12" Bal  
2B10

(S)

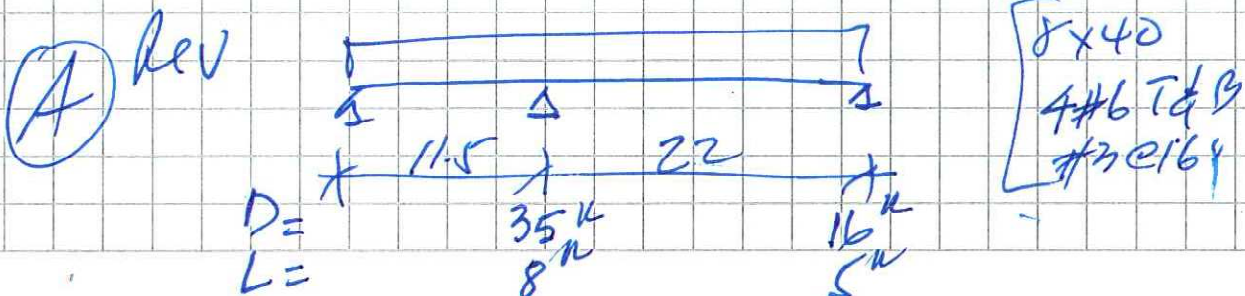
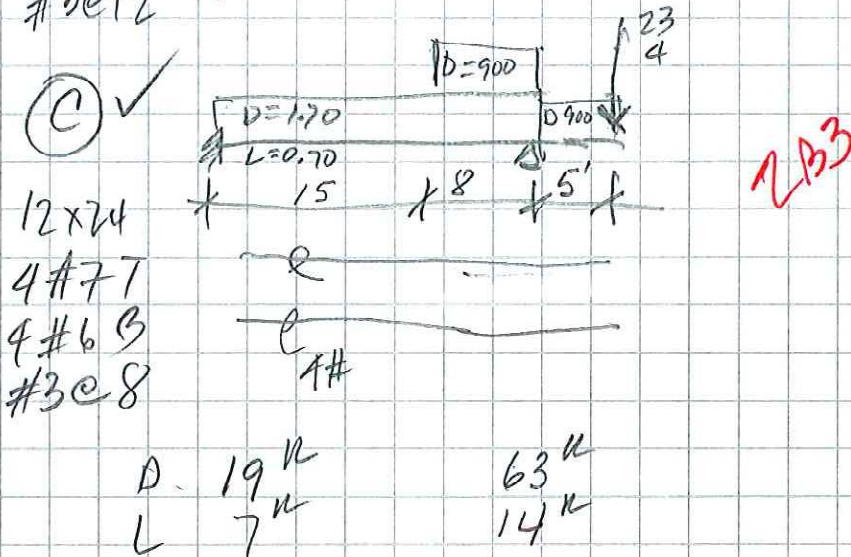
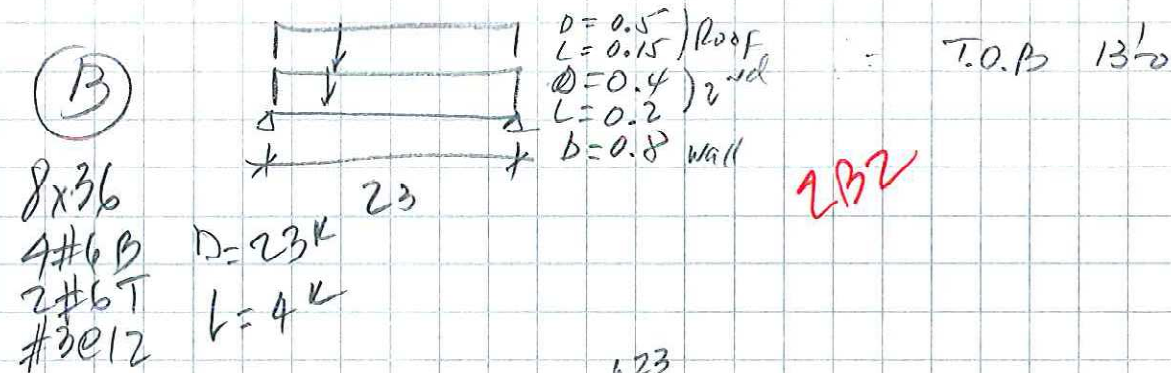
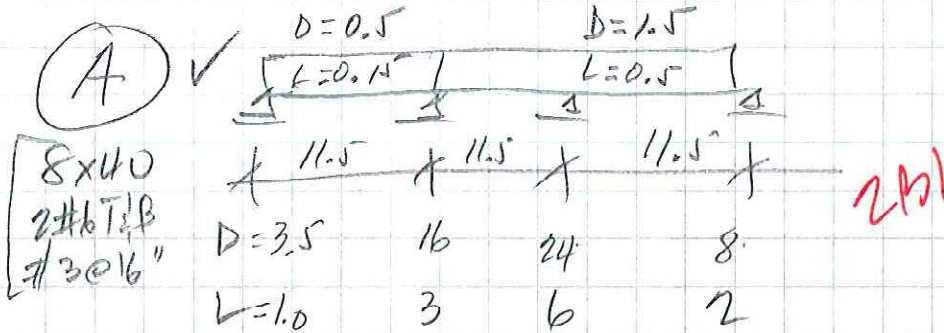
Wind load Beams:

$$W = -61.1 \times 0.6 \times 12' = 440 \text{ PLF}$$

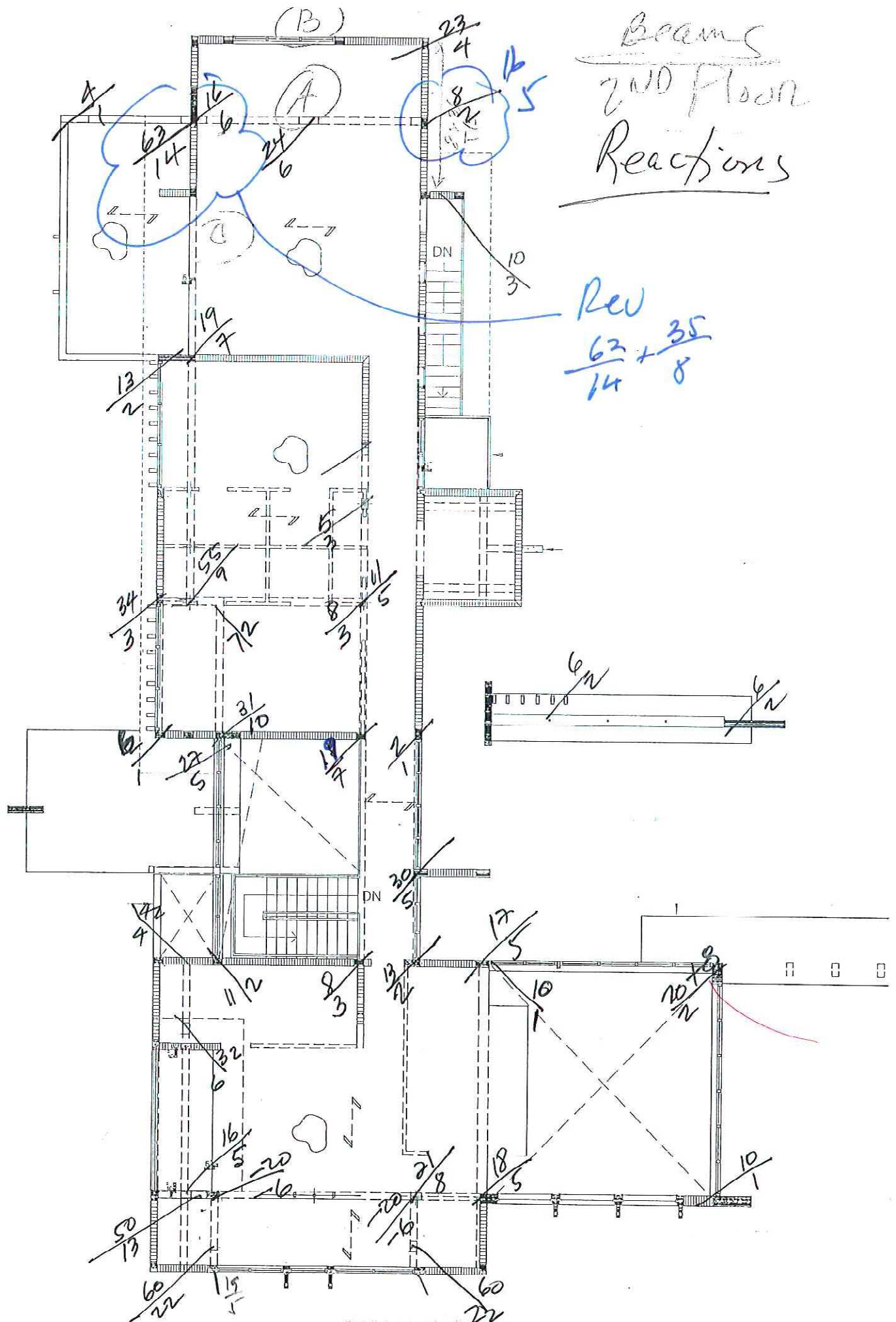


5#6 EF  
10#3 @ 5" EE  
Bal @ 10"  
2B11

# Second Floor Beams





$$\frac{62}{14} + \frac{35}{8}$$




|                   |                  |                |
|-------------------|------------------|----------------|
| Name of Project:  | CASA PA FERNANDZ | General Notes: |
| Job No.:          | 24-115           | EXTERIOR STAIR |
| Client:           | MATEU ARCH       |                |
| Designed by:      | FEH              |                |
| Date:             | 8-20-24          |                |
| Sheet:            |                  | 2 Of 2         |
| Jerv Works Const. |                  |                |

## STAIR DESIGN

Stair no. **2**

## specification

fy **60000** psi  
 fc' **4000** psi

## unfactored service load

service Live Load **40** psf  
 service Dead Live **20** psf (excluding stair self-weight)

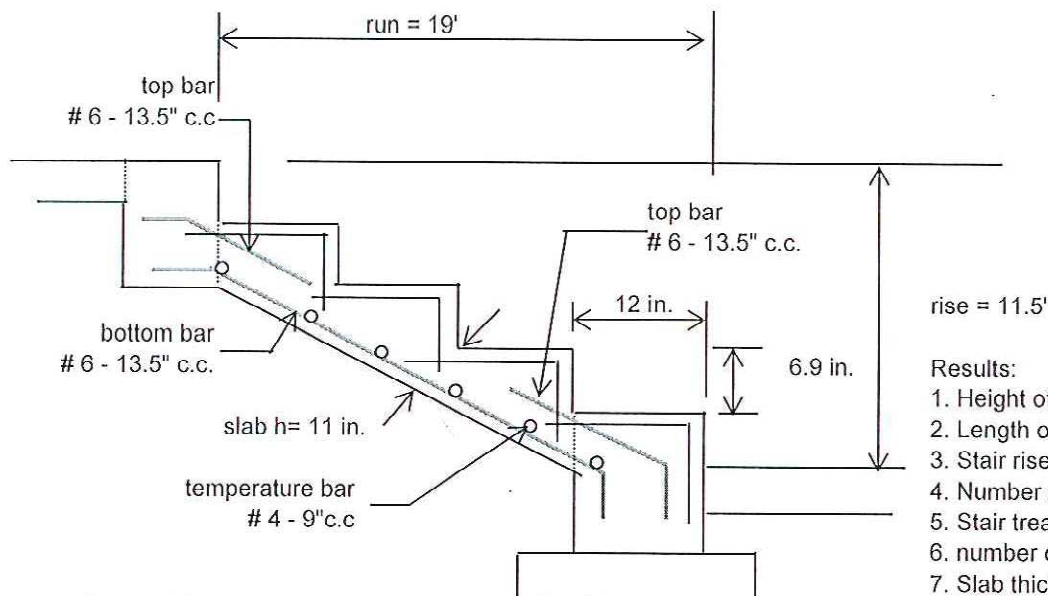
## stair

ht. of rise, ft. **11.5** ft.  
 trial rise, 6.5" - 7.5" **7** in. actual rise 6.9 in.  
 tread, min 9 in. **12** in. decrease tread width!  
 slab h in. **11** in.  $\geq 10.8$  in. OK  
 conc. cover, suggested 3/4" **0.75** in.

| main bar | temp. bar |
|----------|-----------|
| # 6      | # 4       |

## reinforcement ratio

| .75Pb >   | p            | > 200/fy      |
|-----------|--------------|---------------|
| 0.0213801 | <b>0.009</b> | $\geq 0.0033$ |



NO need for shear reinforcement



Project: CASA PA' FERNANDZ

Page # \_\_\_\_\_

Engineer:

10/17/2024

Descrip: beam edge bridge

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 21.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 17.0 | 19.7 | 10.4 | 12.2 |
| ②    | ② | 14.1 | 21.6 | 8.7  | 13.2 |
| ③    | ③ | 14.1 | 21.6 | 8.7  | 13.2 |
| ④    | ④ | 16.3 | 18.4 | 10.0 | 11.3 |
| ⑤    | ⑤ | 16.3 | 18.4 | 10.0 | 11.3 |
| ⑥    | ⑥ | 14.1 | 16.9 | 8.7  | 10.4 |
| ⑦    | ⑦ | 14.1 | 16.9 | 8.7  | 10.4 |
| ⑧    | ⑧ | 16.3 | 18.4 | 10.0 | 11.3 |
| ⑨    | ⑨ | 16.3 | 18.4 | 10.0 | 11.3 |
| ⑩    | ⑩ | 16.3 | 18.4 | 10.0 | 11.3 |
| ⑪    | ⑪ | 8.5  | 12.7 | 5.2  | 7.8  |
| ⑫    | ⑫ | 8.5  | 12.7 | 5.2  | 7.8  |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 82 | 0 | OK |  |
| ②    | 0 | 90 | 0 | OK |  |
| ③    | 0 | 90 | 0 | OK |  |
| ④    | 0 | 77 | 0 | OK |  |
| ⑤    | 0 | 77 | 0 | OK |  |
| ⑥    | 0 | 70 | 0 | OK |  |
| ⑦    | 0 | 70 | 0 | OK |  |
| ⑧    | 0 | 77 | 0 | OK |  |
| ⑨    | 0 | 77 | 0 | OK |  |
| ⑩    | 0 | 77 | 0 | OK |  |
| ⑪    | 0 | 53 | 0 | OK |  |
| ⑫    | 0 | 53 | 0 | OK |  |

**SHEAR FORCES Vu (kip)**

| Comb |      |       |    |  |  |
|------|------|-------|----|--|--|
| ①    | 14.6 | -10.2 | OK |  |  |
| ②    | 16.0 | -11.1 | OK |  |  |
| ③    | 16.0 | -11.1 | OK |  |  |
| ④    | 13.6 | -9.5  | OK |  |  |
| ⑤    | 13.6 | -9.5  | OK |  |  |
| ⑥    | 12.5 | -8.8  | OK |  |  |
| ⑦    | 12.5 | -8.8  | OK |  |  |
| ⑧    | 13.6 | -9.5  | OK |  |  |
| ⑨    | 13.6 | -9.5  | OK |  |  |
| ⑩    | 13.6 | -9.5  | OK |  |  |
| ⑪    | 9.4  | -6.6  | OK |  |  |
| ⑫    | 9.4  | -6.6  | OK |  |  |

**BENDING STRENGTH (k-ft)**

|                                                                                   |              |      |      |                 |
|-----------------------------------------------------------------------------------|--------------|------|------|-----------------|
|  |              |      |      |                 |
| Bot                                                                               | 2#6 Cont     |      |      |                 |
| Bot                                                                               | 2#6x18.00 ft |      |      |                 |
| d                                                                                 | 2.0          | 4.0  | 2.0  | in              |
| +As                                                                               | 0.88         | 1.76 | 0.88 | in <sup>2</sup> |
| c/d                                                                               | 0.10         | 0.15 | 0.10 |                 |
| +φMn                                                                              | 83           | 154  | 83   |                 |
| Top                                                                               | 2#6 Cont     |      |      |                 |
| Top                                                                               | 0#5          |      |      |                 |
| d'                                                                                | 2.0          | 2.0  | 2.0  | in              |
| -As                                                                               | 0.88         | 0.88 | 0.88 | in <sup>2</sup> |
| c/d                                                                               | 0.10         | 0.13 | 0.10 |                 |
| -φMn                                                                              | -83          | -88  | -83  |                 |
| As min                                                                            | 0.00         | 0.59 | 0.00 | in <sup>2</sup> |

**DEFLECTIONS**

|                                                                                     |       |  |  |                 |
|-------------------------------------------------------------------------------------|-------|--|--|-----------------|
|  |       |  |  |                 |
| Comb                                                                                |       |  |  |                 |
| D                                                                                   | 0.23  |  |  | in              |
| L                                                                                   | 0.09  |  |  | in              |
| Lr, S                                                                               | 0.00  |  |  | in              |
| LS                                                                                  | 0.03  |  |  | in              |
| LT                                                                                  | 0.50  |  |  | in              |
| Ieff D                                                                              | 5,428 |  |  | in <sup>4</sup> |
| Ieff L                                                                              | 4,747 |  |  | in <sup>4</sup> |
| Ieff LS                                                                             | 5,167 |  |  | in <sup>4</sup> |
| λ                                                                                   | 1.60  |  |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|                                                                                    |       |      |       |    |
|------------------------------------------------------------------------------------|-------|------|-------|----|
|  |       |      |       |    |
| $\phi V_c$                                                                         | 16.7  |      | -16.7 |    |
| $\phi V_s$                                                                         | 36.3  |      | -36.3 |    |
| $\phi V_n$                                                                         | 53.0  |      | -53.0 |    |
| $A_v/s$                                                                            | 0.037 |      | 0.037 | OK |
| Min $A_v/s$                                                                        | 0.007 |      | N.A.  |    |
| s                                                                                  | 6.0   | 9.0  | 6.0   | OK |
| s max                                                                              | 11.0  | 11.0 | N.A.  |    |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.33 | OK |
| Max. Steel Area As max Ratio ....   | 0.44 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.18 | OK |
| Stirrups Spacing s max Ratio .....  | 0.55 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 2871 | 360    | 0.13  | OK |
| C    | Long-Term | 501  | 480    | 0.96  | OK |
| D    | Long-Term | 501  | 240    | 0.48  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: beam edge bridge

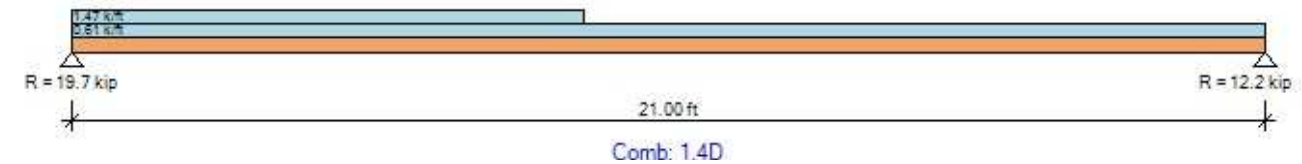
ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

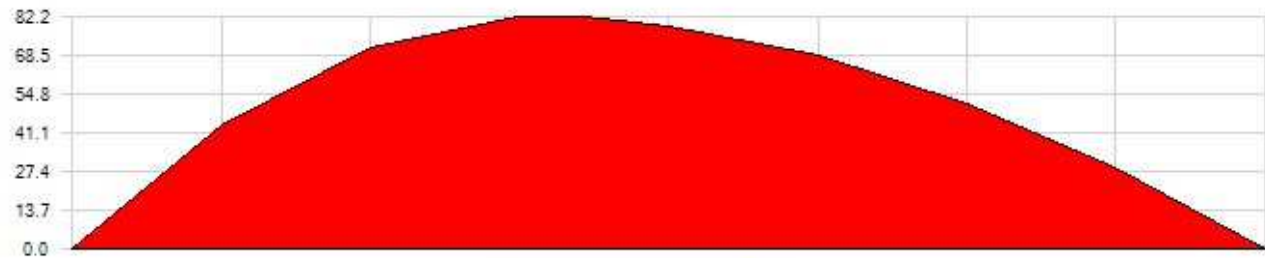
| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

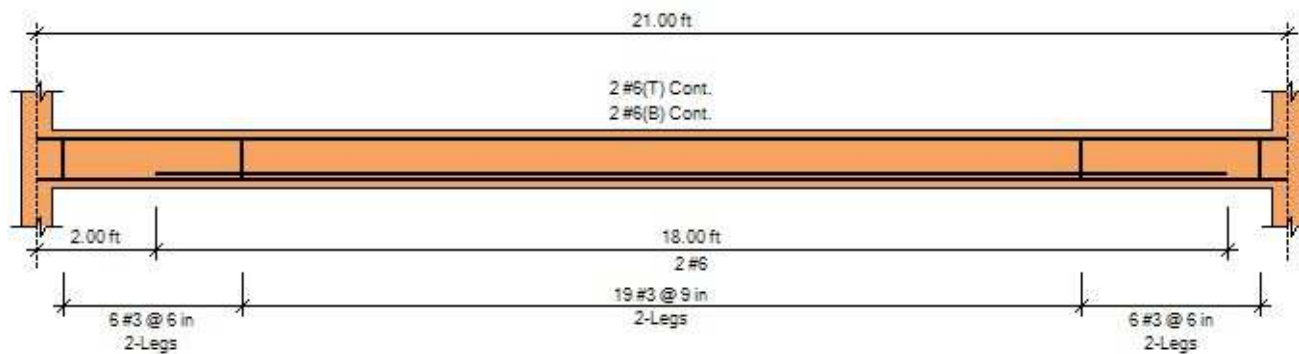
|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| AI (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: FLOATING FACADE BEAM

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

www.asdipsoft.com

### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 10.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |         | 2       |        |
|--------------------------|---------|---------|--------|
| Span                     | Length  | Support | Type   |
| ①                        | 9.00 ft | ①       | Pinned |
| ②                        | N.A.    | ②       | Pinned |
| ③                        | N.A.    | ③       | N.A.   |
| ④                        | N.A.    | ④       | N.A.   |
| ⑤                        | N.A.    | ⑤       | N.A.   |
|                          |         | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |     |     |     |     |
|------|---|-----|-----|-----|-----|
| ①    | ① | 0.7 | 0.8 | 0.7 | 0.8 |
| ②    | ② | 0.6 | 0.9 | 0.6 | 0.9 |
| ③    | ③ | 0.6 | 0.9 | 0.6 | 0.9 |
| ④    | ④ | 0.7 | 0.8 | 0.7 | 0.8 |
| ⑤    | ⑤ | 0.7 | 0.8 | 0.7 | 0.8 |
| ⑥    | ⑥ | 0.6 | 0.7 | 0.6 | 0.7 |
| ⑦    | ⑦ | 0.6 | 0.7 | 0.6 | 0.7 |
| ⑧    | ⑧ | 0.7 | 0.8 | 0.7 | 0.8 |
| ⑨    | ⑨ | 0.7 | 0.8 | 0.7 | 0.8 |
| ⑩    | ⑩ | 0.7 | 0.8 | 0.7 | 0.8 |
| ⑪    | ⑪ | 0.4 | 0.5 | 0.4 | 0.5 |
| ⑫    | ⑫ | 0.4 | 0.5 | 0.4 | 0.5 |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |   |   |   |    |  |
|------|---|---|---|----|--|
| ①    | 0 | 2 | 0 | OK |  |
| ②    | 0 | 2 | 0 | OK |  |
| ③    | 0 | 2 | 0 | OK |  |
| ④    | 0 | 2 | 0 | OK |  |
| ⑤    | 0 | 2 | 0 | OK |  |
| ⑥    | 0 | 2 | 0 | OK |  |
| ⑦    | 0 | 2 | 0 | OK |  |
| ⑧    | 0 | 2 | 0 | OK |  |
| ⑨    | 0 | 2 | 0 | OK |  |
| ⑩    | 0 | 2 | 0 | OK |  |
| ⑪    | 0 | 1 | 0 | OK |  |
| ⑫    | 0 | 1 | 0 | OK |  |

### SHEAR FORCES Vu (kip)

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 0.7 | -0.7 | OK |  |  |
| ②    | 0.7 | -0.7 | OK |  |  |
| ③    | 0.7 | -0.7 | OK |  |  |
| ④    | 0.6 | -0.6 | OK |  |  |
| ⑤    | 0.6 | -0.6 | OK |  |  |
| ⑥    | 0.6 | -0.6 | OK |  |  |
| ⑦    | 0.6 | -0.6 | OK |  |  |
| ⑧    | 0.6 | -0.6 | OK |  |  |
| ⑨    | 0.6 | -0.6 | OK |  |  |
| ⑩    | 0.6 | -0.6 | OK |  |  |
| ⑪    | 0.4 | -0.4 | OK |  |  |
| ⑫    | 0.4 | -0.4 | OK |  |  |

ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

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### BENDING STRENGTH (k-ft)

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 2#4 Cont    |      |                      |
| Bot    | 0#5x6.00 ft |      |                      |
| d      | 2.0         | 2.0  | 2.0 in               |
| +As    | 0.40        | 0.40 | 0.40 in <sup>2</sup> |
| c/d    | 0.19        | 0.19 | 0.19                 |
| +φMn   | 14          | 14   | 14                   |
| Top    | 2#4 Cont    |      |                      |
| Top    | 0#5         |      |                      |
| d'     | 2.0         | 2.0  | 2.0 in               |
| -As    | 0.40        | 0.40 | 0.40 in <sup>2</sup> |
| c/d    | 0.19        | 0.19 | 0.19                 |
| -φMn   | -14         | -14  | -14                  |
| As min | 0.00        | 0.08 | 0.00 in <sup>2</sup> |

### DEFLECTIONS

|         |      |                 |
|---------|------|-----------------|
| Comb    |      |                 |
| D       | 0.01 | in              |
| L       | 0.00 | in              |
| Lr, S   | 0.00 | in              |
| LS      | 0.00 | in              |
| LT      | 0.01 | in              |
| Ieff D  | 717  | in <sup>4</sup> |
| Ieff L  | 717  | in <sup>4</sup> |
| Ieff LS | 717  | in <sup>4</sup> |
| λ       | 1.52 |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### DESIGN CODES

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

### SHEAR STRENGTH (kip, in)

|          |       |            |
|----------|-------|------------|
| φVc      | 4.5   | -4.5       |
| φVs      | 0.0   | 0.0        |
| φVn      | 4.5   | -4.5       |
| Av/s     | 0.007 | 0.007 OK   |
| Min Av/s | N.A.  | N.A.       |
| s        | 6.0   | 8.0 6.0 OK |
| s max    | N.A.  | N.A.       |

### REINFORCEMENT

|                               |      |    |
|-------------------------------|------|----|
| Min. Steel Area As min Ratio  | 0.20 | OK |
| Max. Steel Area As max Ratio  | 0.30 | OK |
| Rebars Min Spacing Smin Ratio | 0.24 | OK |
| Rebars Max Spacing Smax Ratio | 0.46 | OK |
| Shear Vs/Vs max Ratio         | N.A. |    |
| Min. Stirrups Area Av/s Ratio | N.A. |    |
| Stirrups Spacing s max Ratio  | N.A. |    |
| Stirrups Min. # of Legs Ratio | N.A. |    |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.01  | OK |
| C    | Long-Term | 7664 | 480    | 0.06  | OK |
| D    | Long-Term | 7664 | 240    | 0.03  | OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

### MATERIALS

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
Engineer:  
Descrip: FLOATING FACADE BEAM

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

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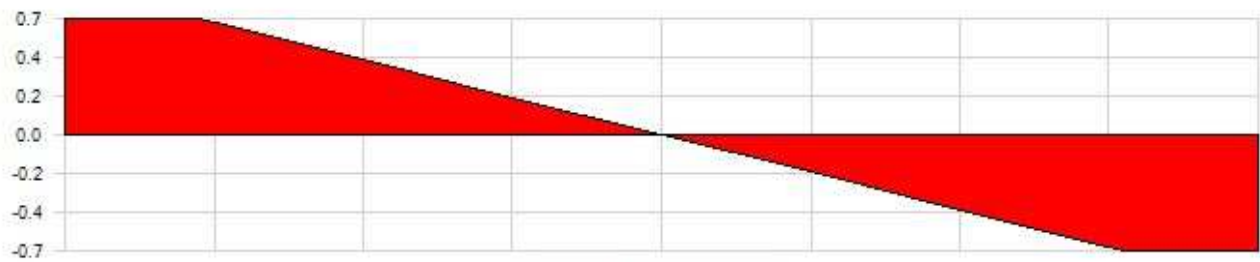
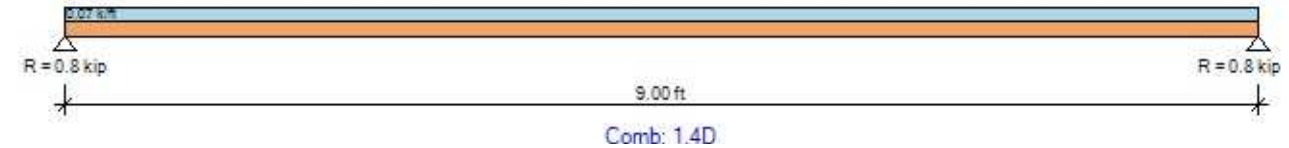
### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

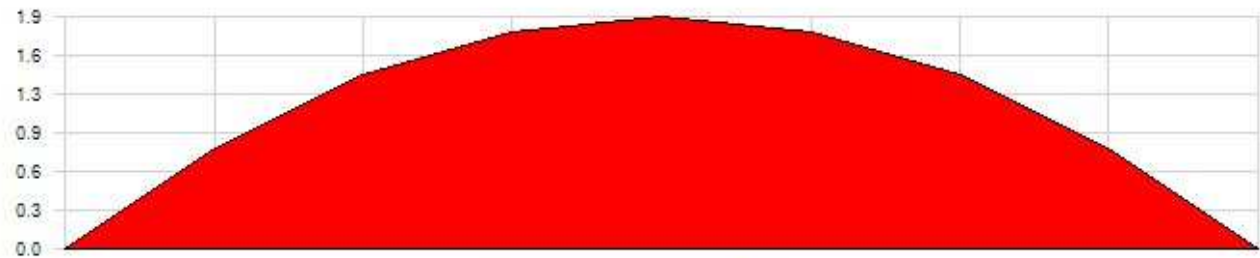
### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|----|
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |

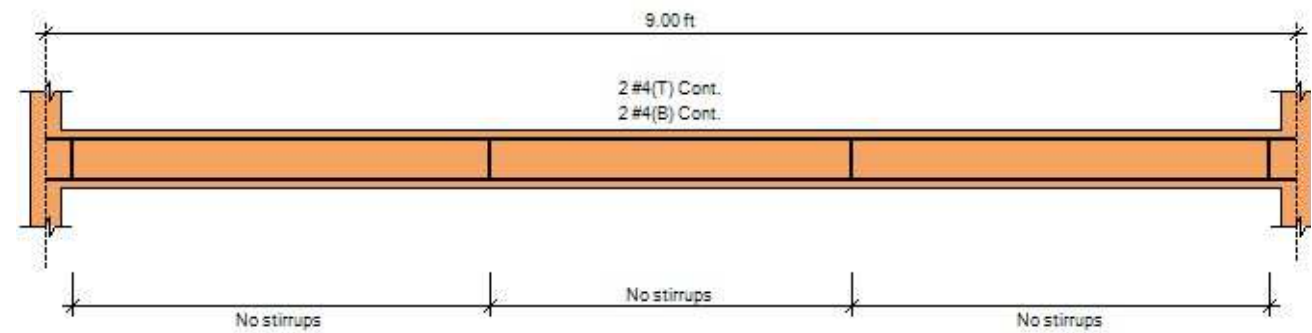




SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: living room windbeam

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 10.0          | in |
| Beam Width b           | 24.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 22.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |     |     |     |     |
|------|---|-----|-----|-----|-----|
| ①    | ① | 0.1 | 0.0 | 0.1 | 0.0 |
| ②    | ② | 0.0 | 0.2 | 0.0 | 0.2 |
| ③    | ③ | 0.0 | 0.2 | 0.0 | 0.2 |
| ④    | ④ | 0.1 | 0.1 | 0.1 | 0.1 |
| ⑤    | ⑤ | 0.1 | 0.1 | 0.1 | 0.1 |
| ⑥    | ⑥ | 4.8 | 4.0 | 4.8 | 4.0 |
| ⑦    | ⑦ | 0.0 | 4.0 | 0.0 | 4.0 |
| ⑧    | ⑧ | 3.7 | 8.0 | 3.7 | 8.0 |
| ⑨    | ⑨ | 3.7 | 8.0 | 3.7 | 8.0 |
| ⑩    | ⑩ | 0.1 | 0.1 | 0.1 | 0.1 |
| ⑪    | ⑪ | 4.8 | 7.9 | 4.8 | 7.9 |
| ⑫    | ⑫ | 0.0 | 0.0 | 0.0 | 0.0 |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 0  | 0 | OK |  |
| ②    | 0 | 1  | 0 | OK |  |
| ③    | 0 | 1  | 0 | OK |  |
| ④    | 0 | 0  | 0 | OK |  |
| ⑤    | 0 | 0  | 0 | OK |  |
| ⑥    | 0 | 22 | 0 | OK |  |
| ⑦    | 0 | 22 | 0 | OK |  |
| ⑧    | 0 | 44 | 0 | OK |  |
| ⑨    | 0 | 44 | 0 | OK |  |
| ⑩    | 0 | 0  | 0 | OK |  |
| ⑪    | 0 | 44 | 0 | OK |  |
| ⑫    | 0 | 0  | 0 | OK |  |

**SHEAR FORCES Vu (kip)**

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 0.0 | 0.0  | OK |  |  |
| ②    | 0.2 | -0.2 | OK |  |  |
| ③    | 0.2 | -0.2 | OK |  |  |
| ④    | 0.1 | -0.1 | OK |  |  |
| ⑤    | 0.1 | -0.1 | OK |  |  |
| ⑥    | 3.6 | -3.6 | OK |  |  |
| ⑦    | 3.6 | -3.6 | OK |  |  |
| ⑧    | 7.3 | -7.3 | OK |  |  |
| ⑨    | 7.3 | -7.3 | OK |  |  |
| ⑩    | 0.1 | -0.1 | OK |  |  |
| ⑪    | 7.2 | -7.2 | OK |  |  |
| ⑫    | 0.0 | 0.0  | OK |  |  |

**BENDING STRENGTH (k-ft)**

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 5#6 Cont    |      |                      |
| Bot    | 0#5x6.00 ft |      |                      |
| d      | 2.0         | 2.0  | 2.0 in               |
| +As    | 2.20        | 2.20 | 2.20 in <sup>2</sup> |
| c/d    | 0.25        | 0.25 | 0.25                 |
| +φMn   | 71          | 71   | 71                   |
| Top    | 5#6 Cont    |      |                      |
| Top    | 0#5         |      |                      |
| d'     | 2.0         | 2.0  | 2.0 in               |
| -As    | 2.20        | 2.20 | 2.20 in <sup>2</sup> |
| c/d    | 0.25        | 0.25 | 0.25                 |
| -φMn   | -71         | -71  | -71                  |
| As min | 0.00        | 0.64 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |  |                 |
|---------------------|-------|--|-----------------|
| Comb                |       |  |                 |
| D                   | 0.00  |  | in              |
| L                   | 0.01  |  | in              |
| Lr, S               | 1.36  |  | in              |
| LS                  | 0.00  |  | in              |
| LT                  | 0.01  |  | in              |
| I <sub>eff</sub> D  | 2,279 |  | in <sup>4</sup> |
| I <sub>eff</sub> L  | 2,279 |  | in <sup>4</sup> |
| I <sub>eff</sub> LS | 2,279 |  | in <sup>4</sup> |
| λ                   | 1.27  |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |             |
|----------|-------|-------------|
| φVc      | 18.2  | -18.2       |
| φVs      | 39.6  | -39.6       |
| φVn      | 57.8  | -57.8       |
| Av/s     | 0.110 | 0.110 OK    |
| Min Av/s | N.A.  | N.A.        |
| s        | 4.0   | 10.0 4.0 OK |
| s max    | N.A.  | N.A.        |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.29 | OK |
| Max. Steel Area As max Ratio ....   | 0.50 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.26 | OK |
| Rebars Max Spacing Smax Ratio       | 0.43 | OK |
| Shear Vs/Vs max Ratio .....         | N.A. |    |
| Min. Stirrups Area Av/s Ratio ..... | N.A. |    |
| Stirrups Spacing s max Ratio .....  | N.A. |    |
| Stirrups Min. # of Legs Ratio ..... | N.A. |    |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 195  | 180    | 0.92  | OK |
| B    | Live Load | 9999 | 360    | 0.01  | OK |
| C    | Long-Term | 9999 | 480    | 0.02  | OK |
| D    | Long-Term | 9999 | 240    | 0.01  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: living room windbeam

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |

Project: CASA PA' FERNANDZ

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Engineer:

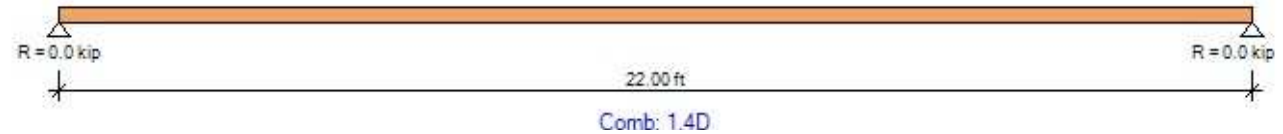
10/17/2024

Descrip: living room windbeam

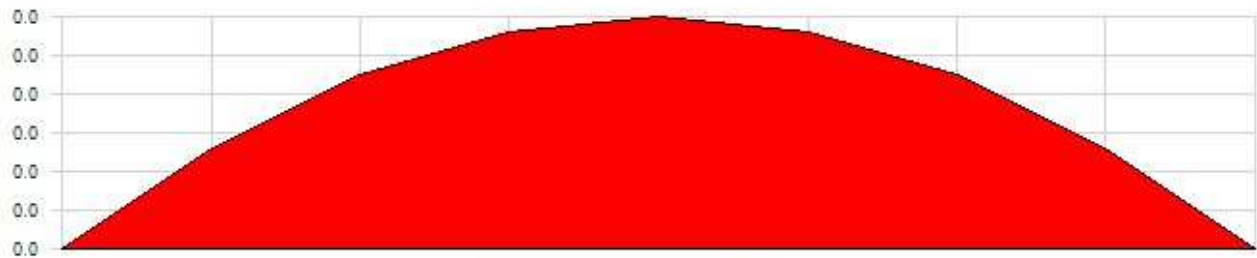
ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

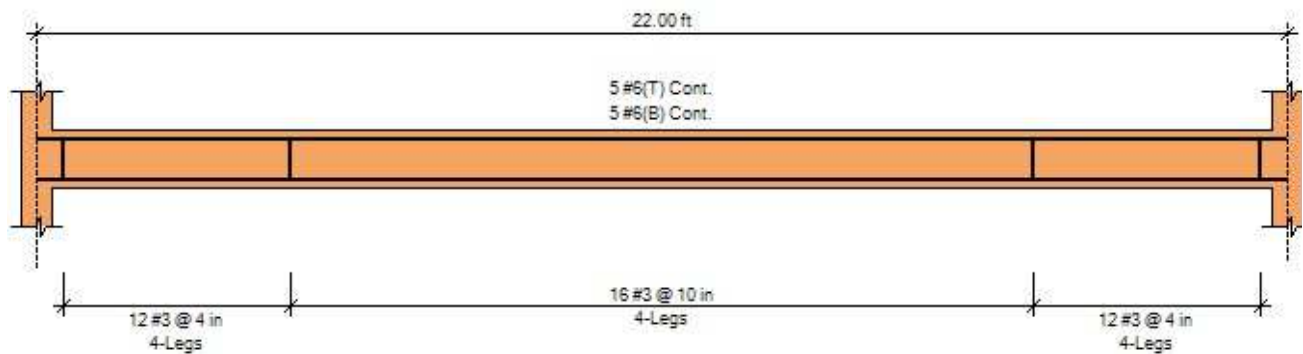
[www.asdipsoft.com](http://www.asdipsoft.com)



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION



## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 11.0          | in |
| Beam Width b           | 24.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 23.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |     |     |     |     |
|------|---|-----|-----|-----|-----|
| ①    | ① | 0.1 | 0.0 | 0.1 | 0.0 |
| ②    | ② | 0.0 | 0.2 | 0.0 | 0.2 |
| ③    | ③ | 0.0 | 0.2 | 0.0 | 0.2 |
| ④    | ④ | 0.1 | 0.1 | 0.1 | 0.1 |
| ⑤    | ⑤ | 0.1 | 0.1 | 0.1 | 0.1 |
| ⑥    | ⑥ | 5.0 | 4.1 | 5.0 | 4.1 |
| ⑦    | ⑦ | 0.0 | 4.1 | 0.0 | 4.1 |
| ⑧    | ⑧ | 3.8 | 8.4 | 3.8 | 8.4 |
| ⑨    | ⑨ | 3.8 | 8.4 | 3.8 | 8.4 |
| ⑩    | ⑩ | 0.1 | 0.1 | 0.1 | 0.1 |
| ⑪    | ⑪ | 5.0 | 8.3 | 5.0 | 8.3 |
| ⑫    | ⑫ | 0.0 | 0.0 | 0.0 | 0.0 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 0  | 0 | OK |  |
| ②    | 0 | 1  | 0 | OK |  |
| ③    | 0 | 1  | 0 | OK |  |
| ④    | 0 | 0  | 0 | OK |  |
| ⑤    | 0 | 0  | 0 | OK |  |
| ⑥    | 0 | 24 | 0 | OK |  |
| ⑦    | 0 | 24 | 0 | OK |  |
| ⑧    | 0 | 48 | 0 | OK |  |
| ⑨    | 0 | 48 | 0 | OK |  |
| ⑩    | 0 | 0  | 0 | OK |  |
| ⑪    | 0 | 48 | 0 | OK |  |
| ⑫    | 0 | 0  | 0 | OK |  |

## SHEAR FORCES Vu (kip)

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 0.0 | 0.0  | OK |  |  |
| ②    | 0.2 | -0.2 | OK |  |  |
| ③    | 0.2 | -0.2 | OK |  |  |
| ④    | 0.1 | -0.1 | OK |  |  |
| ⑤    | 0.1 | -0.1 | OK |  |  |
| ⑥    | 3.8 | -3.8 | OK |  |  |
| ⑦    | 3.8 | -3.8 | OK |  |  |
| ⑧    | 7.6 | -7.6 | OK |  |  |
| ⑨    | 7.6 | -7.6 | OK |  |  |
| ⑩    | 0.1 | -0.1 | OK |  |  |
| ⑪    | 7.5 | -7.5 | OK |  |  |
| ⑫    | 0.0 | 0.0  | OK |  |  |

**BENDING STRENGTH (k-ft)**

|        |             |      |      |                 |
|--------|-------------|------|------|-----------------|
| Bot    | 5#6 Cont    |      |      |                 |
| Bot    | 0#5x6.00 ft |      |      |                 |
| d      | 2.0         | 2.0  | 2.0  | in              |
| +As    | 2.20        | 2.20 | 2.20 | in <sup>2</sup> |
| c/d    | 0.22        | 0.22 | 0.22 |                 |
| +φMn   | 81          | 81   | 81   |                 |
| Top    | 5#6 Cont    |      |      |                 |
| Top    | 0#5         |      |      |                 |
| d'     | 2.0         | 2.0  | 2.0  | in              |
| -As    | 2.20        | 2.20 | 2.20 | in <sup>2</sup> |
| c/d    | 0.22        | 0.22 | 0.22 |                 |
| -φMn   | -81         | -81  | -81  |                 |
| As min | 0.00        | 0.72 | 0.00 | in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |  |  |                 |
|---------------------|-------|--|--|-----------------|
| Comb                |       |  |  |                 |
| D                   | 0.00  |  |  | in              |
| L                   | 0.01  |  |  | in              |
| Lr, S               | 1.17  |  |  | in              |
| LS                  | 0.00  |  |  | in              |
| LT                  | 0.01  |  |  | in              |
| I <sub>eff</sub> D  | 3,042 |  |  | in <sup>4</sup> |
| I <sub>eff</sub> L  | 3,042 |  |  | in <sup>4</sup> |
| I <sub>eff</sub> LS | 3,042 |  |  | in <sup>4</sup> |
| λ                   | 1.33  |  |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |        |
|----------|-------|-------|--------|
| φVc      | 20.5  | -20.5 |        |
| φVs      | 44.6  | -44.6 |        |
| φVn      | 65.0  | -65.0 |        |
| Av/s     | 0.110 | 0.110 | OK     |
| Min Av/s | N.A.  | N.A.  |        |
| s        | 4.0   | 10.0  | 4.0 OK |
| s max    | N.A.  | N.A.  | N.A.   |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.33 | OK |
| Max. Steel Area As max Ratio ....   | 0.44 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.26 | OK |
| Rebars Max Spacing Smax Ratio       | 0.43 | OK |
| Shear Vs/Vs max Ratio .....         | N.A. |    |
| Min. Stirrups Area Av/s Ratio ..... | N.A. |    |
| Stirrups Spacing s max Ratio .....  | N.A. |    |
| Stirrups Min. # of Legs Ratio ..... | N.A. |    |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 236  | 180    | 0.76  | OK |
| B    | Live Load | 9999 | 360    | 0.01  | OK |
| C    | Long-Term | 9999 | 480    | 0.02  | OK |
| D    | Long-Term | 9999 | 240    | 0.01  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: living room windbeam2

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |

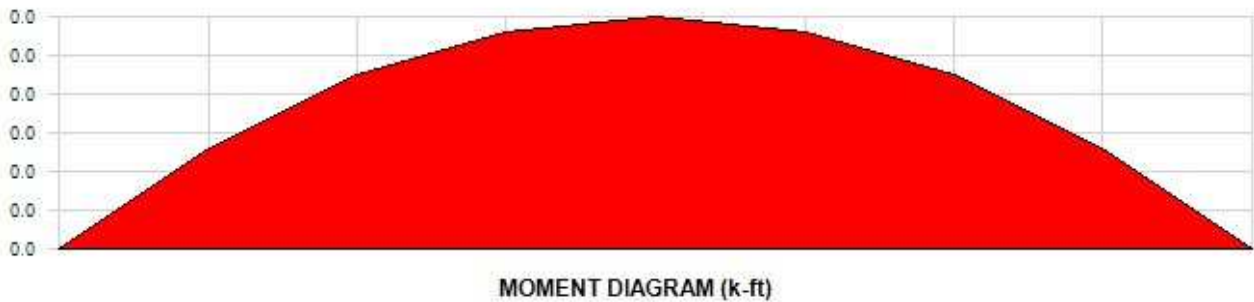
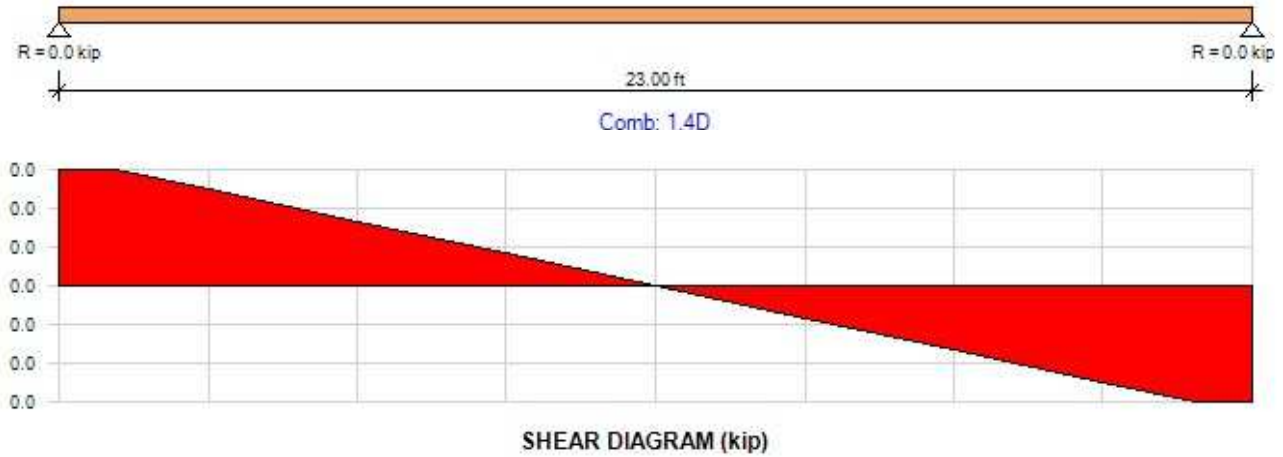
Project: CASA PA' FERNANDZ  
Engineer:  
Descrip: living room windbeam2

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10/17/2024

ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

[www.asdipsoft.com](http://www.asdipsoft.com)



Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: SECOND FLOOR BEAM A

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 40.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 0.00      | ft |
| Right Cantilever       | 0.00      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 4       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 11.50 ft | ①       | Pinned |
| ②                        | 11.50 ft | ②       | Pinned |
| ③                        | 11.50 ft | ③       | Pinned |
| ④                        | N.A.     | ④       | Pinned |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |     |     |      |      |      |      |      |      |
|------|---|-----|-----|------|------|------|------|------|------|
| ①    | ① | 3.5 | 4.8 | 15.7 | 22.0 | 24.3 | 34.1 | 8.2  | 11.5 |
| ②    | ② | 4.0 | 4.4 | 18.9 | 20.5 | 29.7 | 31.9 | 10.0 | 10.8 |
| ③    | ③ | 3.5 | 4.1 | 15.7 | 18.9 | 24.3 | 29.2 | 8.2  | 9.9  |
| ④    | ④ | 3.9 | 5.1 | 18.1 | 24.0 | 28.4 | 37.8 | 9.6  | 12.8 |
| ⑤    | ⑤ | 3.5 | 4.1 | 15.7 | 18.9 | 24.3 | 29.2 | 8.2  | 9.9  |
| ⑥    | ⑥ | 3.5 | 5.1 | 15.7 | 24.0 | 24.3 | 37.8 | 8.2  | 12.8 |
| ⑦    | ⑦ | 3.5 | 4.1 | 15.7 | 18.9 | 24.3 | 29.2 | 8.2  | 9.9  |
| ⑧    | ⑧ | 3.9 | 4.4 | 18.1 | 20.5 | 28.4 | 31.9 | 9.6  | 10.8 |
| ⑨    | ⑨ | 3.5 | 4.1 | 15.7 | 18.9 | 24.3 | 29.2 | 8.2  | 9.9  |
| ⑩    | ⑩ | 3.5 | 4.1 | 15.7 | 18.9 | 24.3 | 29.2 | 8.2  | 9.9  |
| ⑪    | ⑪ | 2.1 | 3.1 | 9.4  | 14.1 | 14.6 | 21.9 | 4.9  | 7.4  |
| ⑫    | ⑫ | 2.1 | 3.1 | 9.4  | 14.1 | 14.6 | 21.9 | 4.9  | 7.4  |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |    |     |    |     |    |   |    |  |
|------|---|----|-----|----|-----|----|---|----|--|
| ①    | 0 | 10 | -22 | 13 | -37 | 26 | 0 | OK |  |
| ②    | 0 | 9  | -20 | 12 | -35 | 24 | 0 | OK |  |
| ③    | 0 | 9  | -19 | 11 | -32 | 22 | 0 | OK |  |
| ④    | 0 | 10 | -23 | 15 | -41 | 29 | 0 | OK |  |
| ⑤    | 0 | 9  | -19 | 11 | -32 | 22 | 0 | OK |  |
| ⑥    | 0 | 10 | -23 | 15 | -41 | 29 | 0 | OK |  |
| ⑦    | 0 | 9  | -19 | 11 | -32 | 22 | 0 | OK |  |
| ⑧    | 0 | 9  | -20 | 12 | -35 | 24 | 0 | OK |  |
| ⑨    | 0 | 9  | -19 | 11 | -32 | 22 | 0 | OK |  |
| ⑩    | 0 | 9  | -19 | 11 | -32 | 22 | 0 | OK |  |
| ⑪    | 0 | 6  | -14 | 8  | -24 | 17 | 0 | OK |  |
| ⑫    | 0 | 6  | -14 | 8  | -24 | 17 | 0 | OK |  |



**SHEAR FORCES  $V_u$  (kip)**

| Comb |      |      |     |      |     |      |    |
|------|------|------|-----|------|-----|------|----|
| ①    | 0.0  | -3.7 | 2.7 | -5.4 | 7.3 | -0.8 | OK |
| ②    | 0.0  | -3.4 | 2.5 | -5.1 | 6.8 | -0.8 | OK |
| ③    | 0.0  | -3.2 | 2.3 | -4.6 | 6.2 | -0.7 | OK |
| ④    | -0.1 | -4.0 | 3.0 | -6.0 | 8.1 | -0.9 | OK |
| ⑤    | 0.0  | -3.2 | 2.3 | -4.6 | 6.2 | -0.7 | OK |
| ⑥    | -0.1 | -4.0 | 3.0 | -6.0 | 8.1 | -0.9 | OK |
| ⑦    | 0.0  | -3.2 | 2.3 | -4.6 | 6.2 | -0.7 | OK |
| ⑧    | 0.0  | -3.4 | 2.5 | -5.1 | 6.8 | -0.8 | OK |
| ⑨    | 0.0  | -3.2 | 2.3 | -4.6 | 6.2 | -0.7 | OK |
| ⑩    | 0.0  | -3.2 | 2.3 | -4.6 | 6.2 | -0.7 | OK |
| ⑪    | 0.0  | -2.4 | 1.7 | -3.5 | 4.7 | -0.5 | OK |
| ⑫    | 0.0  | -2.4 | 1.7 | -3.5 | 4.7 | -0.5 | OK |

**BENDING STRENGTH (k-ft)**

| Bot         | 2#6 Cont    |      | 2#6 Cont    |      | 2#6 Cont    |      |                      |
|-------------|-------------|------|-------------|------|-------------|------|----------------------|
| Bot         | 0#6x9.50 ft |      | 0#6x9.50 ft |      | 0#6x9.50 ft |      |                      |
| d           | 2.0         | 4.0  | 2.0         | 4.0  | 2.0         | 4.0  | 2.0 in               |
| +As         | 0.88        | 0.88 | 0.88        | 0.88 | 0.88        | 0.88 | 0.88 in <sup>2</sup> |
| c/d         | 0.06        | 0.06 | 0.06        | 0.06 | 0.06        | 0.06 | 0.06                 |
| + $\phi$ Mn | 147         | 147  | 147         | 147  | 147         | 147  | 147                  |
| Top         | 2#6 Cont    |      | 2#6 Cont    |      | 2#6 Cont    |      |                      |
| Top         | 0#5         |      | 0#5         |      | 0#5         |      |                      |
| d'          | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | 2.0 in               |
| -As         | 0.88        | 0.88 | 0.88        | 0.88 | 0.88        | 0.88 | 0.88 in <sup>2</sup> |
| c/d         | 0.06        | 0.06 | 0.06        | 0.06 | 0.06        | 0.06 | 0.06                 |
| - $\phi$ Mn | -147        | -147 | -147        | -147 | -147        | -147 | -147                 |
| As min      | 0.00        | 0.08 | 0.18        | 0.12 | 0.32        | 0.23 | 0.00 in <sup>2</sup> |

**SHEAR STRENGTH (kip, in)**

| $\phi V_c$ | 28.8  | -28.8 | 28.8  | -28.8 | 28.8  | -28.8 |    |
|------------|-------|-------|-------|-------|-------|-------|----|
| $\phi V_s$ | 23.5  | -23.5 | 23.5  | -23.5 | 23.5  | -23.5 |    |
| $\phi V_n$ | 52.4  | -52.4 | 52.4  | -52.4 | 52.4  | -52.4 |    |
| Av/s       | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | OK |
| Min Av/s   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  |    |
| s          | 16.0  | 6.0   | 16.0  | 16.0  | 6.0   | 16.0  | OK |
| s max      | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  | N.A.  |    |

**DEFLECTIONS**

| Comb      |        |        |        |     |
|-----------|--------|--------|--------|-----|
| D         | 0.00   | 0.00   | 0.00   | in  |
| L         | 0.00   | 0.00   | 0.00   | in  |
| Lr, S     | 0.00   | 0.00   | 0.00   | in  |
| LS        | 0.00   | 0.00   | 0.00   | in  |
| LT        | 0.00   | 0.00   | 0.00   | in  |
| Ieff D    | 46,684 | 46,684 | 46,684 | in4 |
| Ieff L    | 46,684 | 46,684 | 46,684 | in4 |
| Ieff LS   | 46,684 | 46,684 | 46,684 | in4 |
| $\lambda$ | 1.75   | 1.75   | 1.75   |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.37 | OK |
| Max. Steel Area As max Ratio ....   | 0.14 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.20 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.00 | OK |
| Stirrups Spacing s max Ratio .....  | 0.67 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.19 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 9999       | 180    | 0.00  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 9999       | 480    | 0.01  | OK |
| D    | Long-Term | 9999       | 240    | 0.01  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM A

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

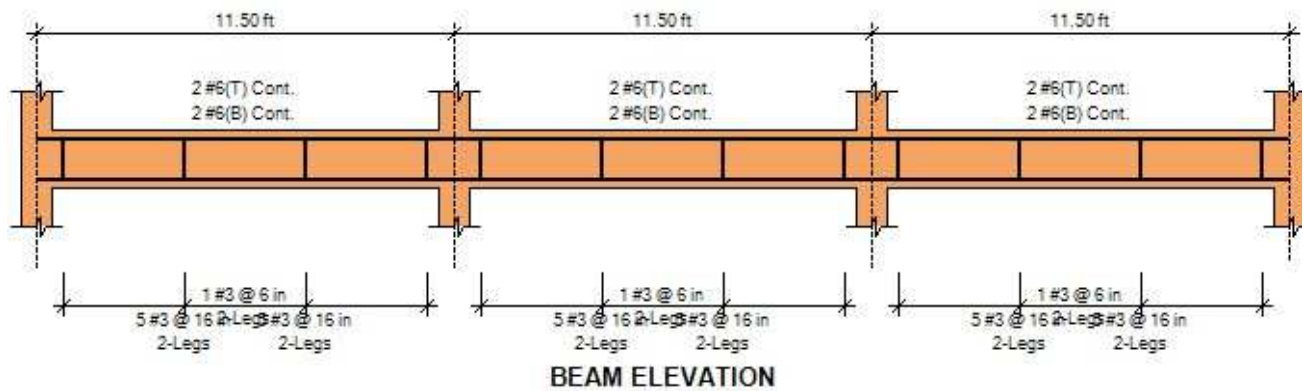
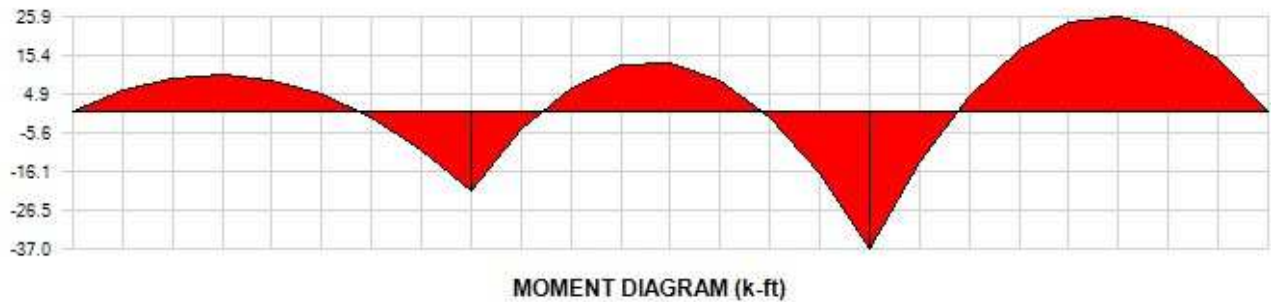
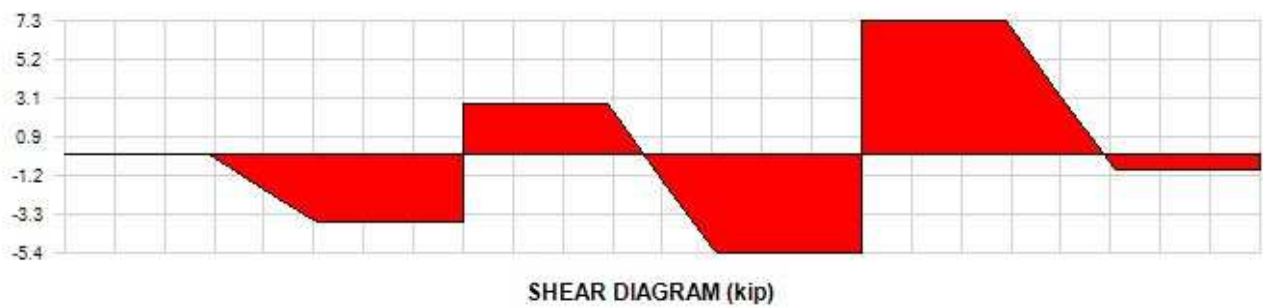
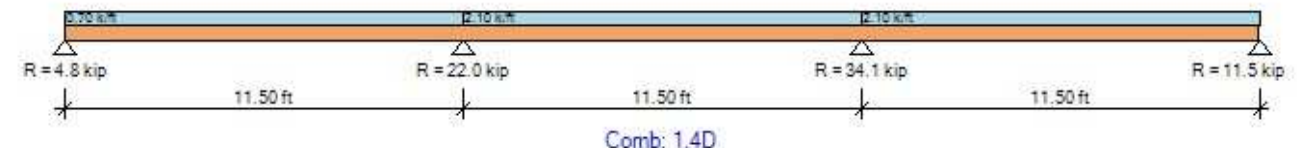
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### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



**GEOMETRY**

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 40.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 0.00      | ft |
| Right Cantilever       | 0.00      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 11.50 ft | ①       | Pinned |
| ②                        | 22.00 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |      |
|------|---|------|------|------|------|------|
| ①    | ① | -2.0 | -2.7 | 35.2 | 49.3 | 16.6 |
| ②    | ② | -2.5 | -2.6 | 42.7 | 46.0 | 20.3 |
| ③    | ③ | -2.0 | -2.3 | 35.2 | 42.3 | 16.6 |
| ④    | ④ | -2.4 | -3.3 | 40.8 | 54.2 | 19.4 |
| ⑤    | ⑤ | -2.0 | -2.3 | 35.2 | 42.3 | 16.6 |
| ⑥    | ⑥ | -2.0 | -3.3 | 35.2 | 54.2 | 16.6 |
| ⑦    | ⑦ | -2.0 | -2.3 | 35.2 | 42.3 | 16.6 |
| ⑧    | ⑧ | -2.4 | -2.6 | 40.8 | 46.0 | 19.4 |
| ⑨    | ⑨ | -2.0 | -2.3 | 35.2 | 42.3 | 16.6 |
| ⑩    | ⑩ | -2.0 | -2.3 | 35.2 | 42.3 | 16.6 |
| ⑪    | ⑪ | -1.2 | -1.8 | 21.1 | 31.7 | 10.0 |
| ⑫    | ⑫ | -1.2 | -1.8 | 21.1 | 31.7 | 10.0 |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |     |   |      |     |   |    |
|------|-----|---|------|-----|---|----|
| ①    | -23 | 0 | -109 | 105 | 0 | OK |
| ②    | -21 | 0 | -101 | 98  | 0 | OK |
| ③    | -19 | 0 | -93  | 90  | 0 | OK |
| ④    | -26 | 0 | -120 | 116 | 0 | OK |
| ⑤    | -19 | 0 | -93  | 90  | 0 | OK |
| ⑥    | -26 | 0 | -120 | 116 | 0 | OK |
| ⑦    | -19 | 0 | -93  | 90  | 0 | OK |
| ⑧    | -21 | 0 | -101 | 98  | 0 | OK |
| ⑨    | -19 | 0 | -93  | 90  | 0 | OK |
| ⑩    | -19 | 0 | -93  | 90  | 0 | OK |
| ⑪    | -15 | 0 | -70  | 67  | 0 | OK |
| ⑫    | -15 | 0 | -70  | 67  | 0 | OK |

**SHEAR FORCES Vu (kip)**

| Comb |      |       |      |       |    |
|------|------|-------|------|-------|----|
| ①    | -7.6 | -11.3 | 22.5 | -12.6 | OK |
| ②    | -7.1 | -10.5 | 21.0 | -11.8 | OK |
| ③    | -6.5 | -9.7  | 19.3 | -10.8 | OK |
| ④    | -8.5 | -12.4 | 24.9 | -14.0 | OK |
| ⑤    | -6.5 | -9.7  | 19.3 | -10.8 | OK |
| ⑥    | -8.5 | -12.4 | 24.9 | -14.0 | OK |
| ⑦    | -6.5 | -9.7  | 19.3 | -10.8 | OK |
| ⑧    | -7.1 | -10.5 | 21.0 | -11.8 | OK |
| ⑨    | -6.5 | -9.7  | 19.3 | -10.8 | OK |
| ⑩    | -6.5 | -9.7  | 19.3 | -10.8 | OK |
| ⑪    | -4.9 | -7.3  | 14.4 | -8.1  | OK |
| ⑫    | -4.9 | -7.3  | 14.4 | -8.1  | OK |



**BENDING STRENGTH (k-ft)**

|        |             |      |             |      |                      |
|--------|-------------|------|-------------|------|----------------------|
| Bot    | 2#6 Cont    |      | 2#6 Cont    |      |                      |
| Bot    | 2#6x9.50 ft |      | 2#6x9.50 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0         | 4.0  | 2.0 in               |
| +As    | 0.88        | 1.76 | 0.88        | 1.76 | 0.88 in <sup>2</sup> |
| c/d    | 0.06        | 0.09 | 0.06        | 0.09 | 0.06                 |
| +φMn   | 147         | 280  | 147         | 280  | 147                  |
| Top    | 2#6 Cont    |      | 2#6 Cont    |      |                      |
| Top    | 1#6         |      | 1#6         |      | 1#6                  |
| d'     | 3.0         | 2.0  | 3.0         | 2.0  | 3.0 in               |
| -As    | 1.32        | 0.88 | 1.32        | 0.88 | 1.32 in <sup>2</sup> |
| c/d    | 0.07        | 0.07 | 0.07        | 0.07 | 0.07                 |
| -φMn   | -216        | -151 | -216        | -151 | -216                 |
| As min | 0.20        | 0.00 | 0.97        | 0.95 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |        |  |        |  |                 |
|---------------------|--------|--|--------|--|-----------------|
| Comb                |        |  |        |  |                 |
| D                   | 0.00   |  | 0.03   |  | in              |
| L                   | 0.00   |  | 0.00   |  | in              |
| Lr, S               | 0.00   |  | 0.01   |  | in              |
| LS                  | 0.00   |  | 0.00   |  | in              |
| LT                  | 0.00   |  | 0.06   |  | in              |
| I <sub>eff</sub> D  | 48,167 |  | 48,167 |  | in <sup>4</sup> |
| I <sub>eff</sub> L  | 48,167 |  | 48,167 |  | in <sup>4</sup> |
| I <sub>eff</sub> LS | 48,167 |  | 48,167 |  | in <sup>4</sup> |
| λ                   | 1.75   |  | 1.75   |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |       |       |             |
|----------|-------|-------|-------|-------|-------------|
| φVc      | 28.8  | -28.8 | 28.8  | -28.8 |             |
| φVs      | 23.5  | -23.5 | 23.5  | -23.5 |             |
| φVn      | 52.4  | -52.4 | 52.4  | -52.4 |             |
| Av/s     | 0.014 | 0.014 | 0.014 | 0.014 | OK          |
| Min Av/s | N.A.  | N.A.  | 0.007 | N.A.  |             |
| s        | 16.0  | 6.0   | 16.0  | 16.0  | 6.0 16.0 OK |
| s max    | N.A.  | N.A.  | N.A.  | 19.0  | 19.0 N.A.   |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.73 | OK |
| Max. Steel Area As max Ratio ....   | 0.28 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.20 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.48 | OK |
| Stirrups Spacing s max Ratio .....  | 0.84 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.19 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 4389 | 480    | 0.11  | OK |
| D    | Long-Term | 4389 | 240    | 0.05  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: SECOND FLOOR BEAM -A-REV 2 SPANS

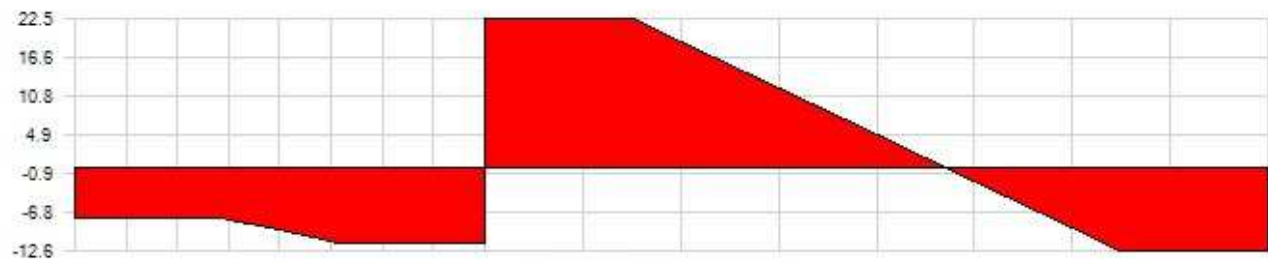
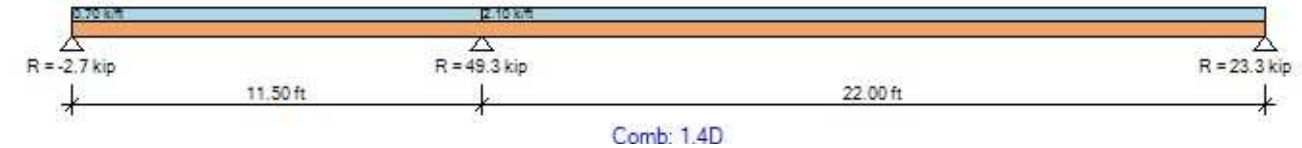
ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

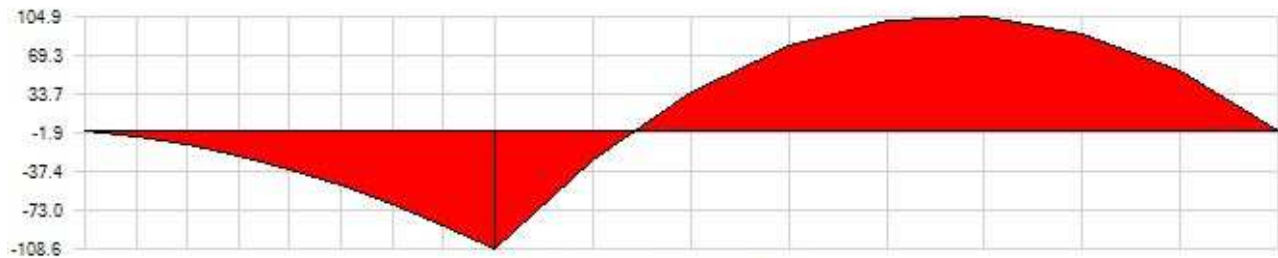
| Comb |     |     |     |     |    |
|------|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

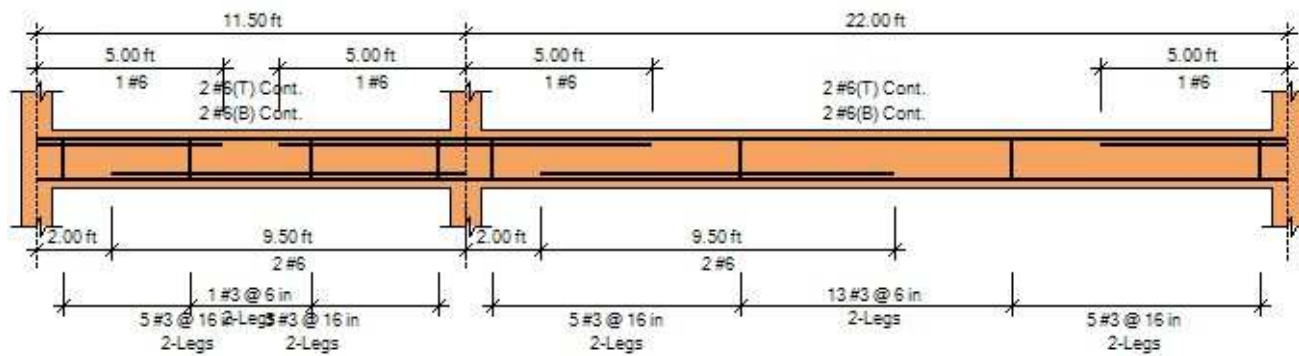
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 36.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 23.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 25.3 | 32.2 | 25.3 | 32.2 |
| ②    | ② | 24.7 | 32.1 | 24.7 | 32.1 |
| ③    | ③ | 23.0 | 31.3 | 23.0 | 31.3 |
| ④    | ④ | 26.0 | 31.5 | 26.0 | 31.5 |
| ⑤    | ⑤ | 24.7 | 28.7 | 24.7 | 28.8 |
| ⑥    | ⑥ | 23.0 | 30.4 | 23.0 | 30.4 |
| ⑦    | ⑦ | 23.0 | 27.6 | 23.0 | 27.6 |
| ⑧    | ⑧ | 26.0 | 29.6 | 26.0 | 29.6 |
| ⑨    | ⑨ | 24.7 | 28.7 | 24.7 | 28.8 |
| ⑩    | ⑩ | 24.7 | 28.7 | 24.7 | 28.8 |
| ⑪    | ⑪ | 13.8 | 20.7 | 13.8 | 20.7 |
| ⑫    | ⑫ | 13.8 | 20.7 | 13.8 | 20.7 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |     |   |    |  |
|------|---|-----|---|----|--|
| ①    | 0 | 185 | 0 | OK |  |
| ②    | 0 | 185 | 0 | OK |  |
| ③    | 0 | 180 | 0 | OK |  |
| ④    | 0 | 181 | 0 | OK |  |
| ⑤    | 0 | 165 | 0 | OK |  |
| ⑥    | 0 | 175 | 0 | OK |  |
| ⑦    | 0 | 159 | 0 | OK |  |
| ⑧    | 0 | 170 | 0 | OK |  |
| ⑨    | 0 | 165 | 0 | OK |  |
| ⑩    | 0 | 165 | 0 | OK |  |
| ⑪    | 0 | 119 | 0 | OK |  |
| ⑫    | 0 | 119 | 0 | OK |  |

## SHEAR FORCES Vu (kip)

| Comb |      |       |    |  |  |
|------|------|-------|----|--|--|
| ①    | 23.3 | -23.3 | OK |  |  |
| ②    | 23.3 | -23.3 | OK |  |  |
| ③    | 22.7 | -22.7 | OK |  |  |
| ④    | 22.8 | -22.8 | OK |  |  |
| ⑤    | 20.8 | -20.8 | OK |  |  |
| ⑥    | 22.0 | -22.0 | OK |  |  |
| ⑦    | 20.0 | -20.0 | OK |  |  |
| ⑧    | 21.5 | -21.5 | OK |  |  |
| ⑨    | 20.8 | -20.8 | OK |  |  |
| ⑩    | 20.8 | -20.8 | OK |  |  |
| ⑪    | 15.0 | -15.0 | OK |  |  |
| ⑫    | 15.0 | -15.0 | OK |  |  |

**BENDING STRENGTH (k-ft)**

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#6 Cont     |      |                      |
| Bot    | 2#6x19.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.88         | 1.76 | 0.88 in <sup>2</sup> |
| c/d    | 0.06         | 0.10 | 0.06                 |
| +φMn   | 131          | 249  | 131                  |
| Top    | 2#6 Cont     |      |                      |
| Top    | 0#5          |      |                      |
| d'     | 4.0          | 2.0  | 4.0 in               |
| -As    | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.06         | 0.08 | 0.06                 |
| -φMn   | -131         | -135 | -131                 |
| As min | 0.00         | 0.91 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |        |  |                 |
|---------------------|--------|--|-----------------|
| Comb                |        |  |                 |
| D                   | 0.22   |  | in              |
| L                   | 0.04   |  | in              |
| Lr, S               | 0.03   |  | in              |
| LS                  | 0.02   |  | in              |
| LT                  | 0.47   |  | in              |
| I <sub>eff</sub> D  | 15,544 |  | in <sup>4</sup> |
| I <sub>eff</sub> L  | 14,267 |  | in <sup>4</sup> |
| I <sub>eff</sub> LS | 14,813 |  | in <sup>4</sup> |
| λ                   | 1.72   |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |              |
|----------|-------|--------------|
| φVc      | 25.8  | -25.8        |
| φVs      | 28.1  | -28.1        |
| φVn      | 53.9  | -53.9        |
| Av/s     | 0.018 | 0.018 OK     |
| Min Av/s | 0.007 | N.A.         |
| s        | 12.0  | 12.0 12.0 OK |
| s max    | 17.0  | 17.0 N.A.    |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.52 | OK |
| Max. Steel Area As max Ratio ....   | 0.31 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.33 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio .....  | 0.71 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.19 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 8241 | 180    | 0.02  | OK |
| B    | Live Load | 6188 | 360    | 0.06  | OK |
| C    | Long-Term | 585  | 480    | 0.82  | OK |
| D    | Long-Term | 585  | 240    | 0.41  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |



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## CONCRETE BEAM DESIGN

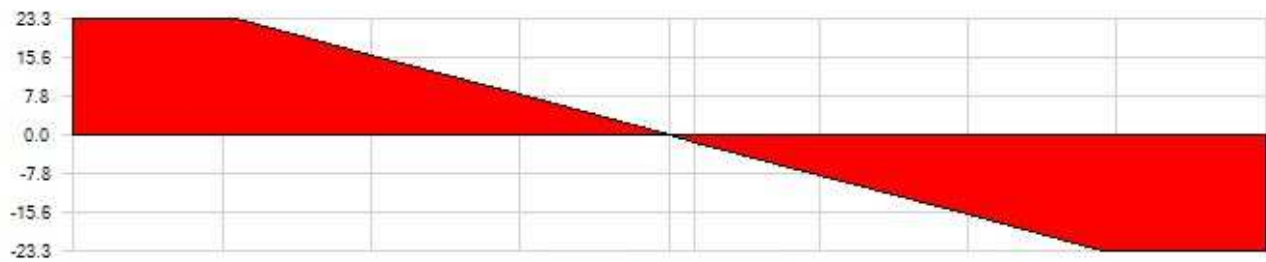
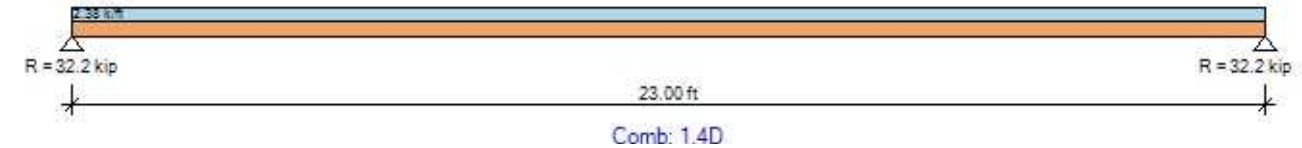
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### TORSION MOMENTS $T_u$ (k-ft)

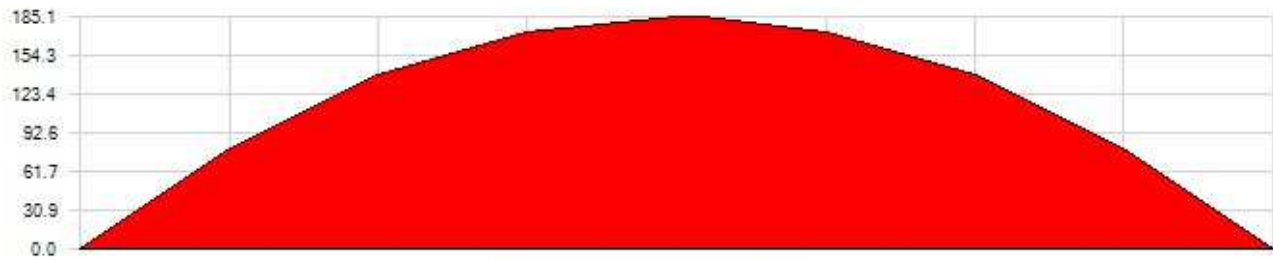
| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

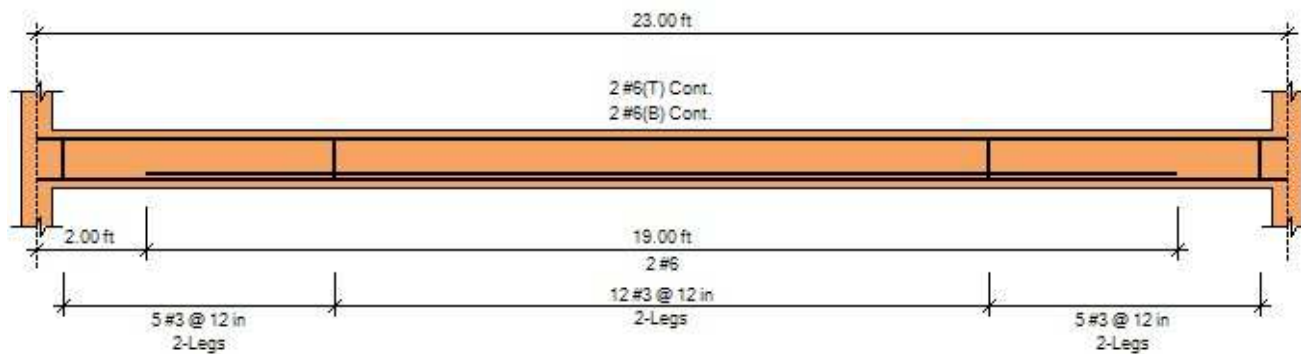
|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| AI (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 12.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 5.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 23.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |           |
|------|---|------|------|-----------|
| ①    | ① | 18.6 | 26.0 | 63.6 89.0 |
| ②    | ② | 25.8 | 25.9 | 76.5 82.8 |
| ③    | ③ | 18.6 | 22.3 | 63.6 76.3 |
| ④    | ④ | 24.0 | 33.8 | 73.3 97.0 |
| ⑤    | ⑤ | 18.6 | 22.3 | 63.6 76.3 |
| ⑥    | ⑥ | 18.6 | 33.8 | 63.6 97.0 |
| ⑦    | ⑦ | 18.6 | 22.3 | 63.6 76.3 |
| ⑧    | ⑧ | 24.0 | 25.9 | 73.3 82.8 |
| ⑨    | ⑨ | 18.6 | 22.3 | 63.6 76.3 |
| ⑩    | ⑩ | 18.6 | 22.3 | 63.6 76.3 |
| ⑪    | ⑪ | 11.2 | 16.7 | 38.2 57.2 |
| ⑫    | ⑫ | 11.2 | 16.7 | 38.2 57.2 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |     |      |    |
|------|---|-----|------|----|
| ①    | 0 | 120 | -182 | OK |
| ②    | 0 | 121 | -166 | OK |
| ③    | 0 | 103 | -156 | OK |
| ④    | 0 | 161 | -188 | OK |
| ⑤    | 0 | 103 | -156 | OK |
| ⑥    | 0 | 161 | -188 | OK |
| ⑦    | 0 | 103 | -156 | OK |
| ⑧    | 0 | 121 | -166 | OK |
| ⑨    | 0 | 103 | -156 | OK |
| ⑩    | 0 | 103 | -156 | OK |
| ⑪    | 0 | 77  | -117 | OK |
| ⑫    | 0 | 77  | -117 | OK |

## SHEAR FORCES Vu (kip)

| Comb |      |       |      |    |
|------|------|-------|------|----|
| ①    | 16.7 | -34.9 | 35.0 | OK |
| ②    | 16.7 | -33.2 | 32.0 | OK |
| ③    | 14.3 | -29.9 | 30.0 | OK |
| ④    | 22.1 | -40.5 | 36.4 | OK |
| ⑤    | 14.3 | -29.9 | 30.0 | OK |
| ⑥    | 22.1 | -40.5 | 36.4 | OK |
| ⑦    | 14.3 | -29.9 | 30.0 | OK |
| ⑧    | 16.7 | -33.2 | 32.0 | OK |
| ⑨    | 14.3 | -29.9 | 30.0 | OK |
| ⑩    | 14.3 | -29.9 | 30.0 | OK |
| ⑪    | 10.7 | -22.4 | 22.5 | OK |
| ⑫    | 10.7 | -22.4 | 22.5 | OK |

**BENDING STRENGTH (k-ft)**

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 4#6 Cont     |      |                      |
| Bot    | 0#6x18.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 1.76         | 1.76 | 1.76 in <sup>2</sup> |
| c/d    | 0.11         | 0.11 | 0.11                 |
| +φMn   | 164          | 164  | 164                  |
| Top    | 4#7 Cont     |      |                      |
| Top    | 0#5          |      | 0#5                  |
| d'     | 2.0          | 2.0  | 2.0 in               |
| -As    | 2.40         | 2.40 | 2.40 in <sup>2</sup> |
| c/d    | 0.13         | 0.13 | 0.13                 |
| -φMn   | -222         | -222 | -222                 |
| As min | 0.00         | 0.88 | 0.88 in <sup>2</sup> |

**DEFLECTIONS**

|         |       |       |                 |
|---------|-------|-------|-----------------|
| Comb    |       |       |                 |
| D       | 0.24  | -0.07 | in              |
| L       | 0.00  | 0.00  | in              |
| Lr, S   | 0.23  | 0.00  | in              |
| LS      | 0.07  | -0.03 | in              |
| LT      | 0.42  | -0.19 | in              |
| Ieff D  | 7,738 | 5,491 | in <sup>4</sup> |
| Ieff L  | 7,738 | 5,491 | in <sup>4</sup> |
| Ieff LS | 6,911 | 5,387 | in <sup>4</sup> |
| λ       | 1.38  | 2.00  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |            |
|----------|-------|-------|------------|
| φVc      | 25.0  | -25.0 | 25.0       |
| φVs      | 27.2  | -27.2 | 27.2       |
| φVn      | 52.3  | -52.3 | 52.3       |
| Av/s     | 0.028 | 0.028 | 0.028 OK   |
| Min Av/s | 0.010 | N.A.  | 0.010      |
| s        | 8.0   | 8.0   | 8.0 8.0 OK |
| s max    | 11.0  | 11.0  | N.A. 11.0  |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.50 | OK |
| Max. Steel Area As max Ratio ....   | 0.38 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.80 | OK |
| Rebars Max Spacing Smax Ratio       | 0.21 | OK |
| Shear Vs/Vs max Ratio .....         | 0.36 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio .....  | 0.73 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.39 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 1225 | 180    | 0.15  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 653  | 480    | 0.73  | OK |
| D    | Long-Term | 653  | 240    | 0.37  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM B

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 10/17/2024

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## CONCRETE BEAM DESIGN

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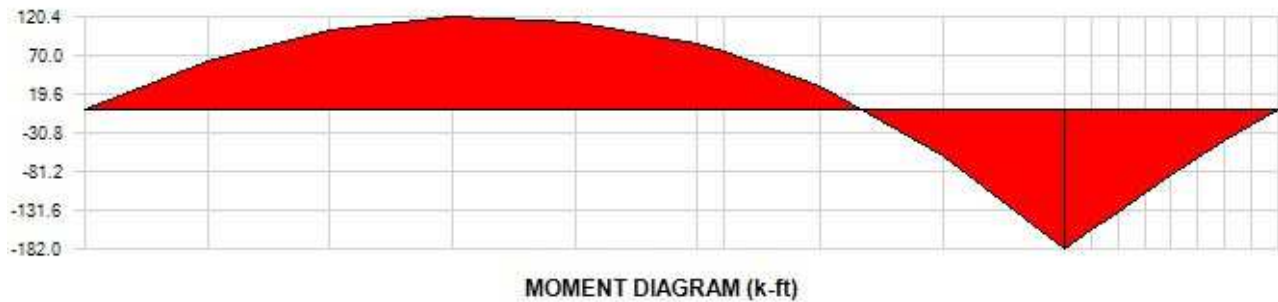
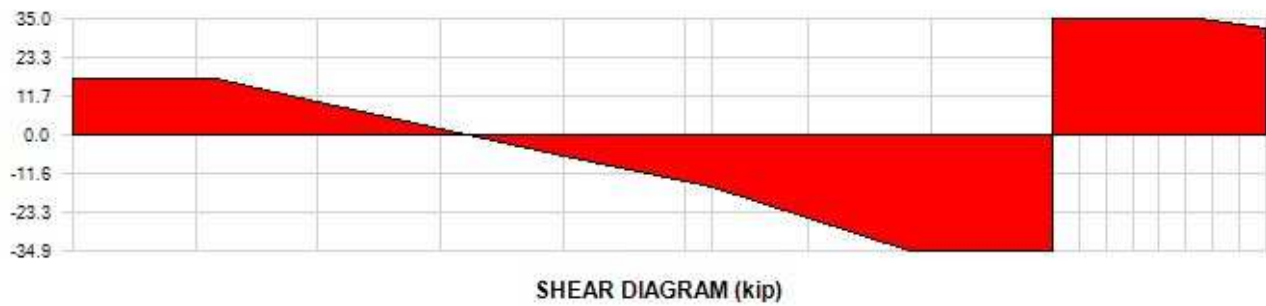
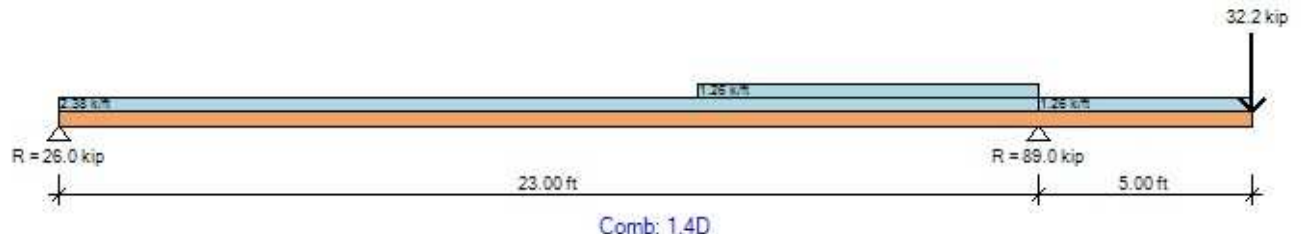
### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |    |
|------|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | OK |





BEAM ELEVATION

## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0 in       |    |
| Beam Width b           | 8.0 in        |    |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00 ft       |    |
| Right Cantilever       | 0.00 ft       |    |

## BEAM SUPPORTS

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 12.00 ft | ①       | Pinned |
| ②                        | 23.00 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |     |     |      |      |      |      |
|------|---|-----|-----|------|------|------|------|
| ①    | ① | 2.8 | 3.4 | 37.1 | 48.4 | 14.2 | 18.6 |
| ②    | ② | 2.6 | 3.5 | 36.9 | 46.7 | 14.3 | 17.9 |
| ③    | ③ | 2.5 | 3.4 | 34.6 | 45.5 | 13.3 | 17.5 |
| ④    | ④ | 2.8 | 3.4 | 38.2 | 46.5 | 14.7 | 17.9 |
| ⑤    | ⑤ | 2.7 | 3.1 | 36.5 | 42.7 | 14.0 | 16.4 |
| ⑥    | ⑥ | 2.5 | 3.2 | 34.6 | 45.3 | 13.3 | 17.5 |
| ⑦    | ⑦ | 2.5 | 2.9 | 34.6 | 41.5 | 13.3 | 16.0 |
| ⑧    | ⑧ | 2.8 | 3.2 | 38.2 | 43.9 | 14.7 | 16.9 |
| ⑨    | ⑨ | 2.7 | 3.1 | 36.5 | 42.7 | 14.0 | 16.4 |
| ⑩    | ⑩ | 2.7 | 3.1 | 36.5 | 42.7 | 14.0 | 16.4 |
| ⑪    | ⑪ | 1.5 | 2.2 | 20.7 | 31.1 | 8.0  | 12.0 |
| ⑫    | ⑫ | 1.5 | 2.2 | 20.7 | 31.1 | 8.0  | 12.0 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |    |   |      |    |   |    |
|------|----|---|------|----|---|----|
| ①    | -5 | 3 | -101 | 87 | 0 | OK |
| ②    | -4 | 3 | -97  | 84 | 0 | OK |
| ③    | -4 | 3 | -95  | 82 | 0 | OK |
| ④    | -4 | 3 | -97  | 84 | 0 | OK |
| ⑤    | -4 | 3 | -89  | 77 | 0 | OK |
| ⑥    | -4 | 3 | -94  | 82 | 0 | OK |
| ⑦    | -4 | 3 | -86  | 75 | 0 | OK |
| ⑧    | -4 | 3 | -91  | 79 | 0 | OK |
| ⑨    | -4 | 3 | -89  | 77 | 0 | OK |
| ⑩    | -4 | 3 | -89  | 77 | 0 | OK |
| ⑪    | -3 | 2 | -65  | 56 | 0 | OK |
| ⑫    | -3 | 2 | -65  | 56 | 0 | OK |

## SHEAR FORCES Vu (kip)

| Comb |      |       |      |       |    |
|------|------|-------|------|-------|----|
| ①    | -0.8 | -16.0 | 23.6 | -14.4 | OK |
| ②    | -0.7 | -15.5 | 22.6 | -13.8 | OK |
| ③    | -0.7 | -15.1 | 22.1 | -13.5 | OK |
| ④    | -0.7 | -15.4 | 22.6 | -13.8 | OK |
| ⑤    | -0.7 | -14.1 | 20.8 | -12.7 | OK |
| ⑥    | -0.8 | -15.0 | 22.1 | -13.5 | OK |
| ⑦    | -0.7 | -13.7 | 20.2 | -12.3 | OK |
| ⑧    | -0.7 | -14.5 | 21.4 | -13.0 | OK |
| ⑨    | -0.7 | -14.1 | 20.8 | -12.7 | OK |
| ⑩    | -0.7 | -14.1 | 20.8 | -12.7 | OK |
| ⑪    | -0.5 | -10.3 | 15.2 | -9.2  | OK |
| ⑫    | -0.5 | -10.3 | 15.2 | -9.2  | OK |

**BENDING STRENGTH (k-ft)**

|        |              |      |              |      |                      |
|--------|--------------|------|--------------|------|----------------------|
| Bot    | 2#5 Cont     |      | 2#6 Cont     |      |                      |
| Bot    | 0#5x10.00 ft |      | 2#6x18.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.62         | 0.62 | 0.62         | 1.76 | 0.88 in <sup>2</sup> |
| c/d    | 0.12         | 0.08 | 0.12         | 0.15 | 0.10                 |
| +φMn   | 64           | 60   | 64           | 154  | 83                   |
| Top    | 2#5 Cont     |      | 2#6 Cont     |      |                      |
| Top    | 2#5          |      | 2#5          |      | 0#5                  |
| d'     | 4.0          | 2.0  | 4.0          | 2.0  | 2.0 in               |
| -As    | 1.24         | 0.62 | 1.24         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.12         | 0.08 | 0.12         | 0.13 | 0.10                 |
| -φMn   | -110         | -60  | -110         | -88  | -83                  |
| As min | 0.06         | 0.04 | 0.59         | 0.59 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |       |                 |
|---------------------|-------|-------|-----------------|
| Comb                |       |       |                 |
| D                   | 0.00  | 0.27  | in              |
| L                   | 0.00  | 0.03  | in              |
| Lr, S               | 0.00  | 0.03  | in              |
| LS                  | 0.00  | 0.02  | in              |
| LT                  | 0.00  | 0.50  | in              |
| I <sub>eff</sub> D  | 9,130 | 5,094 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 9,108 | 4,868 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 9,116 | 4,951 | in <sup>4</sup> |
| λ                   | 1.70  | 1.60  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|                 |       |       |       |                   |
|-----------------|-------|-------|-------|-------------------|
| φV <sub>c</sub> | 16.7  | -16.7 | 16.7  | -16.7             |
| φV <sub>s</sub> | 21.8  | -21.8 | 21.8  | -21.8             |
| φV <sub>n</sub> | 38.5  | -38.5 | 38.5  | -38.5             |
| Av/s            | 0.022 | 0.022 | 0.022 | 0.022 OK          |
| Min Av/s        | N.A.  | N.A.  | 0.007 | N.A.              |
| s               | 10.0  | 8.0   | 10.0  | 10.0 10.0 10.0 OK |
| s max           | N.A.  | 11.0  | N.A.  | 11.0 11.0 N.A.    |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.33 | OK |
| Max. Steel Area As max Ratio ....   | 0.47 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.26 | OK |
| Shear Vs/Vs max Ratio .....         | 0.33 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.30 | OK |
| Stirrups Spacing s max Ratio .....  | 0.91 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 8490 | 180    | 0.02  | OK |
| B    | Live Load | 8620 | 360    | 0.04  | OK |
| C    | Long-Term | 551  | 480    | 0.87  | OK |
| D    | Long-Term | 551  | 240    | 0.44  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                           |                |     |
|-------------------------------------------|----------------|-----|
| Concrete Strength f' <sub>c</sub> .....   | 4.0            | ksi |
| Compression Strain Limit .....            | 0.003          |     |
| Concrete density .....                    | 150            | pcf |
| Concrete Stress-Strain .....              | Hognestad      |     |
| Rebar Steel Strength f <sub>y</sub> ..... | 60.0           | ksi |
| Steel Stress-Strain .....                 | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM E

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 10/17/2024

ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

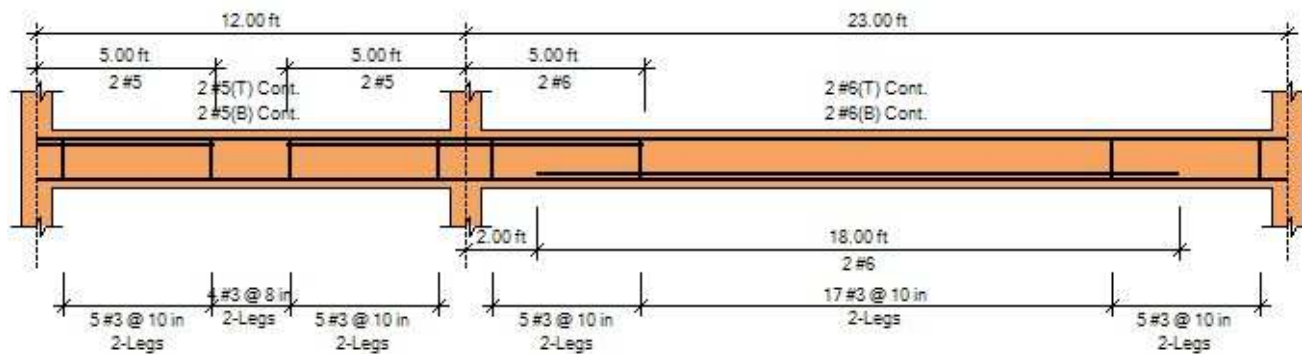
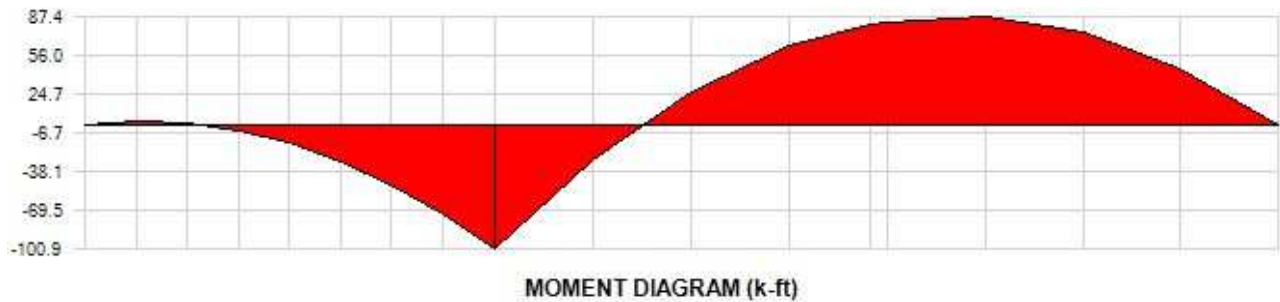
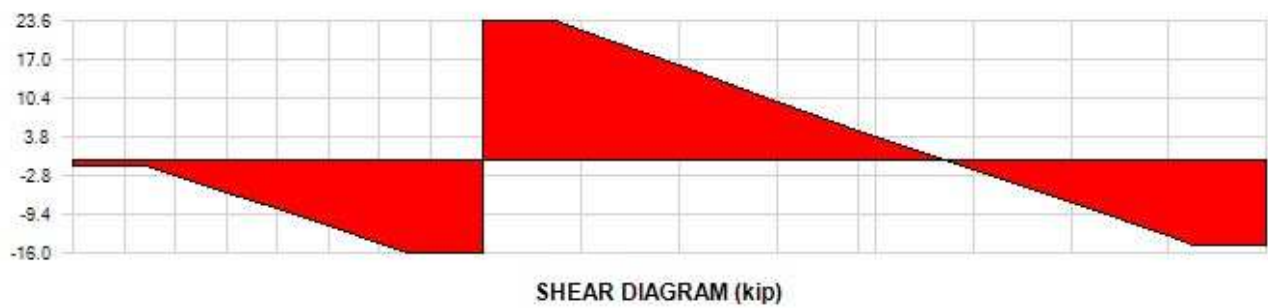
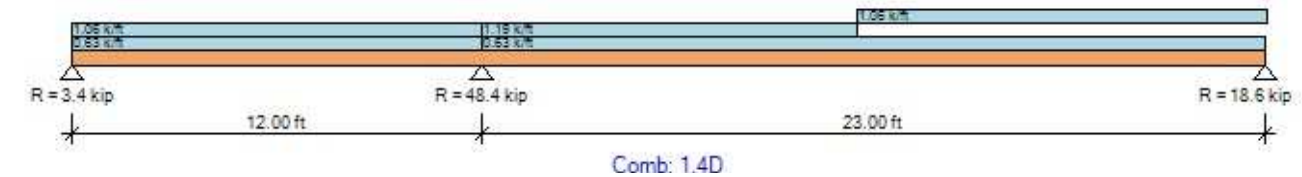
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### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |     |    |
|------|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | OK |





## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 12.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 3.33          | ft |
| Right Cantilever       | 0.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 15.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |         |
|------|---|------|------|---------|
| ①    | ① | 63.3 | 78.0 | 3.2 1.9 |
| ②    | ② | 55.7 | 79.0 | 1.3 4.5 |
| ③    | ③ | 55.7 | 79.0 | 1.3 4.5 |
| ④    | ④ | 61.4 | 70.7 | 2.7 2.5 |
| ⑤    | ⑤ | 61.4 | 70.7 | 2.7 2.5 |
| ⑥    | ⑥ | 55.7 | 66.9 | 1.3 1.6 |
| ⑦    | ⑦ | 55.7 | 66.9 | 1.3 1.6 |
| ⑧    | ⑧ | 61.4 | 70.7 | 2.7 2.5 |
| ⑨    | ⑨ | 61.4 | 70.7 | 2.7 2.5 |
| ⑩    | ⑩ | 61.4 | 70.7 | 2.7 2.5 |
| ⑪    | ⑪ | 33.4 | 50.2 | 0.8 1.2 |
| ⑫    | ⑫ | 33.4 | 50.2 | 0.8 1.2 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |      |   |     |    |
|------|------|---|-----|----|
| ①    | -169 | 0 | -35 | OK |
| ②    | -164 | 5 | -24 | OK |
| ③    | -164 | 5 | -24 | OK |
| ④    | -150 | 2 | -28 | OK |
| ⑤    | -150 | 2 | -28 | OK |
| ⑥    | -145 | 0 | -30 | OK |
| ⑦    | -145 | 0 | -30 | OK |
| ⑧    | -150 | 2 | -28 | OK |
| ⑨    | -150 | 2 | -28 | OK |
| ⑩    | -150 | 2 | -28 | OK |
| ⑪    | -108 | 0 | -23 | OK |
| ⑫    | -108 | 0 | -23 | OK |

## SHEAR FORCES Vu (kip)

| Comb |       |      |      |    |
|------|-------|------|------|----|
| ①    | -49.7 | 20.6 | 1.9  | OK |
| ②    | -48.1 | 21.9 | -0.1 | OK |
| ③    | -48.1 | 21.9 | -0.1 | OK |
| ④    | -44.3 | 19.0 | 1.1  | OK |
| ⑤    | -44.3 | 19.0 | 1.1  | OK |
| ⑥    | -42.6 | 17.6 | 1.6  | OK |
| ⑦    | -42.6 | 17.6 | 1.6  | OK |
| ⑧    | -44.3 | 19.0 | 1.1  | OK |
| ⑨    | -44.3 | 19.0 | 1.1  | OK |
| ⑩    | -44.3 | 19.0 | 1.1  | OK |
| ⑪    | -32.0 | 13.2 | 1.2  | OK |
| ⑫    | -32.0 | 13.2 | 1.2  | OK |

**BENDING STRENGTH (k-ft)**

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#8 Cont     |      |                      |
| Bot    | 0#5x10.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 1.58         | 1.58 | 1.58 in <sup>2</sup> |
| c/d    | 0.10         | 0.10 | 0.10                 |
| +φMn   | 148          | 148  | 148                  |
| Top    | 4#8 Cont     |      |                      |
| Top    | 0#8          |      | 0#6                  |
| d'     | 4.0          | 2.0  | 4.0 in               |
| -As    | 3.16         | 3.16 | 3.16 in <sup>2</sup> |
| c/d    | 0.17         | 0.17 | 0.17                 |
| -φMn   | -288         | -288 | -288                 |
| As min | 0.88         | 0.07 | 0.50 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |        |                 |
|---------------------|-------|--------|-----------------|
| Comb                |       |        |                 |
| D                   | 0.08  | 0.00   | in              |
| L                   | 0.01  | 0.00   | in              |
| Lr, S               | 0.00  | 0.00   | in              |
| LS                  | 0.00  | 0.00   | in              |
| LT                  | 0.16  | 0.00   | in              |
| I <sub>eff</sub> D  | 8,972 | 15,845 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 8,644 | 15,807 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 8,860 | 15,832 | in <sup>4</sup> |
| λ                   | 2.00  | 1.25   |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |          |
|----------|-------|-------|----------|
| φVc      | -25.0 | 25.0  | -25.0    |
| φVs      | -27.2 | 27.2  | -27.2    |
| φVn      | -52.3 | 52.3  | -52.3    |
| Av/s     | 0.028 | 0.028 | 0.028 OK |
| Min Av/s | N.A   | 0.010 | N.A      |
| s        | 8.0   | 8.0   | 8.0 OK   |
| s max    | N.A   | 11.0  | 11.0 N.A |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.28 | OK |
| Max. Steel Area As max Ratio ....   | 0.41 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.89 | OK |
| Rebars Max Spacing Smax Ratio       | 0.60 | OK |
| Shear Vs/Vs max Ratio .....         | 0.36 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio .....  | 0.73 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.39 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 90     | 0.00  | OK |
| B    | Live Load | 7772 | 180    | 0.02  | OK |
| C    | Long-Term | 246  | 240    | 0.97  | OK |
| D    | Long-Term | 246  | 120    | 0.49  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

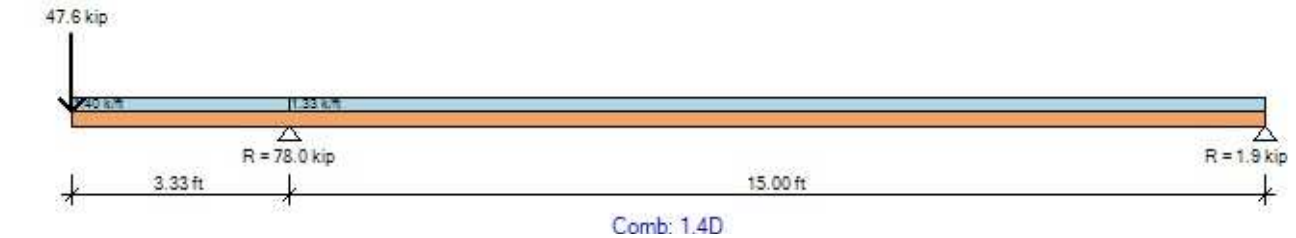
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### TORSION MOMENTS $T_u$ (k-ft)

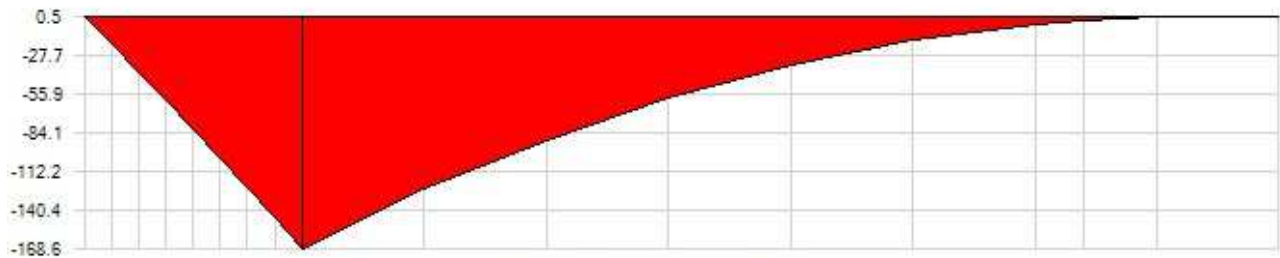
| Comb |     |     |     |    |
|------|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

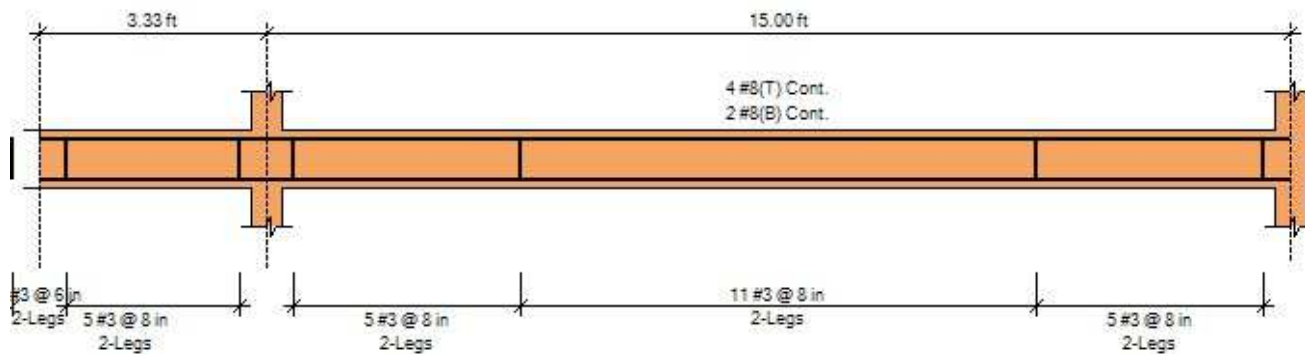
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM f

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## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 40.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 6.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 15.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 40.6 | 44.3 | -4.5 | -4.1 |
| ②    | ② | 31.7 | 52.2 | -2.9 | -6.0 |
| ③    | ③ | 31.7 | 52.2 | -2.9 | -6.0 |
| ④    | ④ | 38.3 | 42.5 | -4.1 | -4.3 |
| ⑤    | ⑤ | 38.3 | 42.5 | -4.1 | -4.3 |
| ⑥    | ⑥ | 31.7 | 38.0 | -2.9 | -3.5 |
| ⑦    | ⑦ | 31.7 | 38.0 | -2.9 | -3.5 |
| ⑧    | ⑧ | 38.3 | 42.5 | -4.1 | -4.3 |
| ⑨    | ⑨ | 38.3 | 42.5 | -4.1 | -4.3 |
| ⑩    | ⑩ | 38.3 | 42.5 | -4.1 | -4.3 |
| ⑪    | ⑪ | 19.0 | 28.5 | -1.8 | -2.6 |
| ⑫    | ⑫ | 19.0 | 28.5 | -1.8 | -2.6 |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |      |   |     |    |  |
|------|------|---|-----|----|--|
| ①    | -122 | 0 | -46 | OK |  |
| ②    | -150 | 0 | -60 | OK |  |
| ③    | -150 | 0 | -60 | OK |  |
| ④    | -119 | 0 | -46 | OK |  |
| ⑤    | -119 | 0 | -46 | OK |  |
| ⑥    | -104 | 0 | -39 | OK |  |
| ⑦    | -104 | 0 | -39 | OK |  |
| ⑧    | -119 | 0 | -46 | OK |  |
| ⑨    | -119 | 0 | -46 | OK |  |
| ⑩    | -119 | 0 | -46 | OK |  |
| ⑪    | -78  | 0 | -29 | OK |  |
| ⑫    | -78  | 0 | -29 | OK |  |

### SHEAR FORCES Vu (kip)

| Comb |       |      |     |    |  |
|------|-------|------|-----|----|--|
| ①    | -31.6 | 10.3 | 6.0 | OK |  |
| ②    | -37.6 | 12.2 | 7.9 | OK |  |
| ③    | -37.6 | 12.2 | 7.9 | OK |  |
| ④    | -30.4 | 9.9  | 6.0 | OK |  |
| ⑤    | -30.4 | 9.9  | 6.0 | OK |  |
| ⑥    | -27.1 | 8.8  | 5.1 | OK |  |
| ⑦    | -27.1 | 8.8  | 5.1 | OK |  |
| ⑧    | -30.4 | 9.9  | 6.0 | OK |  |
| ⑨    | -30.4 | 9.9  | 6.0 | OK |  |
| ⑩    | -30.4 | 9.9  | 6.0 | OK |  |
| ⑪    | -20.3 | 6.6  | 3.8 | OK |  |
| ⑫    | -20.3 | 6.6  | 3.8 | OK |  |



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## CONCRETE BEAM DESIGN

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### BENDING STRENGTH (k-ft)

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#6 Cont     |      |                      |
| Bot    | 0#5x10.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.07         | 0.06 | 0.06                 |
| +φMn   | 151          | 147  | 147                  |
| Top    | 2#6 Cont     |      |                      |
| Top    | 2#6          |      | 0#6                  |
| d'     | 4.0          | 2.0  | 4.0 in               |
| -As    | 1.76         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.09         | 0.06 | 0.06                 |
| -φMn   | -280         | -147 | -147                 |
| As min | 1.01         | 0.00 | 0.49 in <sup>2</sup> |

### DEFLECTIONS

|         |        |        |                 |
|---------|--------|--------|-----------------|
| Comb    |        |        |                 |
| D       | 0.02   | 0.00   | in              |
| L       | 0.02   | 0.00   | in              |
| Lr, S   | 0.00   | 0.00   | in              |
| LS      | 0.00   | 0.00   | in              |
| LT      | 0.08   | 0.00   | in              |
| Ieff D  | 48,271 | 46,922 | in <sup>4</sup> |
| Ieff L  | 32,879 | 44,613 | in <sup>4</sup> |
| Ieff LS | 48,012 | 46,883 | in <sup>4</sup> |
| λ       | 2.00   | 1.75   |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### DESIGN CODES

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

### SHEAR STRENGTH (kip, in)

|          |       |       |             |
|----------|-------|-------|-------------|
| φVc      | -28.8 | 13.6  | -10.8       |
| φVs      | -31.4 | 0.0   | 0.0         |
| φVn      | -60.2 | 13.6  | -10.8       |
| Av/s     | 0.018 | 0.007 | 0.007 OK    |
| Min Av/s | N.A   | N.A   | N.A         |
| s        | 12.0  | 12.0  | N.A 12.0 OK |
| s max    | N.A   | N.A   | N.A         |

### REINFORCEMENT

|                               |       |      |    |
|-------------------------------|-------|------|----|
| Min. Steel Area As min Ratio  | ..... | 0.58 | OK |
| Max. Steel Area As max Ratio  | ....  | 0.28 | OK |
| Rebars Min Spacing Smin Ratio | ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio |       | 0.46 | OK |
| Shear Vs/Vs max Ratio         | ..... | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio | ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio  | ..... | 0.63 | OK |
| Stirrups Min. # of Legs Ratio | ..... | 0.21 | OK |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 90     | 0.00  | OK |
| B    | Live Load | 3019 | 180    | 0.06  | OK |
| C    | Long-Term | 913  | 240    | 0.26  | OK |
| D    | Long-Term | 913  | 120    | 0.13  | OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

### MATERIALS

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |

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### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |    |
|------|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | OK |

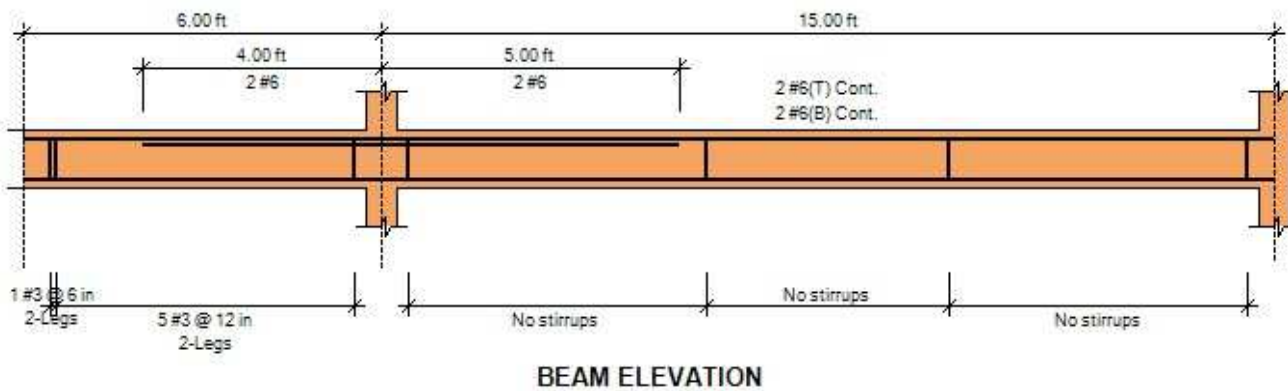
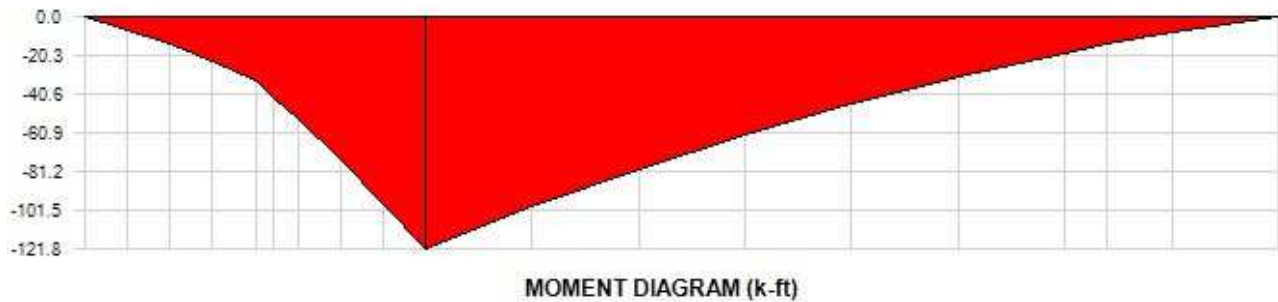
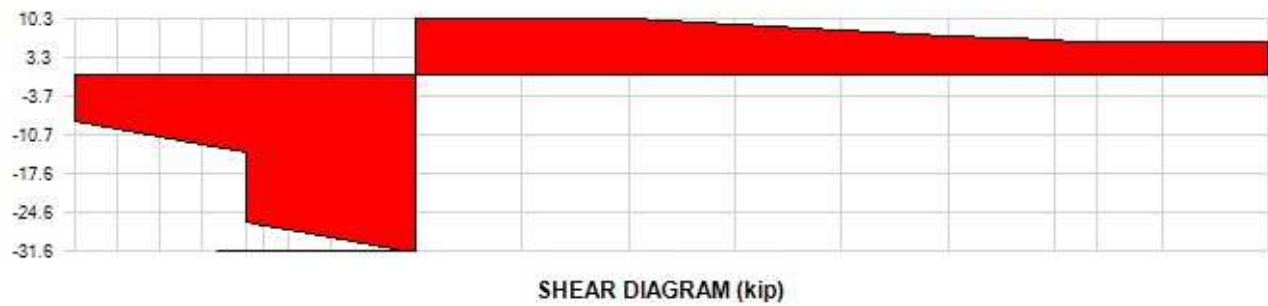
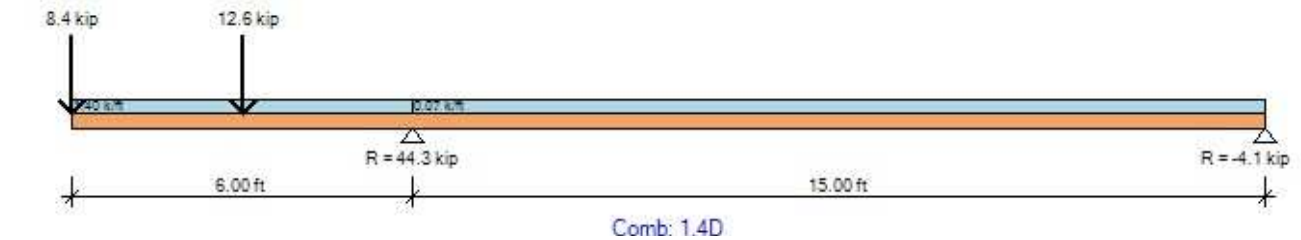
### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | OK |

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**CONCRETE BEAM DESIGN**

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## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |          | 4       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 21.50 ft | ①       | Pinned |
| ②                        | 12.50 ft | ②       | Pinned |
| ③                        | 9.50 ft  | ③       | Pinned |
| ④                        | N.A.     | ④       | Pinned |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |      |      |     |     |
|------|---|------|------|------|------|------|------|-----|-----|
| ①    | ① | 10.7 | 11.5 | 24.4 | 25.8 | 15.7 | 16.3 | 7.1 | 7.4 |
| ②    | ② | 8.2  | 13.9 | 18.5 | 31.7 | 11.7 | 20.4 | 5.3 | 9.3 |
| ③    | ③ | 8.2  | 13.9 | 18.5 | 31.7 | 11.7 | 20.4 | 5.3 | 9.3 |
| ④    | ④ | 10.1 | 11.1 | 22.9 | 25.1 | 14.7 | 16.0 | 6.7 | 7.3 |
| ⑤    | ⑤ | 10.1 | 11.1 | 22.9 | 25.1 | 14.7 | 16.0 | 6.7 | 7.3 |
| ⑥    | ⑥ | 8.2  | 9.9  | 18.5 | 22.1 | 11.7 | 14.0 | 5.3 | 6.4 |
| ⑦    | ⑦ | 8.2  | 9.9  | 18.5 | 22.1 | 11.7 | 14.0 | 5.3 | 6.4 |
| ⑧    | ⑧ | 10.1 | 11.1 | 22.9 | 25.1 | 14.7 | 16.0 | 6.7 | 7.3 |
| ⑨    | ⑨ | 10.1 | 11.1 | 22.9 | 25.1 | 14.7 | 16.0 | 6.7 | 7.3 |
| ⑩    | ⑩ | 10.1 | 11.1 | 22.9 | 25.1 | 14.7 | 16.0 | 6.7 | 7.3 |
| ⑪    | ⑪ | 4.9  | 7.4  | 11.1 | 16.6 | 7.0  | 10.5 | 3.2 | 4.8 |
| ⑫    | ⑫ | 4.9  | 7.4  | 11.1 | 16.6 | 7.0  | 10.5 | 3.2 | 4.8 |

### BENDING MOMENTS Mu (k-ft)

| Comb |   |    |     |   |     |    |   |    |  |
|------|---|----|-----|---|-----|----|---|----|--|
| ①    | 0 | 52 | -51 | 2 | -11 | 15 | 0 | OK |  |
| ②    | 0 | 62 | -62 | 2 | -15 | 19 | 0 | OK |  |
| ③    | 0 | 62 | -62 | 2 | -15 | 19 | 0 | OK |  |
| ④    | 0 | 50 | -49 | 2 | -11 | 15 | 0 | OK |  |
| ⑤    | 0 | 50 | -49 | 2 | -11 | 15 | 0 | OK |  |
| ⑥    | 0 | 45 | -44 | 2 | -10 | 13 | 0 | OK |  |
| ⑦    | 0 | 45 | -44 | 2 | -10 | 13 | 0 | OK |  |
| ⑧    | 0 | 50 | -49 | 2 | -11 | 15 | 0 | OK |  |
| ⑨    | 0 | 50 | -49 | 2 | -11 | 15 | 0 | OK |  |
| ⑩    | 0 | 50 | -49 | 2 | -11 | 15 | 0 | OK |  |
| ⑪    | 0 | 33 | -33 | 1 | -7  | 10 | 0 | OK |  |
| ⑫    | 0 | 33 | -33 | 1 | -7  | 10 | 0 | OK |  |

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**CONCRETE BEAM DESIGN**

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**SHEAR FORCES  $V_u$  (kip)**

| Comb |      |       |      |      |     |      |    |
|------|------|-------|------|------|-----|------|----|
| ①    | 9.8  | -11.3 | 9.4  | -3.1 | 5.9 | -3.5 | OK |
| ②    | 11.7 | -13.8 | 11.5 | -3.9 | 7.4 | -4.4 | OK |
| ③    | 11.7 | -13.8 | 11.5 | -3.9 | 7.4 | -4.4 | OK |
| ④    | 9.4  | -11.0 | 9.2  | -3.1 | 5.8 | -3.4 | OK |
| ⑤    | 9.4  | -11.0 | 9.2  | -3.1 | 5.8 | -3.4 | OK |
| ⑥    | 8.4  | -9.7  | 8.1  | -2.7 | 5.1 | -3.0 | OK |
| ⑦    | 8.4  | -9.7  | 8.1  | -2.7 | 5.1 | -3.0 | OK |
| ⑧    | 9.4  | -11.0 | 9.2  | -3.1 | 5.8 | -3.4 | OK |
| ⑨    | 9.4  | -11.0 | 9.2  | -3.1 | 5.8 | -3.4 | OK |
| ⑩    | 9.4  | -11.0 | 9.2  | -3.1 | 5.8 | -3.4 | OK |
| ⑪    | 6.3  | -7.3  | 6.1  | -2.0 | 3.8 | -2.2 | OK |
| ⑫    | 6.3  | -7.3  | 6.1  | -2.0 | 3.8 | -2.2 | OK |

**BENDING STRENGTH (k-ft)**

| Bot         | 2#6 Cont     |      | 2#6 Cont     |      | 2#6 Cont    |      |                 |
|-------------|--------------|------|--------------|------|-------------|------|-----------------|
| Bot         | 0#5x10.00 ft |      | 0#5x10.00 ft |      | 0#5x7.50 ft |      |                 |
| d           | 2.0          | 4.0  | 2.0          | 4.0  | 2.0         | 4.0  | in              |
| +As         | 0.88         | 0.88 | 0.88         | 0.88 | 0.88        | 0.88 | in <sup>2</sup> |
| c/d         | 0.10         | 0.10 | 0.10         | 0.10 | 0.10        | 0.10 |                 |
| + $\phi$ Mn | 83           | 83   | 83           | 83   | 83          | 83   |                 |
| Top         | 2#6 Cont     |      | 2#6 Cont     |      | 2#6 Cont    |      |                 |
| Top         | 0#5          |      | 0#5          |      | 0#5         |      |                 |
| d'          | 4.0          | 2.0  | 4.0          | 2.0  | 4.0         | 2.0  | in              |
| -As         | 0.88         | 0.88 | 0.88         | 0.88 | 0.88        | 0.88 | in <sup>2</sup> |
| c/d         | 0.10         | 0.10 | 0.10         | 0.10 | 0.10        | 0.10 |                 |
| - $\phi$ Mn | -83          | -83  | -83          | -83  | -83         | -83  |                 |
| As min      | 0.00         | 0.59 | 0.59         | 0.03 | 0.21        | 0.27 | in <sup>2</sup> |

**SHEAR STRENGTH (kip, in)**

| $\phi V_c$ | 16.7  | -16.7 | 16.7  | -16.7 | 16.7  | -16.7 |    |
|------------|-------|-------|-------|-------|-------|-------|----|
| $\phi V_s$ | 27.2  | -27.2 | 27.2  | -27.2 | 27.2  | -27.2 |    |
| $\phi V_n$ | 43.9  | -43.9 | 43.9  | -43.9 | 43.9  | -43.9 |    |
| Av/s       | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | OK |
| Min Av/s   | 0.007 | N.A.  | 0.007 | N.A.  | N.A.  | N.A.  |    |
| s          | 8.0   | 8.0   | 8.0   | 8.0   | 8.0   | 8.0   | OK |
| s max      | 11.0  | 11.0  | N.A.  | 11.0  | 11.0  | N.A.  |    |



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## CONCRETE BEAM DESIGN

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### DEFLECTIONS

| Comb      |       |        |        |     |
|-----------|-------|--------|--------|-----|
| D         | 0.07  | 0.00   | 0.00   | in  |
| L         | 0.08  | 0.00   | 0.00   | in  |
| Lr, S     | 0.00  | 0.00   | 0.00   | in  |
| LS        | 0.02  | 0.00   | 0.00   | in  |
| LT        | 0.24  | 0.00   | 0.01   | in  |
| Ieff D    | 8,912 | 10,271 | 10,456 | in4 |
| Ieff L    | 5,378 | 9,702  | 10,456 | in4 |
| Ieff LS   | 7,433 | 10,030 | 10,456 | in4 |
| $\lambda$ | 1.60  | 1.60   | 1.60   |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### REINFORCEMENT

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.67 | OK |
| Max. Steel Area As max Ratio ....   | 0.22 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.41 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.24 | OK |
| Stirrups Spacing s max Ratio .....  | 0.73 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

### MATERIALS

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

### DESIGN CODES

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 3038 | 360    | 0.12  | OK |
| C    | Long-Term | 1083 | 480    | 0.44  | OK |
| D    | Long-Term | 1083 | 240    | 0.22  | OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM G

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

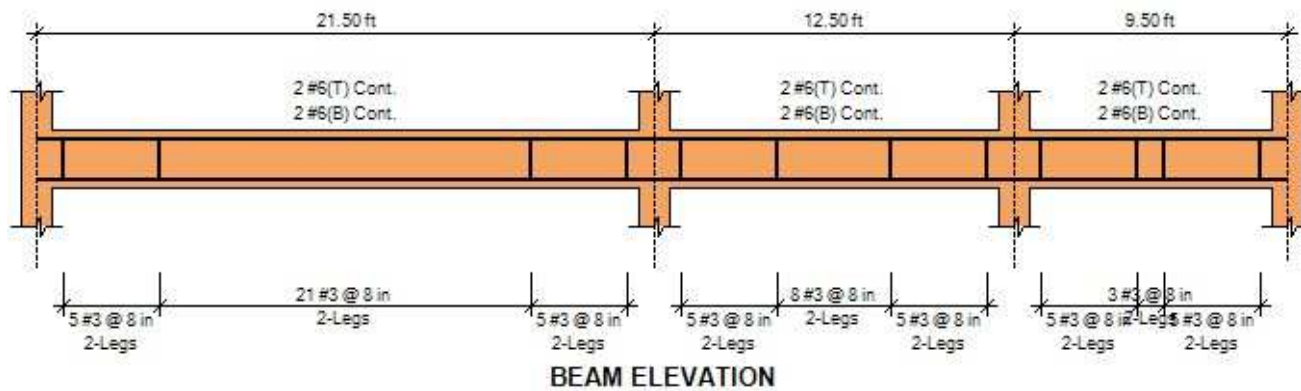
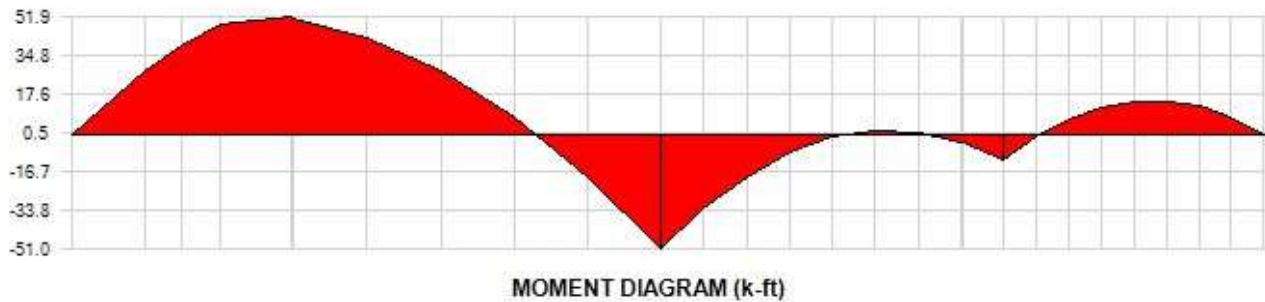
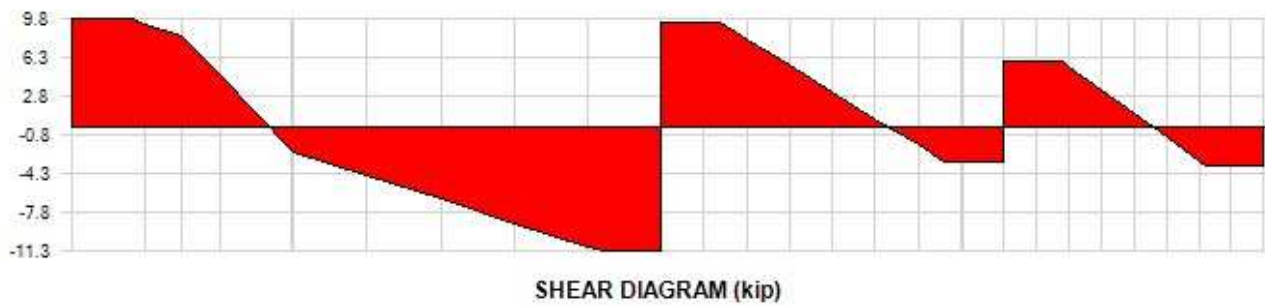
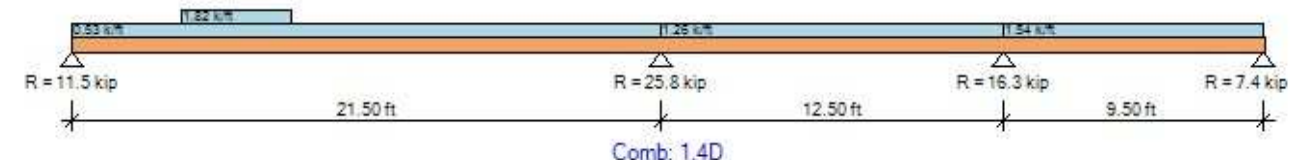
www.asdipsoft.com

### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 2.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 21.50 ft | ①       | Pinned |
| ②                        | 12.50 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |     |      |
|------|---|------|------|------|------|-----|------|
| ①    | ① | 10.6 | 11.5 | 25.3 | 26.7 | 8.3 | 8.7  |
| ②    | ② | 8.2  | 13.8 | 19.1 | 32.8 | 6.2 | 10.8 |
| ③    | ③ | 8.2  | 13.8 | 19.1 | 32.8 | 6.2 | 10.8 |
| ④    | ④ | 10.0 | 11.1 | 23.7 | 26.0 | 7.8 | 8.5  |
| ⑤    | ⑤ | 10.0 | 11.1 | 23.7 | 26.0 | 7.8 | 8.5  |
| ⑥    | ⑥ | 8.2  | 9.8  | 19.1 | 22.9 | 6.2 | 7.5  |
| ⑦    | ⑦ | 8.2  | 9.8  | 19.1 | 22.9 | 6.2 | 7.5  |
| ⑧    | ⑧ | 10.0 | 11.1 | 23.7 | 26.0 | 7.8 | 8.5  |
| ⑨    | ⑨ | 10.0 | 11.1 | 23.7 | 26.0 | 7.8 | 8.5  |
| ⑩    | ⑩ | 10.0 | 11.1 | 23.7 | 26.0 | 7.8 | 8.5  |
| ⑪    | ⑪ | 4.9  | 7.4  | 11.4 | 17.2 | 3.7 | 5.6  |
| ⑫    | ⑫ | 4.9  | 7.4  | 11.4 | 17.2 | 3.7 | 5.6  |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |    |     |   |    |    |
|------|---|----|-----|---|----|----|
| ①    | 0 | 51 | -53 | 7 | -3 | OK |
| ②    | 0 | 61 | -64 | 9 | -4 | OK |
| ③    | 0 | 61 | -64 | 9 | -4 | OK |
| ④    | 0 | 49 | -51 | 7 | -3 | OK |
| ⑤    | 0 | 49 | -51 | 7 | -3 | OK |
| ⑥    | 0 | 44 | -45 | 6 | -3 | OK |
| ⑦    | 0 | 44 | -45 | 6 | -3 | OK |
| ⑧    | 0 | 49 | -51 | 7 | -3 | OK |
| ⑨    | 0 | 49 | -51 | 7 | -3 | OK |
| ⑩    | 0 | 49 | -51 | 7 | -3 | OK |
| ⑪    | 0 | 33 | -34 | 5 | -2 | OK |
| ⑫    | 0 | 33 | -34 | 5 | -2 | OK |

## SHEAR FORCES Vu (kip)

| Comb |      |       |      |      |     |    |
|------|------|-------|------|------|-----|----|
| ①    | 9.7  | -11.4 | 10.2 | -2.3 | 0.0 | OK |
| ②    | 11.6 | -13.9 | 12.6 | -2.9 | 0.0 | OK |
| ③    | 11.6 | -13.9 | 12.6 | -2.9 | 0.0 | OK |
| ④    | 9.3  | -11.1 | 10.0 | -2.3 | 0.0 | OK |
| ⑤    | 9.3  | -11.1 | 10.0 | -2.3 | 0.0 | OK |
| ⑥    | 8.3  | -9.8  | 8.8  | -2.0 | 0.0 | OK |
| ⑦    | 8.3  | -9.8  | 8.8  | -2.0 | 0.0 | OK |
| ⑧    | 9.3  | -11.1 | 10.0 | -2.3 | 0.0 | OK |
| ⑨    | 9.3  | -11.1 | 10.0 | -2.3 | 0.0 | OK |
| ⑩    | 9.3  | -11.1 | 10.0 | -2.3 | 0.0 | OK |
| ⑪    | 6.2  | -7.3  | 6.6  | -1.5 | 0.0 | OK |
| ⑫    | 6.2  | -7.3  | 6.6  | -1.5 | 0.0 | OK |

**BENDING STRENGTH (k-ft)**

|        |              |      |              |      |                      |
|--------|--------------|------|--------------|------|----------------------|
| Bot    | 2#6 Cont     |      | 2#6 Cont     |      |                      |
| Bot    | 0#5x10.00 ft |      | 0#5x10.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.88         | 0.88 | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.10         | 0.10 | 0.10         | 0.10 | 0.10                 |
| +φMn   | 83           | 83   | 83           | 83   | 83                   |
| Top    | 2#6 Cont     |      | 2#6 Cont     |      |                      |
| Top    | 0#5          |      | 0#5          |      | 0#5                  |
| d'     | 4.0          | 2.0  | 4.0          | 2.0  | 4.0 in               |
| -As    | 0.88         | 0.88 | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.10         | 0.10 | 0.10         | 0.10 | 0.10                 |
| -φMn   | -83          | -83  | -83          | -83  | -83                  |
| As min | 0.00         | 0.59 | 0.59         | 0.13 | 0.05 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |        |        |                 |
|---------------------|-------|--------|--------|-----------------|
| Comb                |       |        |        |                 |
| D                   | 0.07  | 0.00   | 0.00   | in              |
| L                   | 0.08  | 0.00   | 0.00   | in              |
| Lr, S               | 0.00  | 0.00   | 0.00   | in              |
| LS                  | 0.02  | 0.00   | 0.00   | in              |
| LT                  | 0.23  | 0.00   | 0.00   | in              |
| I <sub>eff</sub> D  | 9,010 | 10,184 | 10,456 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 5,427 | 9,662  | 10,456 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 7,511 | 9,962  | 10,456 | in <sup>4</sup> |
| λ                   | 1.60  | 1.60   | 2.00   |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |       |       |           |
|----------|-------|-------|-------|-------|-----------|
| φVc      | 16.7  | -16.7 | 16.7  | -16.7 | 16.7      |
| φVs      | 27.2  | -27.2 | 27.2  | -27.2 | 27.2      |
| φVn      | 43.9  | -43.9 | 43.9  | -43.9 | 43.9      |
| Av/s     | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 OK  |
| Min Av/s | 0.007 | N.A.  | 0.007 | N.A.  | N.A.      |
| s        | 8.0   | 8.0   | 8.0   | 8.0   | 8.0 OK    |
| s max    | 11.0  | 11.0  | N.A.  | 11.0  | 11.0 N.A. |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.67 | OK |
| Max. Steel Area As max Ratio ....   | 0.22 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.24 | OK |
| Stirrups Spacing s max Ratio .....  | 0.73 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 3130 | 360    | 0.12  | OK |
| C    | Long-Term | 1116 | 480    | 0.43  | OK |
| D    | Long-Term | 1116 | 240    | 0.21  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |



Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: SECOND FLOOR BEAM G-2 SPANS

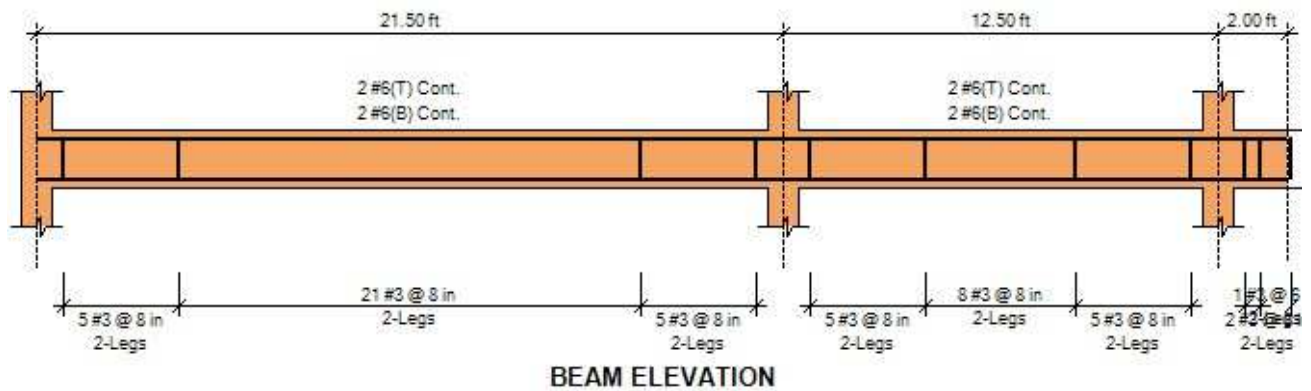
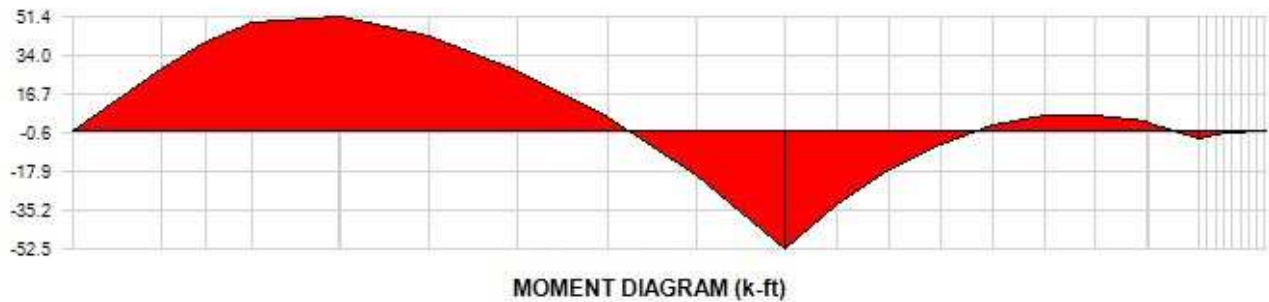
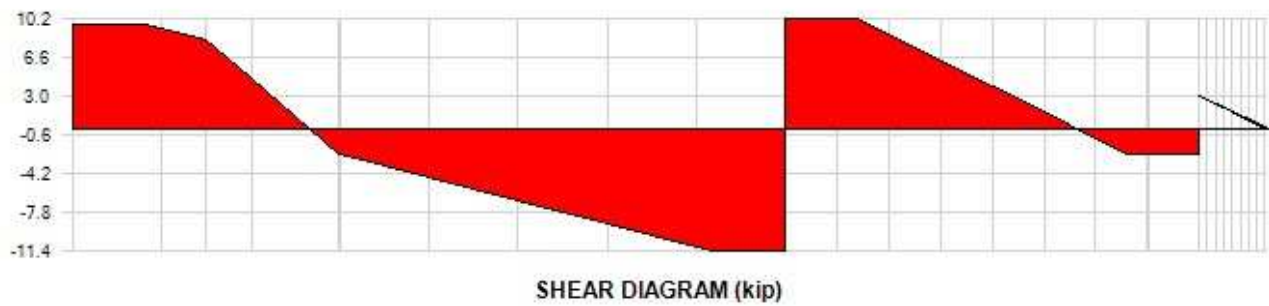
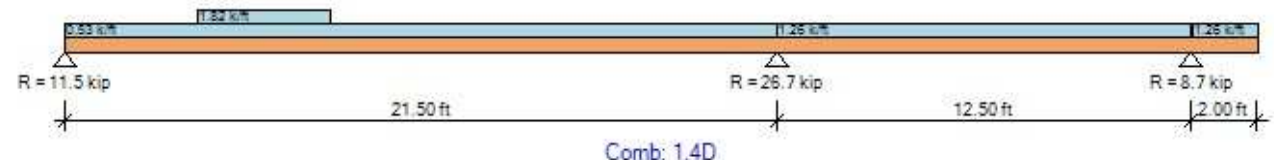
ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 12.0          | in |
| Beam Width b           | 24.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 21.50 ft | ①       | Pinned |
| ②                        | 12.00 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |     |      |      |      |     |     |
|------|---|-----|------|------|------|-----|-----|
| ①    | ① | 8.7 | 0.0  | 22.4 | 0.0  | 2.4 | 0.0 |
| ②    | ② | 0.0 | 14.0 | 0.0  | 35.9 | 0.0 | 3.8 |
| ③    | ③ | 0.0 | 14.0 | 0.0  | 35.9 | 0.0 | 3.8 |
| ④    | ④ | 6.6 | 4.4  | 16.8 | 11.2 | 1.8 | 1.2 |
| ⑤    | ⑤ | 6.6 | 4.4  | 16.8 | 11.2 | 1.8 | 1.2 |
| ⑥    | ⑥ | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 |
| ⑦    | ⑦ | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 |
| ⑧    | ⑧ | 6.6 | 4.4  | 16.8 | 11.2 | 1.8 | 1.2 |
| ⑨    | ⑨ | 6.6 | 4.4  | 16.8 | 11.2 | 1.8 | 1.2 |
| ⑩    | ⑩ | 6.6 | 4.4  | 16.8 | 11.2 | 1.8 | 1.2 |
| ⑪    | ⑪ | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 |
| ⑫    | ⑫ | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |    |     |   |    |    |
|------|---|----|-----|---|----|----|
| ①    | 0 | 0  | 0   | 0 | 0  | OK |
| ②    | 0 | 61 | -70 | 4 | -6 | OK |
| ③    | 0 | 61 | -70 | 4 | -6 | OK |
| ④    | 0 | 19 | -22 | 1 | -2 | OK |
| ⑤    | 0 | 19 | -22 | 1 | -2 | OK |
| ⑥    | 0 | 0  | 0   | 0 | 0  | OK |
| ⑦    | 0 | 0  | 0   | 0 | 0  | OK |
| ⑧    | 0 | 19 | -22 | 1 | -2 | OK |
| ⑨    | 0 | 19 | -22 | 1 | -2 | OK |
| ⑩    | 0 | 19 | -22 | 1 | -2 | OK |
| ⑪    | 0 | 0  | 0   | 0 | 0  | OK |
| ⑫    | 0 | 0  | 0   | 0 | 0  | OK |

## SHEAR FORCES Vu (kip)

| Comb |      |       |      |      |    |
|------|------|-------|------|------|----|
| ①    | 0.0  | 0.0   | 0.0  | 0.0  | OK |
| ②    | 12.0 | -18.5 | 13.5 | -1.8 | OK |
| ③    | 12.0 | -18.5 | 13.5 | -1.8 | OK |
| ④    | 3.8  | -5.8  | 4.2  | -0.6 | OK |
| ⑤    | 3.8  | -5.8  | 4.2  | -0.6 | OK |
| ⑥    | 0.0  | 0.0   | 0.0  | 0.0  | OK |
| ⑦    | 0.0  | 0.0   | 0.0  | 0.0  | OK |
| ⑧    | 3.8  | -5.8  | 4.2  | -0.6 | OK |
| ⑨    | 3.8  | -5.8  | 4.2  | -0.6 | OK |
| ⑩    | 3.8  | -5.8  | 4.2  | -0.6 | OK |
| ⑪    | 0.0  | 0.0   | 0.0  | 0.0  | OK |
| ⑫    | 0.0  | 0.0   | 0.0  | 0.0  | OK |

**BENDING STRENGTH (k-ft)**

|        |              |      |              |      |                      |
|--------|--------------|------|--------------|------|----------------------|
| Bot    | 3#7 Cont     |      | 3#7 Cont     |      |                      |
| Bot    | 0#5x10.00 ft |      | 0#5x10.00 ft |      |                      |
| d      | 1.3          | 4.0  | 1.3          | 4.0  | 1.3 in               |
| +As    | 1.80         | 1.80 | 1.80         | 1.80 | 1.80 in <sup>2</sup> |
| c/d    | 0.13         | 0.13 | 0.13         | 0.13 | 0.13                 |
| +φMn   | 81           | 81   | 81           | 81   | 81                   |
| Top    | 3#7 Cont     |      | 3#7 Cont     |      |                      |
| Top    | 0#5          |      | 0#5          |      | 0#5                  |
| d'     | 4.0          | 1.3  | 4.0          | 1.3  | 4.0 in               |
| -As    | 1.80         | 1.80 | 1.80         | 1.80 | 1.80 in <sup>2</sup> |
| c/d    | 0.13         | 0.13 | 0.13         | 0.13 | 0.13                 |
| -φMn   | -81          | -81  | -81          | -81  | -81                  |
| As min | 0.00         | 0.86 | 0.86         | 0.13 | 0.19 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |       |                 |
|---------------------|-------|-------|-----------------|
| Comb                |       |       |                 |
| D                   | 0.00  | 0.00  | in              |
| L                   | 0.36  | 0.00  | in              |
| Lr, S               | 0.00  | 0.00  | in              |
| LS                  | 0.06  | 0.00  | in              |
| LT                  | 0.44  | 0.00  | in              |
| I <sub>eff</sub> D  | 4,016 | 4,016 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 2,035 | 3,678 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 4,016 | 4,016 | in <sup>4</sup> |
| λ                   | 1.48  | 1.48  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |       |       |
|----------|-------|-------|-------|-------|
| φVc      | 24.4  | -24.4 | 24.4  | -24.4 |
| φVs      | 26.5  | -26.5 | 53.0  | -53.0 |
| φVn      | 50.8  | -50.8 | 77.3  | -77.3 |
| Av/s     | 0.055 | 0.055 | 0.110 | 0.110 |
| Min Av/s | N.A.  | N.A.  | 0.020 | N.A.  |
| s        | 4.0   | 10.0  | 4.0   | 10.0  |
| s max    | N.A.  | 5.0   | N.A.  | 5.0   |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.48 | OK |
| Max. Steel Area As max Ratio ....   | 0.29 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.12 | OK |
| Rebars Max Spacing Smax Ratio       | 0.78 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio .....  | 0.80 | OK |
| Stirrups Min. # of Legs Ratio ..... | 2.06 | NG |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 713  | 360    | 0.51  | OK |
| C    | Long-Term | 581  | 480    | 0.83  | OK |
| D    | Long-Term | 581  | 240    | 0.41  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: SECOND FLOOR BEAM H-FOR WIND

ASDIP Concrete 5.4.2.2

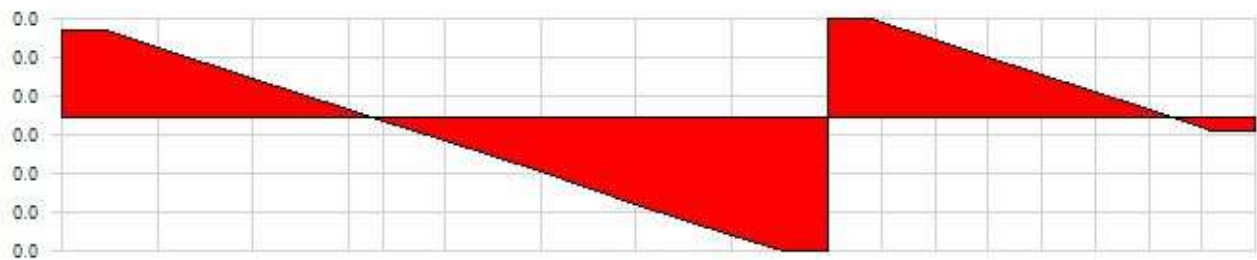
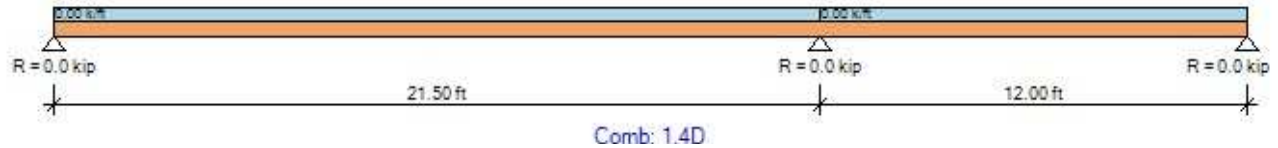
**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |     |     |    |
|------|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | OK |

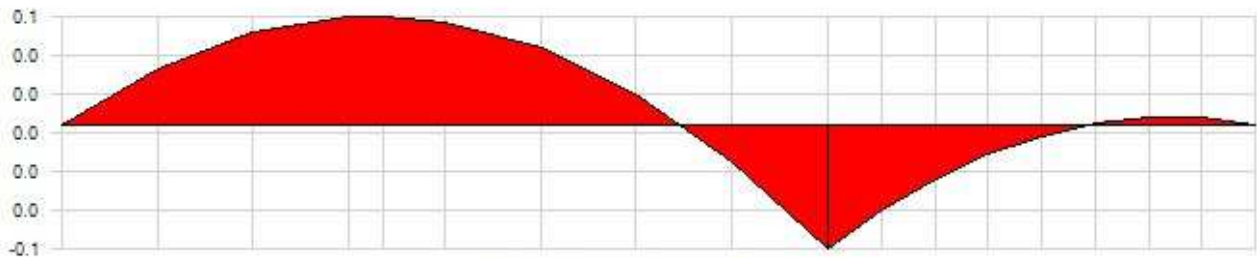
**TORSION STRENGTH (k-ft)**

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | OK |

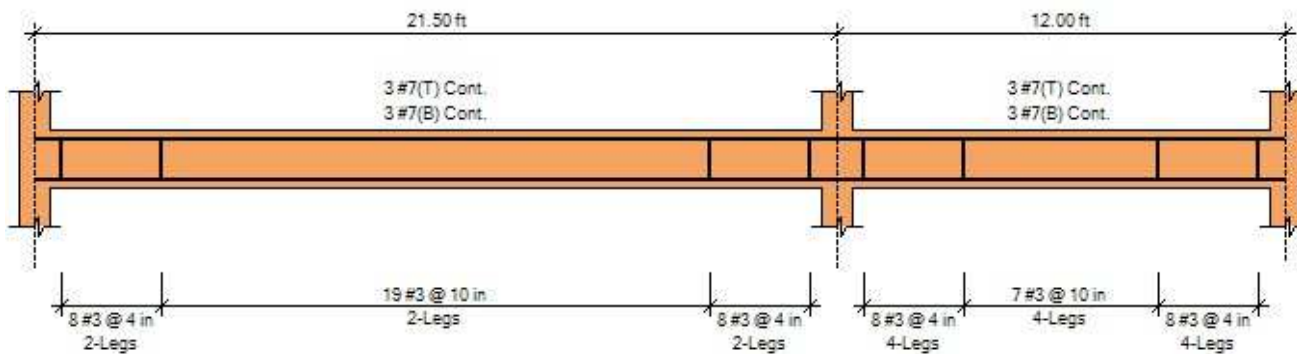




SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM J

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 9.00 ft  | ①       | Pinned |
| ②                        | 12.00 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |     |     |      |      |      |      |
|------|---|-----|-----|------|------|------|------|
| ①    | ① | 2.3 | 2.5 | 34.3 | 42.3 | 14.6 | 18.2 |
| ②    | ② | 1.8 | 2.9 | 30.2 | 42.8 | 13.0 | 18.2 |
| ③    | ③ | 1.8 | 2.9 | 30.2 | 42.8 | 13.0 | 18.2 |
| ④    | ④ | 2.2 | 2.4 | 33.3 | 38.3 | 14.2 | 16.4 |
| ⑤    | ⑤ | 2.2 | 2.4 | 33.3 | 38.3 | 14.2 | 16.4 |
| ⑥    | ⑥ | 1.8 | 2.2 | 30.2 | 36.3 | 13.0 | 15.6 |
| ⑦    | ⑦ | 1.8 | 2.2 | 30.2 | 36.3 | 13.0 | 15.6 |
| ⑧    | ⑧ | 2.2 | 2.4 | 33.3 | 38.3 | 14.2 | 16.4 |
| ⑨    | ⑨ | 2.2 | 2.4 | 33.3 | 38.3 | 14.2 | 16.4 |
| ⑩    | ⑩ | 2.2 | 2.4 | 33.3 | 38.3 | 14.2 | 16.4 |
| ⑪    | ⑪ | 1.1 | 1.6 | 18.1 | 27.2 | 7.8  | 11.7 |
| ⑫    | ⑫ | 1.1 | 1.6 | 18.1 | 27.2 | 7.8  | 11.7 |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |   |   |     |    |   |    |
|------|---|---|-----|----|---|----|
| ①    | 0 | 2 | -34 | 48 | 0 | OK |
| ②    | 0 | 3 | -35 | 48 | 0 | OK |
| ③    | 0 | 3 | -35 | 48 | 0 | OK |
| ④    | 0 | 2 | -31 | 43 | 0 | OK |
| ⑤    | 0 | 2 | -31 | 43 | 0 | OK |
| ⑥    | 0 | 2 | -29 | 41 | 0 | OK |
| ⑦    | 0 | 2 | -29 | 41 | 0 | OK |
| ⑧    | 0 | 2 | -31 | 43 | 0 | OK |
| ⑨    | 0 | 2 | -31 | 43 | 0 | OK |
| ⑩    | 0 | 2 | -31 | 43 | 0 | OK |
| ⑪    | 0 | 1 | -22 | 31 | 0 | OK |
| ⑫    | 0 | 1 | -22 | 31 | 0 | OK |

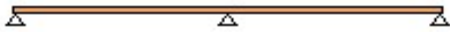
### SHEAR FORCES Vu (kip)

| Comb |      |       |      |       |    |
|------|------|-------|------|-------|----|
| ①    | -0.5 | -9.6  | 12.4 | -15.1 | OK |
| ②    | -0.4 | -10.2 | 12.8 | -14.9 | OK |
| ③    | -0.4 | -10.2 | 12.8 | -14.9 | OK |
| ④    | -0.4 | -8.9  | 11.3 | -13.6 | OK |
| ⑤    | -0.4 | -8.9  | 11.3 | -13.6 | OK |
| ⑥    | -0.4 | -8.2  | 10.6 | -13.0 | OK |
| ⑦    | -0.4 | -8.2  | 10.6 | -13.0 | OK |
| ⑧    | -0.4 | -8.9  | 11.3 | -13.6 | OK |
| ⑨    | -0.4 | -8.9  | 11.3 | -13.6 | OK |
| ⑩    | -0.4 | -8.9  | 11.3 | -13.6 | OK |
| ⑪    | -0.3 | -6.2  | 8.0  | -9.7  | OK |
| ⑫    | -0.3 | -6.2  | 8.0  | -9.7  | OK |

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## CONCRETE BEAM DESIGN

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| BENDING STRENGTH (k-ft)                                                           |             |      |             |      |                      |
|-----------------------------------------------------------------------------------|-------------|------|-------------|------|----------------------|
|  |             |      |             |      |                      |
| Bot                                                                               | 2#5 Cont    |      | 2#5 Cont    |      |                      |
| Bot                                                                               | 0#5x7.00 ft |      | 0#5x7.00 ft |      |                      |
| d                                                                                 | 2.0         | 4.0  | 2.0         | 4.0  | 2.0 in               |
| +As                                                                               | 0.62        | 0.62 | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d                                                                               | 0.08        | 0.08 | 0.08        | 0.08 | 0.08                 |
| +φMn                                                                              | 60          | 60   | 60          | 60   | 60                   |
| Top                                                                               | 2#5 Cont    |      | 2#5 Cont    |      |                      |
| Top                                                                               | 0#5         |      | 0#5         |      | 0#5                  |
| d'                                                                                | 4.0         | 2.0  | 4.0         | 2.0  | 4.0 in               |
| -As                                                                               | 0.62        | 0.62 | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d                                                                               | 0.08        | 0.08 | 0.08        | 0.08 | 0.08                 |
| -φMn                                                                              | -60         | -60  | -60         | -60  | -60                  |
| As min                                                                            | 0.00        | 0.04 | 0.51        | 0.59 | 0.00 in <sup>2</sup> |

| DEFLECTIONS                                                                         |        |       |                 |
|-------------------------------------------------------------------------------------|--------|-------|-----------------|
|  |        |       |                 |
| Comb                                                                                |        |       |                 |
| D                                                                                   | 0.00   | 0.02  | in              |
| L                                                                                   | 0.00   | 0.01  | in              |
| Lr, S                                                                               | 0.00   | 0.00  | in              |
| LS                                                                                  | 0.00   | 0.00  | in              |
| LT                                                                                  | 0.00   | 0.04  | in              |
| Ieff D                                                                              | 10,090 | 9,379 | in <sup>4</sup> |
| Ieff L                                                                              | 10,090 | 7,593 | in <sup>4</sup> |
| Ieff LS                                                                             | 10,090 | 8,758 | in <sup>4</sup> |
| λ                                                                                   | 1.70   | 1.70  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

| DESIGN CODES            |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

| SHEAR STRENGTH (kip, in)                                                           |       |       |       |       |             |
|------------------------------------------------------------------------------------|-------|-------|-------|-------|-------------|
|  |       |       |       |       |             |
| φVc                                                                                | 16.7  | -16.7 | 16.7  | -16.7 |             |
| φVs                                                                                | 21.8  | -21.8 | 21.8  | -21.8 |             |
| φVn                                                                                | 38.5  | -38.5 | 38.5  | -38.5 |             |
| Av/s                                                                               | 0.022 | 0.022 | 0.022 | 0.022 | OK          |
| Min Av/s                                                                           | N.A.  | N.A.  | 0.007 | N.A.  |             |
| s                                                                                  | 10.0  | 6.0   | 10.0  | 10.0  | 6.0 10.0 OK |
| s max                                                                              | N.A.  | N.A.  | N.A.  | 11.0  | 11.0 N.A.   |

| REINFORCEMENT                       |         |
|-------------------------------------|---------|
| Min. Steel Area As min Ratio .....  | 0.95 OK |
| Max. Steel Area As max Ratio ....   | 0.17 OK |
| Rebars Min Spacing Smin Ratio ..    | 0.50 OK |
| Rebars Max Spacing Smax Ratio       | 0.26 OK |
| Shear Vs/Vs max Ratio .....         | 0.33 OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.30 OK |
| Stirrups Spacing s max Ratio .....  | 0.91 OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 OK |

| MAX. DEFLECTIONS L/δ |           |      |        |         |
|----------------------|-----------|------|--------|---------|
| Type                 | Load      | L/δ  | Allow. | Ratio   |
| A                    | Lr, S, W  | 9999 | 180    | 0.00 OK |
| B                    | Live Load | 9999 | 360    | 0.02 OK |
| C                    | Long-Term | 3449 | 480    | 0.14 OK |
| D                    | Long-Term | 3449 | 240    | 0.07 OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

| MATERIALS                      |                |
|--------------------------------|----------------|
| Concrete Strength f'c .....    | 4.0 ksi        |
| Compression Strain Limit ..... | 0.003          |
| Concrete density .....         | 150 pcf        |
| Concrete Stress-Strain .....   | Hognestad      |
| Rebar Steel Strength fy .....  | 60.0 ksi       |
| Steel Stress-Strain .....      | Elasto-plastic |

Project: CASA PA' FERNANDZ  
Engineer:  
Descrip: SECOND FLOOR BEAM J

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## CONCRETE BEAM DESIGN

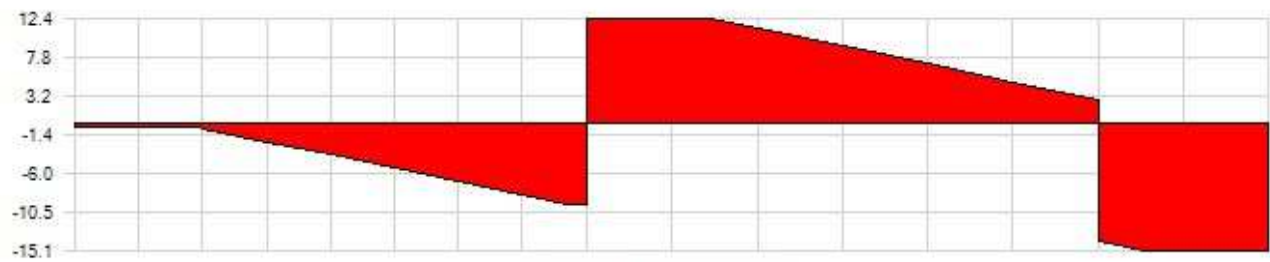
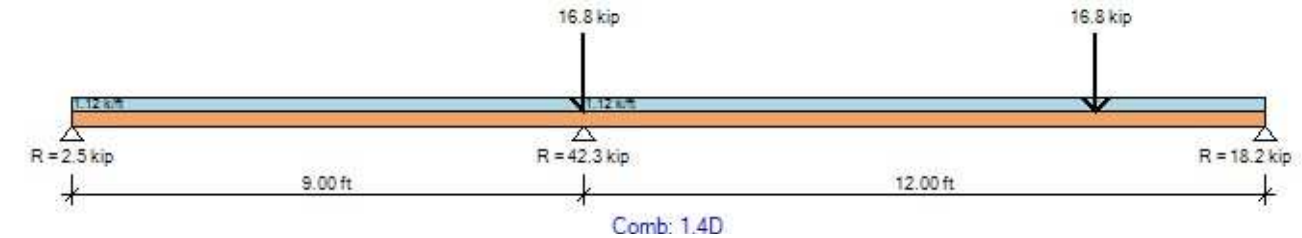
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### TORSION MOMENTS $T_u$ (k-ft)

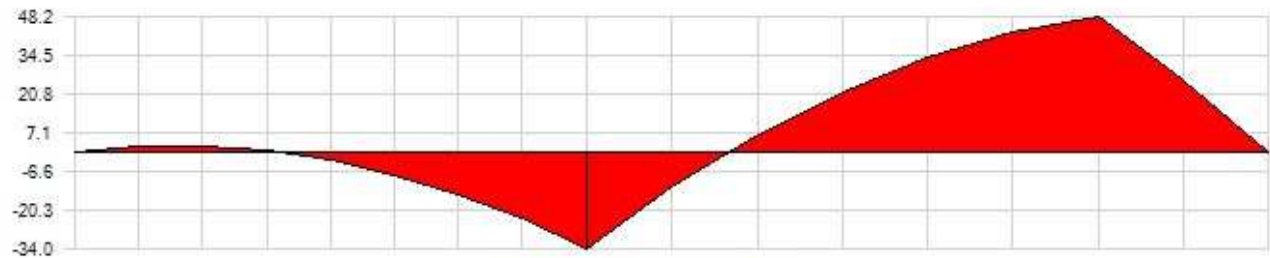
| Comb |     |     |     |     |    |
|------|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

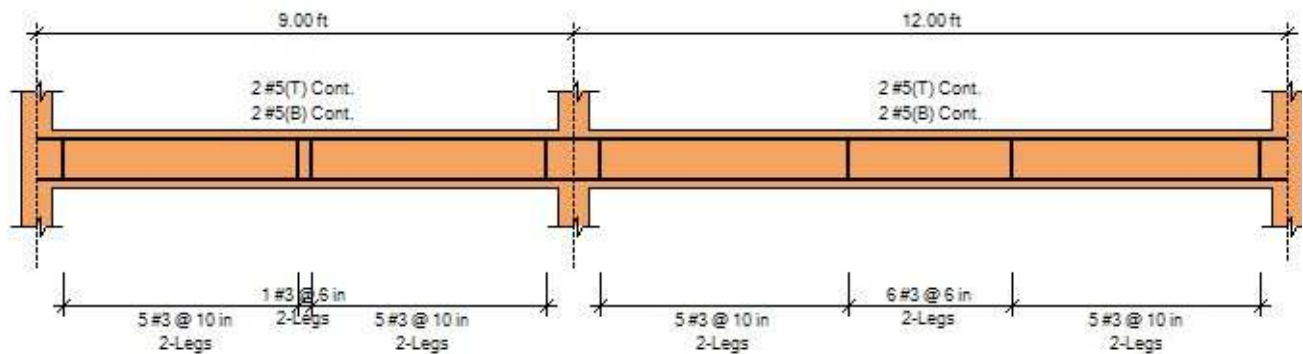
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION



## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 12.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 2.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 22.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 22.0 | 24.6 | 22.6 | 25.5 |
| ②    | ② | 17.6 | 28.1 | 18.2 | 28.9 |
| ③    | ③ | 17.6 | 28.1 | 18.2 | 28.9 |
| ④    | ④ | 20.9 | 23.3 | 21.5 | 24.1 |
| ⑤    | ⑤ | 20.9 | 23.3 | 21.5 | 24.1 |
| ⑥    | ⑥ | 17.6 | 21.1 | 18.2 | 21.9 |
| ⑦    | ⑦ | 17.6 | 21.1 | 18.2 | 21.9 |
| ⑧    | ⑧ | 20.9 | 23.3 | 21.5 | 24.1 |
| ⑨    | ⑨ | 20.9 | 23.3 | 21.5 | 24.1 |
| ⑩    | ⑩ | 20.9 | 23.3 | 21.5 | 24.1 |
| ⑪    | ⑪ | 10.5 | 15.8 | 10.9 | 16.4 |
| ⑫    | ⑫ | 10.5 | 15.8 | 10.9 | 16.4 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |     |    |    |  |
|------|---|-----|----|----|--|
| ①    | 0 | 135 | -1 | OK |  |
| ②    | 0 | 155 | -1 | OK |  |
| ③    | 0 | 155 | -1 | OK |  |
| ④    | 0 | 128 | -1 | OK |  |
| ⑤    | 0 | 128 | -1 | OK |  |
| ⑥    | 0 | 116 | -1 | OK |  |
| ⑦    | 0 | 116 | -1 | OK |  |
| ⑧    | 0 | 128 | -1 | OK |  |
| ⑨    | 0 | 128 | -1 | OK |  |
| ⑩    | 0 | 128 | -1 | OK |  |
| ⑪    | 0 | 87  | -1 | OK |  |
| ⑫    | 0 | 87  | -1 | OK |  |

## SHEAR FORCES Vu (kip)

| Comb |      |       |     |    |  |
|------|------|-------|-----|----|--|
| ①    | 19.7 | -19.8 | 0.0 | OK |  |
| ②    | 22.6 | -22.6 | 0.0 | OK |  |
| ③    | 22.6 | -22.6 | 0.0 | OK |  |
| ④    | 18.7 | -18.8 | 0.0 | OK |  |
| ⑤    | 18.7 | -18.8 | 0.0 | OK |  |
| ⑥    | 16.9 | -17.0 | 0.0 | OK |  |
| ⑦    | 16.9 | -17.0 | 0.0 | OK |  |
| ⑧    | 18.7 | -18.8 | 0.0 | OK |  |
| ⑨    | 18.7 | -18.8 | 0.0 | OK |  |
| ⑩    | 18.7 | -18.8 | 0.0 | OK |  |
| ⑪    | 12.7 | -12.7 | 0.0 | OK |  |
| ⑫    | 12.7 | -12.7 | 0.0 | OK |  |

**BENDING STRENGTH (k-ft)**

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 4#7 Cont    |      |                      |
| Bot    | 0#5x7.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0 in               |
| +As    | 2.40        | 2.40 | 2.40 in <sup>2</sup> |
| c/d    | 0.13        | 0.13 | 0.13                 |
| +φMn   | 222         | 222  | 222                  |
| Top    | 4#7 Cont    |      |                      |
| Top    | 0#5         |      |                      |
| d'     | 4.0         | 2.0  | 4.0 in               |
| -As    | 2.40        | 2.40 | 2.40 in <sup>2</sup> |
| c/d    | 0.13        | 0.13 | 0.13                 |
| -φMn   | -222        | -222 | -222                 |
| As min | 0.00        | 0.88 | 0.01 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |        |                 |
|---------------------|-------|--------|-----------------|
| Comb                |       |        |                 |
| D                   | 0.24  | -0.04  | in              |
| L                   | 0.09  | -0.01  | in              |
| Lr, S               | 0.00  | 0.00   | in              |
| LS                  | 0.03  | 0.00   | in              |
| LT                  | 0.46  | -0.09  | in              |
| I <sub>eff</sub> D  | 9,659 | 17,163 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 8,721 | 17,163 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 9,284 | 17,163 | in <sup>4</sup> |
| λ                   | 1.38  | 2.00   |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |              |
|----------|-------|-------|--------------|
| φVc      | 25.0  | -25.0 | 25.0         |
| φVs      | 21.8  | -21.8 | 21.8         |
| φVn      | 46.8  | -46.8 | 46.8         |
| Av/s     | 0.022 | 0.022 | 0.022 OK     |
| Min Av/s | 0.010 | N.A.  | N.A.         |
| s        | 10.0  | 6.0   | 10.0 10.0 OK |
| s max    | 11.0  | 11.0  | N.A. N.A.    |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.37 | OK |
| Max. Steel Area As max Ratio ....   | 0.34 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.80 | OK |
| Rebars Max Spacing Smax Ratio       | 0.30 | OK |
| Shear Vs/Vs max Ratio .....         | 0.36 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.45 | OK |
| Stirrups Spacing s max Ratio .....  | 0.91 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.39 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 2839 | 360    | 0.13  | OK |
| C    | Long-Term | 569  | 480    | 0.84  | OK |
| D    | Long-Term | 569  | 240    | 0.42  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
Engineer:  
Descrip: SECOND FLOOR BEAM K

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

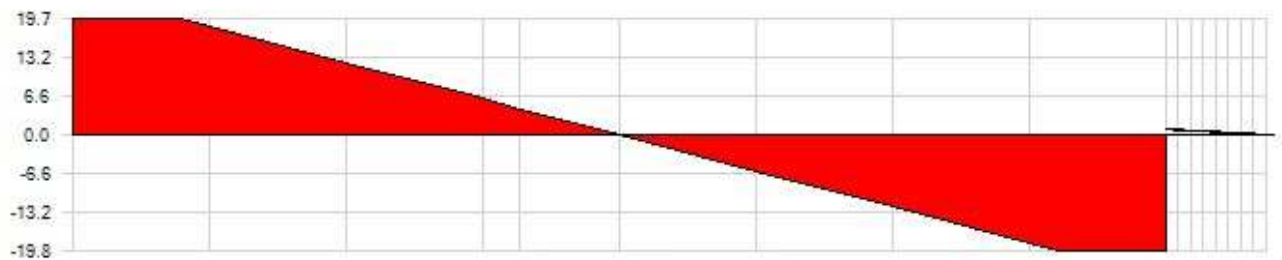
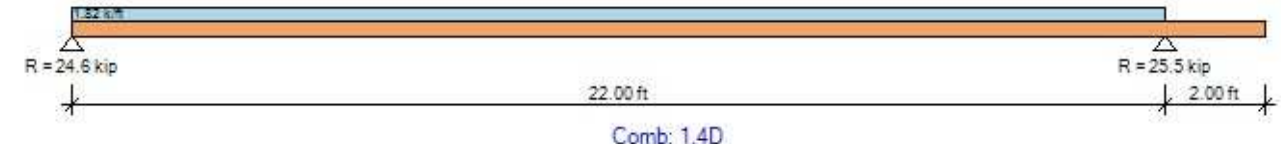
[www.asdipsoft.com](http://www.asdipsoft.com)

### TORSION MOMENTS $T_u$ (k-ft)

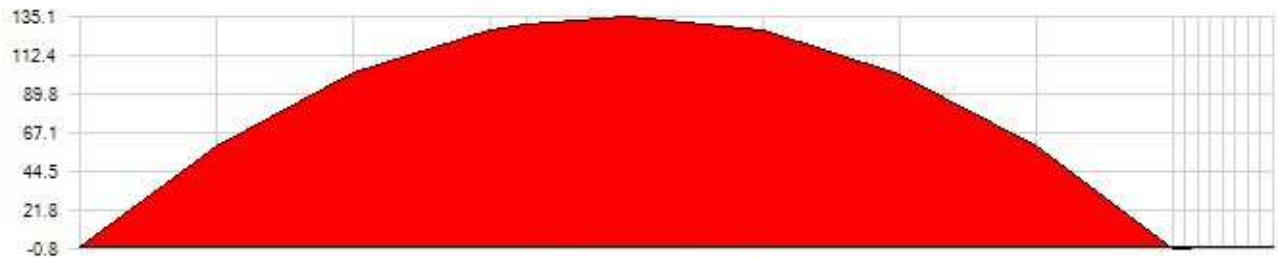
| Comb |     |     |     |    |
|------|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

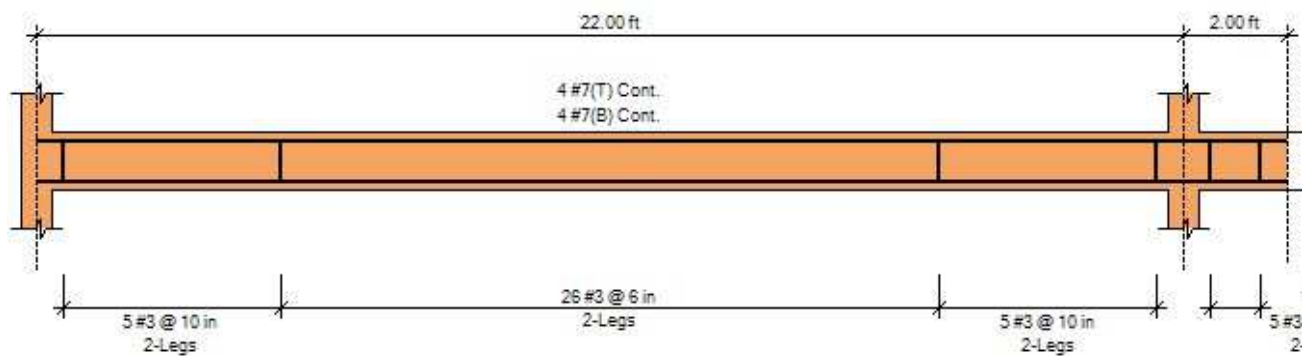
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM L

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 32.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 16.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |
|------|---|------|------|------|------|
| ①    | ① | 20.9 | 22.5 | 37.4 | 45.6 |
| ②    | ② | 16.8 | 27.4 | 37.8 | 49.4 |
| ③    | ③ | 16.1 | 27.0 | 32.6 | 46.8 |
| ④    | ④ | 20.2 | 22.9 | 40.1 | 49.9 |
| ⑤    | ⑤ | 19.7 | 21.7 | 36.2 | 41.5 |
| ⑥    | ⑥ | 16.1 | 20.5 | 32.6 | 47.5 |
| ⑦    | ⑦ | 16.1 | 19.3 | 32.6 | 39.1 |
| ⑧    | ⑧ | 20.2 | 22.1 | 40.1 | 44.1 |
| ⑨    | ⑨ | 19.7 | 21.7 | 36.2 | 41.5 |
| ⑩    | ⑩ | 19.7 | 21.7 | 36.2 | 41.5 |
| ⑪    | ⑪ | 9.7  | 14.5 | 19.5 | 29.3 |
| ⑫    | ⑫ | 9.7  | 14.5 | 19.5 | 29.3 |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |   |     |   |    |  |
|------|---|-----|---|----|--|
| ①    | 0 | 108 | 0 | OK |  |
| ②    | 0 | 126 | 0 | OK |  |
| ③    | 0 | 122 | 0 | OK |  |
| ④    | 0 | 114 | 0 | OK |  |
| ⑤    | 0 | 102 | 0 | OK |  |
| ⑥    | 0 | 105 | 0 | OK |  |
| ⑦    | 0 | 93  | 0 | OK |  |
| ⑧    | 0 | 106 | 0 | OK |  |
| ⑨    | 0 | 102 | 0 | OK |  |
| ⑩    | 0 | 102 | 0 | OK |  |
| ⑪    | 0 | 70  | 0 | OK |  |
| ⑫    | 0 | 70  | 0 | OK |  |

### SHEAR FORCES Vu (kip)

| Comb |      |       |    |  |  |
|------|------|-------|----|--|--|
| ①    | 15.9 | -44.8 | OK |  |  |
| ②    | 19.0 | -48.4 | OK |  |  |
| ③    | 18.6 | -45.8 | OK |  |  |
| ④    | 16.4 | -49.1 | OK |  |  |
| ⑤    | 15.2 | -40.7 | OK |  |  |
| ⑥    | 14.8 | -46.8 | OK |  |  |
| ⑦    | 13.6 | -38.4 | OK |  |  |
| ⑧    | 15.6 | -43.4 | OK |  |  |
| ⑨    | 15.2 | -40.7 | OK |  |  |
| ⑩    | 15.2 | -40.7 | OK |  |  |
| ⑪    | 10.2 | -28.8 | OK |  |  |
| ⑫    | 10.2 | -28.8 | OK |  |  |



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## CONCRETE BEAM DESIGN

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### BENDING STRENGTH (k-ft)

|        |              |      |                      |
|--------|--------------|------|----------------------|
| Bot    | 2#6 Cont     |      |                      |
| Bot    | 2#6x12.00 ft |      |                      |
| d      | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.88         | 1.76 | 0.88 in <sup>2</sup> |
| c/d    | 0.07         | 0.11 | 0.07                 |
| +φMn   | 115          | 217  | 115                  |
| Top    | 2#6 Cont     |      |                      |
| Top    | 0#5          |      |                      |
| d'     | 4.0          | 2.0  | 4.0 in               |
| -As    | 0.88         | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.07         | 0.09 | 0.07                 |
| -φMn   | -115         | -119 | -115                 |
| As min | 0.00         | 0.80 | 0.00 in <sup>2</sup> |

### DEFLECTIONS

|         |        |  |                 |
|---------|--------|--|-----------------|
| Comb    |        |  |                 |
| D       | 0.06   |  | in              |
| L       | 0.04   |  | in              |
| Lr, S   | 0.02   |  | in              |
| LS      | 0.02   |  | in              |
| LT      | 0.17   |  | in              |
| Ieff D  | 16,792 |  | in <sup>4</sup> |
| Ieff L  | 12,452 |  | in <sup>4</sup> |
| Ieff LS | 14,300 |  | in <sup>4</sup> |
| λ       | 1.69   |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### DESIGN CODES

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

### SHEAR STRENGTH (kip, in)

|          |       |              |
|----------|-------|--------------|
| φVc      | 22.8  | -22.8        |
| φVs      | 24.8  | -29.7        |
| φVn      | 47.5  | -52.5        |
| Av/s     | 0.018 | 0.022 OK     |
| Min Av/s | 0.007 | N.A.         |
| s        | 12.0  | 12.0 10.0 OK |
| s max    | 15.0  | 24.0 N.A.    |

### REINFORCEMENT

|                               |      |    |
|-------------------------------|------|----|
| Min. Steel Area As min Ratio  | 0.45 | OK |
| Max. Steel Area As max Ratio  | 0.34 | OK |
| Rebars Min Spacing Smin Ratio | 0.53 | OK |
| Rebars Max Spacing Smax Ratio | 0.25 | OK |
| Shear Vs/Vs max Ratio         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio | 0.36 | OK |
| Stirrups Spacing s max Ratio  | 0.80 | OK |
| Stirrups Min. # of Legs Ratio | 0.19 | OK |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.02  | OK |
| B    | Live Load | 4715 | 360    | 0.08  | OK |
| C    | Long-Term | 1115 | 480    | 0.43  | OK |
| D    | Long-Term | 1115 | 240    | 0.22  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

### MATERIALS

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
Engineer:  
Descrip: SECOND FLOOR BEAM L

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

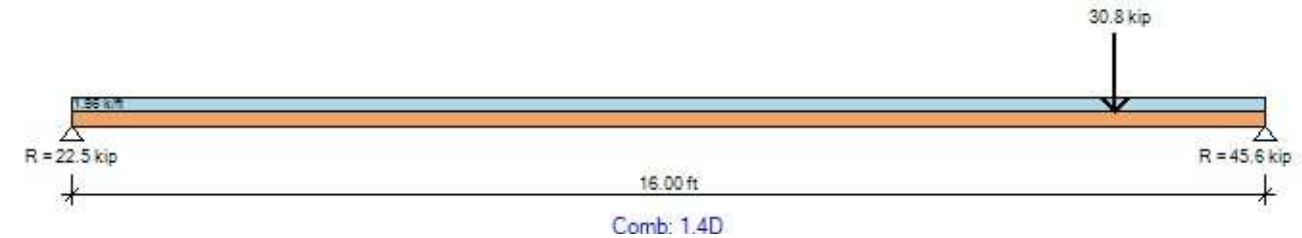
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### TORSION MOMENTS $T_u$ (k-ft)

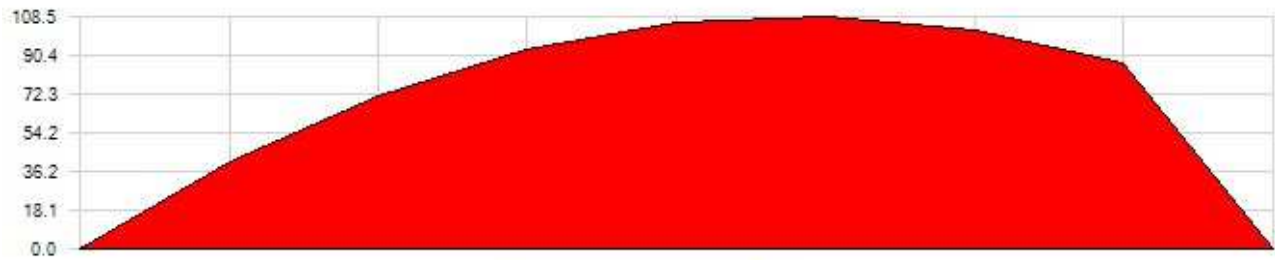
| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

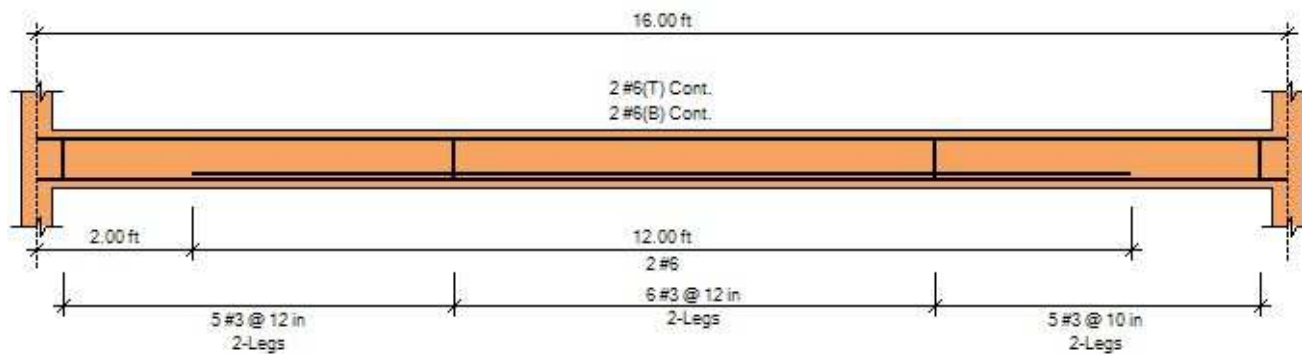
| At/s (in)             | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM M

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 12.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 3.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 20.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |      |      |           |
|------|---|------|------|-----------|
| ①    | ① | 63.0 | 70.2 | 28.6 29.5 |
| ②    | ② | 50.1 | 80.8 | 21.1 37.3 |
| ③    | ③ | 50.1 | 80.8 | 21.1 37.3 |
| ④    | ④ | 59.8 | 66.6 | 26.7 29.0 |
| ⑤    | ⑤ | 59.8 | 66.6 | 26.7 29.0 |
| ⑥    | ⑥ | 50.1 | 60.2 | 21.1 25.3 |
| ⑦    | ⑦ | 50.1 | 60.2 | 21.1 25.3 |
| ⑧    | ⑧ | 59.8 | 66.6 | 26.7 29.0 |
| ⑨    | ⑨ | 59.8 | 66.6 | 26.7 29.0 |
| ⑩    | ⑩ | 59.8 | 66.6 | 26.7 29.0 |
| ⑪    | ⑪ | 30.1 | 45.1 | 12.6 19.0 |
| ⑫    | ⑫ | 30.1 | 45.1 | 12.6 19.0 |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |     |     |   |    |
|------|-----|-----|---|----|
| ①    | -82 | 127 | 0 | OK |
| ②    | -86 | 165 | 0 | OK |
| ③    | -86 | 165 | 0 | OK |
| ④    | -75 | 126 | 0 | OK |
| ⑤    | -75 | 126 | 0 | OK |
| ⑥    | -71 | 109 | 0 | OK |
| ⑦    | -71 | 109 | 0 | OK |
| ⑧    | -75 | 126 | 0 | OK |
| ⑨    | -75 | 126 | 0 | OK |
| ⑩    | -75 | 126 | 0 | OK |
| ⑪    | -53 | 82  | 0 | OK |
| ⑫    | -53 | 82  | 0 | OK |

### SHEAR FORCES Vu (kip)

| Comb |       |      |       |    |
|------|-------|------|-------|----|
| ①    | -25.2 | 30.4 | -22.2 | OK |
| ②    | -25.9 | 36.9 | -28.3 | OK |
| ③    | -25.9 | 36.9 | -28.3 | OK |
| ④    | -22.9 | 29.5 | -21.9 | OK |
| ⑤    | -22.9 | 29.5 | -21.9 | OK |
| ⑥    | -21.6 | 26.1 | -19.0 | OK |
| ⑦    | -21.6 | 26.1 | -19.0 | OK |
| ⑧    | -22.9 | 29.5 | -21.9 | OK |
| ⑨    | -22.9 | 29.5 | -21.9 | OK |
| ⑩    | -22.9 | 29.5 | -21.9 | OK |
| ⑪    | -16.2 | 19.6 | -14.3 | OK |
| ⑫    | -16.2 | 19.6 | -14.3 | OK |

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## CONCRETE BEAM DESIGN

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### BENDING STRENGTH (k-ft)

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 4#7 Cont    |      |                      |
| Bot    | 0#6x4.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0 in               |
| +As    | 2.40        | 2.40 | 2.40 in <sup>2</sup> |
| c/d    | 0.13        | 0.13 | 0.13                 |
| +φMn   | 222         | 222  | 222                  |
| Top    | 4#7 Cont    |      |                      |
| Top    | 0#6         | 0#5  |                      |
| d'     | 4.0         | 2.0  | 4.0 in               |
| -As    | 2.40        | 2.40 | 2.40 in <sup>2</sup> |
| c/d    | 0.13        | 0.13 | 0.13                 |
| -φMn   | -222        | -222 | -222                 |
| As min | 0.88        | 0.88 | 0.00 in <sup>2</sup> |

### DEFLECTIONS

|         |        |       |                 |
|---------|--------|-------|-----------------|
| Comb    |        |       |                 |
| D       | -0.04  | 0.17  | in              |
| L       | -0.03  | 0.13  | in              |
| Lr, S   | 0.00   | 0.00  | in              |
| LS      | -0.01  | 0.04  | in              |
| LT      | -0.12  | 0.42  | in              |
| Ieff D  | 16,040 | 9,883 | in <sup>4</sup> |
| Ieff L  | 12,404 | 7,887 | in <sup>4</sup> |
| Ieff LS | 14,708 | 9,031 | in <sup>4</sup> |
| λ       | 2.00   | 1.38  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### DESIGN CODES

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

### SHEAR STRENGTH (kip, in)

|          |       |       |            |
|----------|-------|-------|------------|
| φVc      | -25.0 | 25.0  | -25.0      |
| φVs      | -36.3 | 27.2  | -36.3      |
| φVn      | -61.3 | 52.3  | -61.3      |
| Av/s     | 0.037 | 0.028 | 0.037 OK   |
| Min Av/s | N.A   | 0.010 | N.A        |
| s        | 6.0   | 8.0   | 8.0 6.0 OK |
| s max    | N.A   | 11.0  | 11.0 N.A   |

### REINFORCEMENT

|                               |       |      |    |
|-------------------------------|-------|------|----|
| Min. Steel Area As min Ratio  | ..... | 0.37 | OK |
| Max. Steel Area As max Ratio  | ....  | 0.34 | OK |
| Rebars Min Spacing Smin Ratio | ..    | 0.80 | OK |
| Rebars Max Spacing Smax Ratio |       | 0.20 | OK |
| Shear Vs/Vs max Ratio         | ..... | 0.36 | OK |
| Min. Stirrups Area Av/s Ratio | ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio  | ..... | 0.73 | OK |
| Stirrups Min. # of Legs Ratio | ..... | 0.39 | OK |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 1845 | 360    | 0.20  | OK |
| C    | Long-Term | 573  | 480    | 0.84  | OK |
| D    | Long-Term | 573  | 240    | 0.42  | OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

### MATERIALS

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |



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## CONCRETE BEAM DESIGN

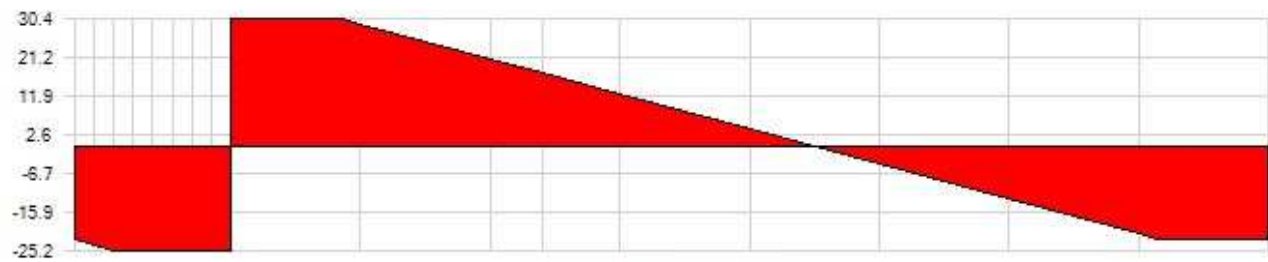
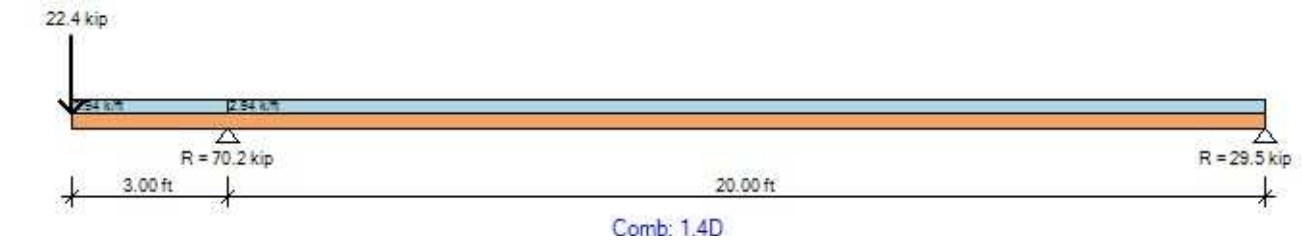
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### TORSION MOMENTS $T_u$ (k-ft)

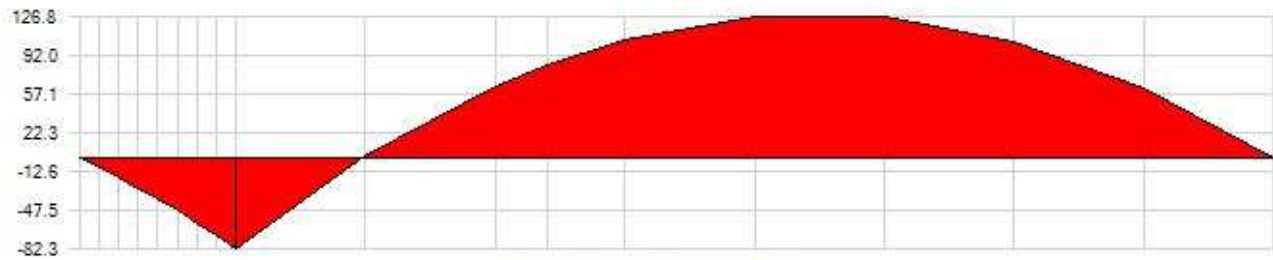
| Comb |     |     |     |    |
|------|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

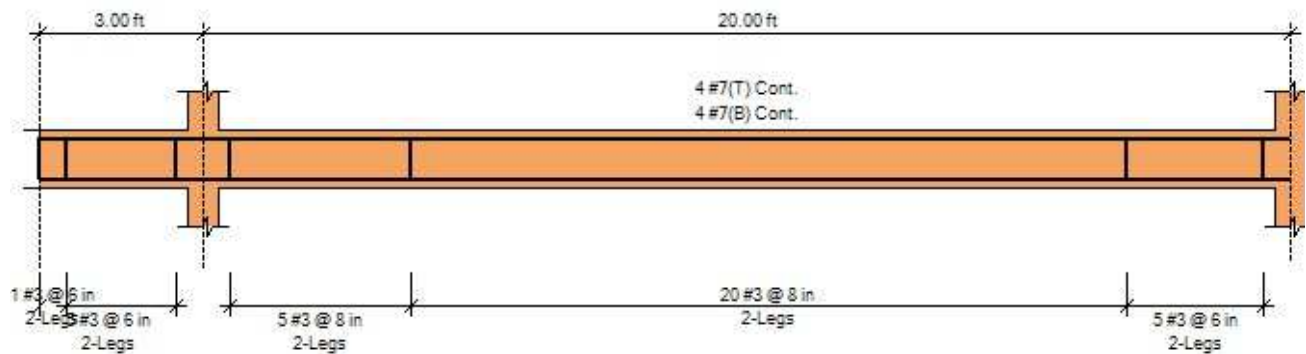
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: SECOND FLOOR BEAM N

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

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**GEOMETRY**

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 24.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 0.00      | ft |
| Right Cantilever       | 0.00      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 4       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 6.00 ft  | ①       | Pinned |
| ②                        | 21.00 ft | ②       | Pinned |
| ③                        | 6.00 ft  | ③       | Pinned |
| ④                        | N.A.     | ④       | Pinned |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |      |      |      |      |      |      |
|------|---|------|------|------|------|------|------|------|------|
| ①    | ① | -2.3 | -3.2 | 18.8 | 26.3 | 18.8 | 26.3 | -2.3 | -3.2 |
| ②    | ② | -3.1 | -3.1 | 25.3 | 25.8 | 25.3 | 25.8 | -3.1 | -3.1 |
| ③    | ③ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ④    | ④ | -2.9 | -4.0 | 23.7 | 33.0 | 23.7 | 33.0 | -2.9 | -4.0 |
| ⑤    | ⑤ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ⑥    | ⑥ | -2.3 | -4.0 | 18.8 | 33.0 | 18.8 | 33.0 | -2.3 | -4.0 |
| ⑦    | ⑦ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ⑧    | ⑧ | -2.9 | -3.1 | 23.7 | 25.8 | 23.7 | 25.8 | -2.9 | -3.1 |
| ⑨    | ⑨ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ⑩    | ⑩ | -2.3 | -2.7 | 18.8 | 22.5 | 18.8 | 22.5 | -2.3 | -2.7 |
| ⑪    | ⑪ | -1.4 | -2.0 | 11.3 | 16.9 | 11.3 | 16.9 | -1.4 | -2.0 |
| ⑫    | ⑫ | -1.4 | -2.0 | 11.3 | 16.9 | 11.3 | 16.9 | -1.4 | -2.0 |

**BENDING MOMENTS Mu (k-ft)**

| Comb |   |     |   |     |    |     |   |     |    |
|------|---|-----|---|-----|----|-----|---|-----|----|
| ①    | ① | -11 | 0 | -44 | 33 | -44 | 0 | -16 | OK |
| ②    | ② | -10 | 0 | -43 | 32 | -43 | 0 | -16 | OK |
| ③    | ③ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ④    | ④ | -13 | 0 | -56 | 41 | -56 | 0 | -20 | OK |
| ⑤    | ⑤ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ⑥    | ⑥ | -13 | 0 | -56 | 41 | -56 | 0 | -20 | OK |
| ⑦    | ⑦ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ⑧    | ⑧ | -10 | 0 | -43 | 32 | -43 | 0 | -16 | OK |
| ⑨    | ⑨ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ⑩    | ⑩ | -9  | 0 | -38 | 28 | -38 | 0 | -14 | OK |
| ⑪    | ⑪ | -7  | 0 | -28 | 21 | -28 | 0 | -10 | OK |
| ⑫    | ⑫ | -7  | 0 | -28 | 21 | -28 | 0 | -10 | OK |

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**CONCRETE BEAM DESIGN**

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**SHEAR FORCES  $V_u$  (kip)**

| Comb |      |       |      |       |      |     |    |
|------|------|-------|------|-------|------|-----|----|
| ①    | -6.2 | -8.5  | 11.7 | -11.7 | 8.5  | 6.2 | OK |
| ②    | -6.1 | -8.4  | 11.5 | -11.5 | 8.4  | 6.1 | OK |
| ③    | -5.3 | -7.3  | 10.0 | -10.0 | 7.3  | 5.3 | OK |
| ④    | -7.8 | -10.7 | 14.7 | -14.7 | 10.7 | 7.8 | OK |
| ⑤    | -5.3 | -7.3  | 10.0 | -10.0 | 7.3  | 5.3 | OK |
| ⑥    | -7.8 | -10.7 | 14.7 | -14.7 | 10.7 | 7.8 | OK |
| ⑦    | -5.3 | -7.3  | 10.0 | -10.0 | 7.3  | 5.3 | OK |
| ⑧    | -6.1 | -8.4  | 11.5 | -11.5 | 8.4  | 6.1 | OK |
| ⑨    | -5.3 | -7.3  | 10.0 | -10.0 | 7.3  | 5.3 | OK |
| ⑩    | -5.3 | -7.3  | 10.0 | -10.0 | 7.3  | 5.3 | OK |
| ⑪    | -4.0 | -5.5  | 7.5  | -7.5  | 5.5  | 4.0 | OK |
| ⑫    | -4.0 | -5.5  | 7.5  | -7.5  | 5.5  | 4.0 | OK |

**BENDING STRENGTH (k-ft)**

| Bot         | 2#6 Cont    |      | 2#6 Cont    |      | 2#6 Cont    |      |                      |
|-------------|-------------|------|-------------|------|-------------|------|----------------------|
| Bot         | 0#6x4.00 ft |      | 0#6x4.00 ft |      | 0#6x4.00 ft |      |                      |
| d           | 2.0         | 4.0  | 2.0         | 4.0  | 2.0         | 4.0  | in                   |
| +As         | 0.88        | 0.88 | 0.88        | 0.88 | 0.88        | 0.88 | in <sup>2</sup>      |
| c/d         | 0.10        | 0.10 | 0.10        | 0.10 | 0.10        | 0.10 |                      |
| + $\phi$ Mn | 83          | 83   | 83          | 83   | 83          | 83   |                      |
| Top         | 2#6 Cont    |      | 2#6 Cont    |      | 2#6 Cont    |      |                      |
| Top         | 0#5         |      | 0#5         |      | 0#5         |      |                      |
| d'          | 2.0         | 2.0  | 2.0         | 2.0  | 2.0         | 2.0  | in                   |
| -As         | 0.88        | 0.88 | 0.88        | 0.88 | 0.88        | 0.88 | in <sup>2</sup>      |
| c/d         | 0.10        | 0.10 | 0.10        | 0.10 | 0.10        | 0.10 |                      |
| - $\phi$ Mn | -83         | -83  | -83         | -83  | -83         | -83  |                      |
| As min      | 0.18        | 0.00 | 0.59        | 0.59 | 0.59        | 0.00 | 0.27 in <sup>2</sup> |

**SHEAR STRENGTH (kip, in)**

| $\phi V_c$ | 16.7  | -16.7 | 16.7  | -16.7 | 16.7  | -16.7 |    |
|------------|-------|-------|-------|-------|-------|-------|----|
| $\phi V_s$ | 21.8  | -21.8 | 21.8  | -21.8 | 21.8  | -21.8 |    |
| $\phi V_n$ | 38.5  | -38.5 | 38.5  | -38.5 | 38.5  | -38.5 |    |
| Av/s       | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | OK |
| Min Av/s   | N.A.  | N.A.  | 0.007 | N.A.  | 0.007 | N.A.  |    |
| s          | 10.0  | 6.0   | 10.0  | 10.0  | 6.0   | 10.0  | OK |
| s max      | N.A.  | N.A.  | N.A.  | 11.0  | 11.0  | N.A.  |    |

**DEFLECTIONS**

| Comb      |        |        |        |     |
|-----------|--------|--------|--------|-----|
| D         | 0.00   | 0.04   | 0.00   | in  |
| L         | 0.00   | 0.00   | 0.00   | in  |
| Lr, S     | 0.00   | 0.02   | 0.00   | in  |
| LS        | 0.00   | 0.00   | 0.00   | in  |
| LT        | 0.00   | 0.06   | 0.00   | in  |
| Ieff D    | 10,456 | 10,456 | 10,456 | in4 |
| Ieff L    | 10,456 | 10,456 | 10,456 | in4 |
| Ieff LS   | 10,408 | 10,361 | 10,408 | in4 |
| $\lambda$ | 1.60   | 1.60   | 1.60   |     |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.67 | OK |
| Max. Steel Area As max Ratio ....   | 0.22 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.33 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.30 | OK |
| Stirrups Spacing s max Ratio .....  | 0.91 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

**MATERIALS**

|                                  |                |     |
|----------------------------------|----------------|-----|
| Concrete Strength $f'_c$ .....   | 4.0            | ksi |
| Compression Strain Limit .....   | 0.003          |     |
| Concrete density .....           | 150            | pcf |
| Concrete Stress-Strain .....     | Hognestad      |     |
| Rebar Steel Strength $f_y$ ..... | 60.0           | ksi |
| Steel Stress-Strain .....        | Elasto-plastic |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**MAX. DEFLECTIONS  $L/\delta$** 

| Type | Load      | $L/\delta$ | Allow. | Ratio |    |
|------|-----------|------------|--------|-------|----|
| A    | Lr, S, W  | 9999       | 180    | 0.01  | OK |
| B    | Live Load | 9999       | 360    | 0.00  | OK |
| C    | Long-Term | 3895       | 480    | 0.12  | OK |
| D    | Long-Term | 3895       | 240    | 0.06  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |



Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM N

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

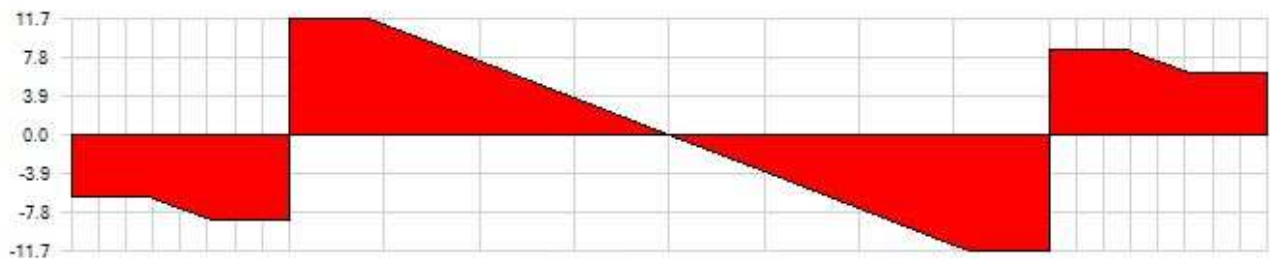
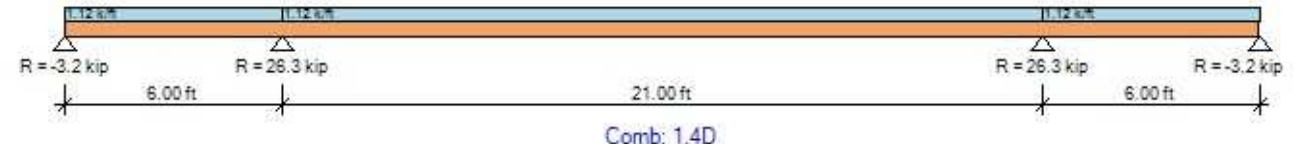
www.asdipsoft.com

### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

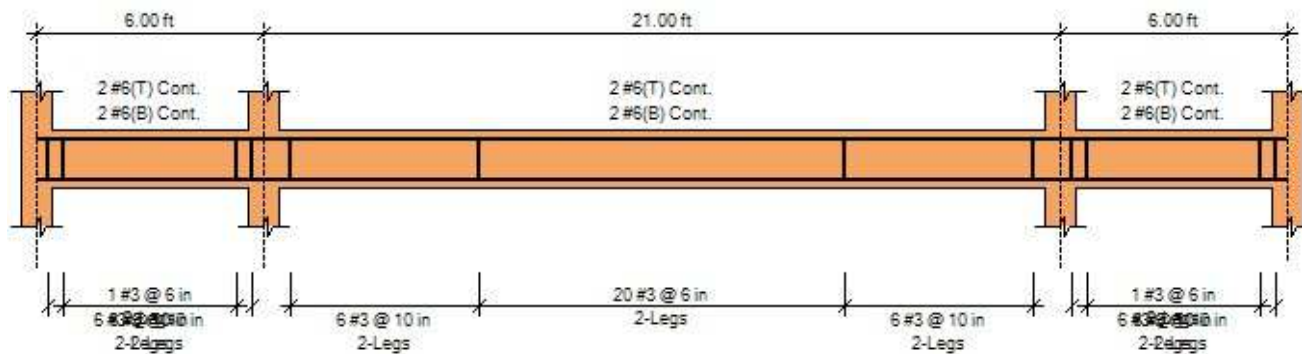
| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

**GEOMETRY**

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 18.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 3       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 8.00 ft  | ①       | Pinned |
| ②                        | 22.00 ft | ②       | Pinned |
| ③                        | N.A.     | ③       | Pinned |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |     |     |      |      |      |      |
|------|---|-----|-----|------|------|------|------|
| ①    | ① | 1.4 | 2.8 | 20.3 | 23.1 | 10.8 | 13.5 |
| ②    | ② | 2.0 | 1.4 | 16.5 | 25.9 | 9.7  | 13.5 |
| ③    | ③ | 2.0 | 1.4 | 16.5 | 25.9 | 9.7  | 13.5 |
| ④    | ④ | 1.5 | 2.1 | 19.3 | 21.7 | 10.5 | 12.2 |
| ⑤    | ⑤ | 1.5 | 2.1 | 19.3 | 21.7 | 10.5 | 12.2 |
| ⑥    | ⑥ | 2.0 | 2.4 | 16.5 | 19.8 | 9.7  | 11.6 |
| ⑦    | ⑦ | 2.0 | 2.4 | 16.5 | 19.8 | 9.7  | 11.6 |
| ⑧    | ⑧ | 1.5 | 2.1 | 19.3 | 21.7 | 10.5 | 12.2 |
| ⑨    | ⑨ | 1.5 | 2.1 | 19.3 | 21.7 | 10.5 | 12.2 |
| ⑩    | ⑩ | 1.5 | 2.1 | 19.3 | 21.7 | 10.5 | 12.2 |
| ⑪    | ⑪ | 1.2 | 1.8 | 9.9  | 14.8 | 5.8  | 8.7  |
| ⑫    | ⑫ | 1.2 | 1.8 | 9.9  | 14.8 | 5.8  | 8.7  |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |    |   |     |    |   |    |
|------|----|---|-----|----|---|----|
| ①    | -1 | 2 | -43 | 44 | 0 | OK |
| ②    | -4 | 0 | -50 | 47 | 0 | OK |
| ③    | -4 | 0 | -50 | 47 | 0 | OK |
| ④    | -2 | 1 | -41 | 40 | 0 | OK |
| ⑤    | -2 | 1 | -41 | 40 | 0 | OK |
| ⑥    | -1 | 1 | -37 | 37 | 0 | OK |
| ⑦    | -1 | 1 | -37 | 37 | 0 | OK |
| ⑧    | -2 | 1 | -41 | 40 | 0 | OK |
| ⑨    | -2 | 1 | -41 | 40 | 0 | OK |
| ⑩    | -2 | 1 | -41 | 40 | 0 | OK |
| ⑪    | -1 | 1 | -28 | 28 | 0 | OK |
| ⑫    | -1 | 1 | -28 | 28 | 0 | OK |

**SHEAR FORCES Vu (kip)**

| Comb |      |       |      |       |    |
|------|------|-------|------|-------|----|
| ①    | -0.6 | -10.1 | 8.8  | -10.1 | OK |
| ②    | -1.8 | -10.6 | 10.8 | -10.3 | OK |
| ③    | -1.8 | -10.6 | 10.8 | -10.3 | OK |
| ④    | -0.9 | -9.3  | 8.6  | -9.2  | OK |
| ⑤    | -0.9 | -9.3  | 8.6  | -9.2  | OK |
| ⑥    | -0.5 | -8.7  | 7.5  | -8.7  | OK |
| ⑦    | -0.5 | -8.7  | 7.5  | -8.7  | OK |
| ⑧    | -0.9 | -9.3  | 8.6  | -9.2  | OK |
| ⑨    | -0.9 | -9.3  | 8.6  | -9.2  | OK |
| ⑩    | -0.9 | -9.3  | 8.6  | -9.2  | OK |
| ⑪    | -0.4 | -6.5  | 5.6  | -6.5  | OK |
| ⑫    | -0.4 | -6.5  | 5.6  | -6.5  | OK |

**BENDING STRENGTH (k-ft)**

|        |             |      |              |      |                      |
|--------|-------------|------|--------------|------|----------------------|
| Bot    | 2#5 Cont    |      | 2#5 Cont     |      |                      |
| Bot    | 2#5x6.00 ft |      | 2#5x18.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0          | 4.0  | 2.0 in               |
| +As    | 0.62        | 1.24 | 0.62         | 1.24 | 0.62 in <sup>2</sup> |
| c/d    | 0.12        | 0.16 | 0.12         | 0.16 | 0.12                 |
| +φMn   | 43          | 77   | 43           | 77   | 43                   |
| Top    | 4#5 Cont    |      | 4#5 Cont     |      |                      |
| Top    | 0#5         |      | 0#5          |      | 0#5                  |
| d'     | 4.0         | 2.0  | 4.0          | 2.0  | 4.0 in               |
| -As    | 1.24        | 1.24 | 1.24         | 1.24 | 1.24 in <sup>2</sup> |
| c/d    | 0.17        | 0.20 | 0.17         | 0.20 | 0.17                 |
| -φMn   | -82         | -84  | -82          | -84  | -82                  |
| As min | 0.09        | 0.03 | 0.43         | 0.43 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |       |                 |
|---------------------|-------|-------|-----------------|
| Comb                |       |       |                 |
| D                   | 0.00  | 0.24  | in              |
| L                   | 0.00  | 0.12  | in              |
| Lr, S               | 0.00  | 0.00  | in              |
| LS                  | 0.00  | 0.04  | in              |
| LT                  | 0.00  | 0.49  | in              |
| I <sub>eff</sub> D  | 4,301 | 2,321 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 4,241 | 1,928 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 4,277 | 2,169 | in <sup>4</sup> |
| λ                   | 1.35  | 1.35  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |       |                |
|----------|-------|-------|-------|----------------|
| φVc      | 12.1  | -12.1 | 12.1  | -12.1          |
| φVs      | 19.8  | -19.8 | 19.8  | -19.8          |
| φVn      | 31.9  | -31.9 | 31.9  | -31.9          |
| Av/s     | 0.028 | 0.028 | 0.028 | 0.028 OK       |
| Min Av/s | N.A.  | N.A.  | 0.007 | N.A.           |
| s        | 8.0   | 6.0   | 8.0   | 8.0 8.0 8.0 OK |
| s max    | N.A.  | 8.0   | N.A.  | 8.0 8.0 N.A.   |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.34 | OK |
| Max. Steel Area As max Ratio ....   | 0.36 | OK |
| Rebars Min Spacing Smin Ratio ..    | 6.00 | NG |
| Rebars Max Spacing Smax Ratio       | 0.26 | OK |
| Shear Vs/Vs max Ratio .....         | 0.41 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.24 | OK |
| Stirrups Spacing s max Ratio .....  | 1.00 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.29 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 2232 | 360    | 0.16  | OK |
| C    | Long-Term | 542  | 480    | 0.89  | OK |
| D    | Long-Term | 542  | 240    | 0.44  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Engineer:

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Descrip: SECOND FLOOR BEAM P

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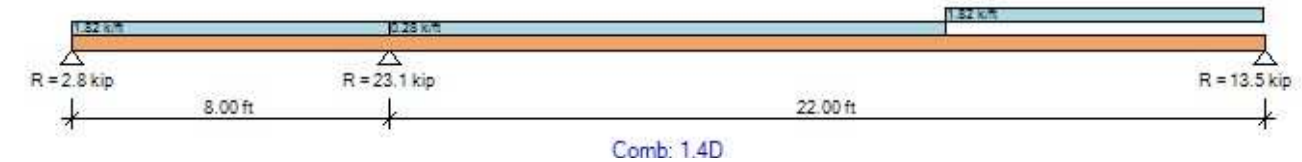
**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |     |     |    |
|------|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | OK |

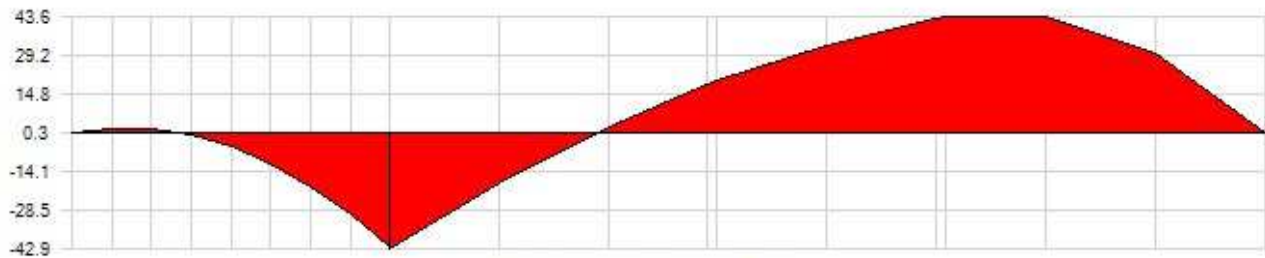
**TORSION STRENGTH (k-ft)**

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | OK |





SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM Q

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## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 24.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 3.00      | ft |
| Right Cantilever       | 0.00      | ft |

### BEAM SUPPORTS

| Number of Supports ..... |         | 2       |        |
|--------------------------|---------|---------|--------|
| Span                     | Length  | Support | Type   |
| ①                        | 6.00 ft | ①       | Pinned |
| ②                        | N.A.    | ②       | Pinned |
| ③                        | N.A.    | ③       | N.A.   |
| ④                        | N.A.    | ④       | N.A.   |
| ⑤                        | N.A.    | ⑤       | N.A.   |
|                          |         | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |      |      |             |
|------|---|------|------|-------------|
| ①    | ① | 46.2 | 59.5 | -13.2 -17.4 |
| ②    | ② | 42.5 | 56.9 | -12.4 -16.2 |
| ③    | ③ | 42.5 | 56.9 | -12.4 -16.2 |
| ④    | ④ | 45.3 | 52.9 | -13.0 -15.3 |
| ⑤    | ⑤ | 45.3 | 52.9 | -13.0 -15.3 |
| ⑥    | ⑥ | 42.5 | 51.0 | -12.4 -14.9 |
| ⑦    | ⑦ | 42.5 | 51.0 | -12.4 -14.9 |
| ⑧    | ⑧ | 45.3 | 52.9 | -13.0 -15.3 |
| ⑨    | ⑨ | 45.3 | 52.9 | -13.0 -15.3 |
| ⑩    | ⑩ | 45.3 | 52.9 | -13.0 -15.3 |
| ⑪    | ⑪ | 25.5 | 38.3 | -7.5 -11.2  |
| ⑫    | ⑫ | 25.5 | 38.3 | -7.5 -11.2  |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |      |   |     |    |
|------|------|---|-----|----|
| ①    | -112 | 0 | -54 | OK |
| ②    | -106 | 0 | -51 | OK |
| ③    | -106 | 0 | -51 | OK |
| ④    | -99  | 0 | -48 | OK |
| ⑤    | -99  | 0 | -48 | OK |
| ⑥    | -96  | 0 | -46 | OK |
| ⑦    | -96  | 0 | -46 | OK |
| ⑧    | -99  | 0 | -48 | OK |
| ⑨    | -99  | 0 | -48 | OK |
| ⑩    | -99  | 0 | -48 | OK |
| ⑪    | -72  | 0 | -35 | OK |
| ⑫    | -72  | 0 | -35 | OK |

### SHEAR FORCES Vu (kip)

| Comb |       |      |      |    |
|------|-------|------|------|----|
| ①    | -36.3 | 19.0 | 18.3 | OK |
| ②    | -34.4 | 18.1 | 17.3 | OK |
| ③    | -34.4 | 18.1 | 17.3 | OK |
| ④    | -32.1 | 16.9 | 16.2 | OK |
| ⑤    | -32.1 | 16.9 | 16.2 | OK |
| ⑥    | -31.1 | 16.3 | 15.7 | OK |
| ⑦    | -31.1 | 16.3 | 15.7 | OK |
| ⑧    | -32.1 | 16.9 | 16.2 | OK |
| ⑨    | -32.1 | 16.9 | 16.2 | OK |
| ⑩    | -32.1 | 16.9 | 16.2 | OK |
| ⑪    | -23.3 | 12.2 | 11.8 | OK |
| ⑫    | -23.3 | 12.2 | 11.8 | OK |

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## CONCRETE BEAM DESIGN

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### BENDING STRENGTH (k-ft)

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 2#6 Cont    |      |                      |
| Bot    | 0#6x4.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0 in               |
| +As    | 0.88        | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.13        | 0.10 | 0.10                 |
| +φMn   | 88          | 83   | 83                   |
| Top    | 2#6 Cont    |      |                      |
| Top    | 2#6         | 0#5  |                      |
| d'     | 4.0         | 2.0  | 4.0 in               |
| -As    | 1.76        | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.15        | 0.10 | 0.10                 |
| -φMn   | -154        | -83  | -83                  |
| As min | 0.59        | 0.00 | 0.59 in <sup>2</sup> |

### DEFLECTIONS

|         |       |       |                 |
|---------|-------|-------|-----------------|
| Comb    |       |       |                 |
| D       | 0.05  | 0.00  | in              |
| L       | 0.01  | 0.00  | in              |
| Lr, S   | 0.00  | 0.00  | in              |
| LS      | 0.00  | 0.00  | in              |
| LT      | 0.11  | 0.00  | in              |
| Ieff D  | 4,474 | 9,559 | in <sup>4</sup> |
| Ieff L  | 4,344 | 9,539 | in <sup>4</sup> |
| Ieff LS | 4,431 | 9,552 | in <sup>4</sup> |
| λ       | 2.00  | 1.60  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### DESIGN CODES

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

### SHEAR STRENGTH (kip, in)

|          |       |       |          |
|----------|-------|-------|----------|
| φVc      | -16.7 | 16.7  | -16.7    |
| φVs      | -36.3 | 36.3  | -36.3    |
| φVn      | -53.0 | 53.0  | -53.0    |
| Av/s     | 0.037 | 0.037 | 0.037 OK |
| Min Av/s | N.A   | 0.007 | 0.007    |
| s        | 6.0   | 6.0   | 6.0 OK   |
| s max    | N.A   | 11.0  | 11.0     |

### REINFORCEMENT

|                               |      |    |
|-------------------------------|------|----|
| Min. Steel Area As min Ratio  | 0.33 | OK |
| Max. Steel Area As max Ratio  | 0.44 | OK |
| Rebars Min Spacing Smin Ratio | 0.53 | OK |
| Rebars Max Spacing Smax Ratio | 0.25 | OK |
| Shear Vs/Vs max Ratio         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio | 0.18 | OK |
| Stirrups Spacing s max Ratio  | 0.55 | OK |
| Stirrups Min. # of Legs Ratio | 0.21 | OK |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 90     | 0.00  | OK |
| B    | Live Load | 6392 | 180    | 0.03  | OK |
| C    | Long-Term | 320  | 240    | 0.75  | OK |
| D    | Long-Term | 320  | 120    | 0.37  | OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

### MATERIALS

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM Q

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## CONCRETE BEAM DESIGN

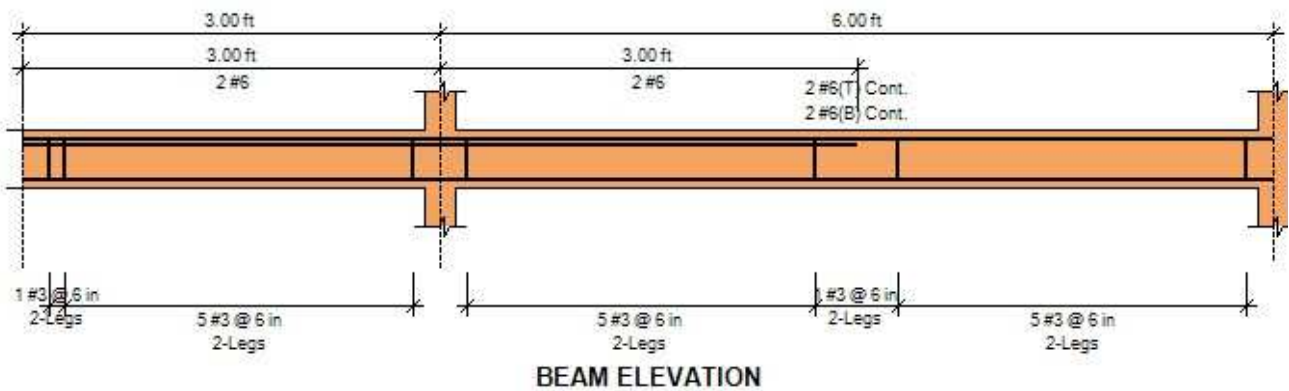
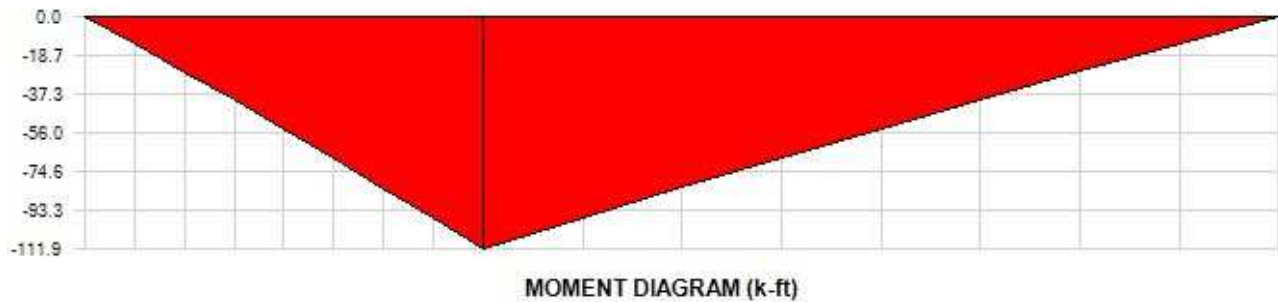
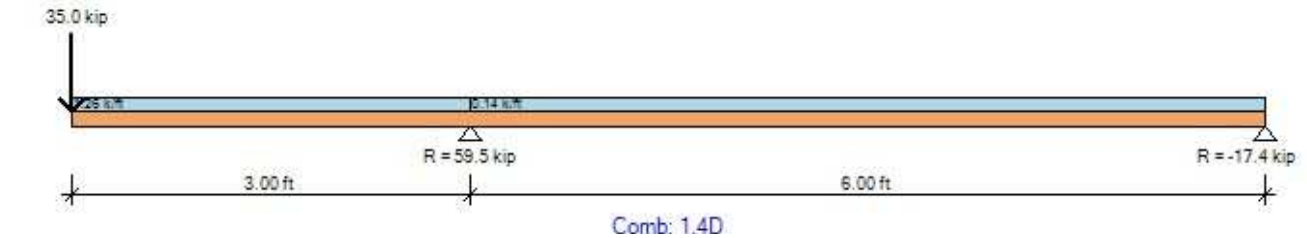
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### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |    |
|------|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | OK |





Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM R

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## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 24.0      | in |
| Beam Width b           | 12.0      | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 2.50      | ft |
| Right Cantilever       | 0.00      | ft |

### BEAM SUPPORTS

| Number of Supports ..... |         | 2       |        |
|--------------------------|---------|---------|--------|
| Span                     | Length  | Support | Type   |
| ①                        | 5.00 ft | ①       | Pinned |
| ②                        | N.A.    | ②       | Pinned |
| ③                        | N.A.    | ③       | N.A.   |
| ④                        | N.A.    | ④       | N.A.   |
| ⑤                        | N.A.    | ⑤       | N.A.   |
|                          |         | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |      |       |             |
|------|---|------|-------|-------------|
| ①    | ① | 81.2 | 86.4  | -25.9 -27.2 |
| ②    | ② | 61.7 | 105.2 | -19.4 -33.7 |
| ③    | ③ | 61.7 | 105.2 | -19.4 -33.7 |
| ④    | ④ | 76.3 | 83.8  | -24.3 -26.6 |
| ⑤    | ⑤ | 76.3 | 83.8  | -24.3 -26.6 |
| ⑥    | ⑥ | 61.7 | 74.0  | -19.4 -23.3 |
| ⑦    | ⑦ | 61.7 | 74.0  | -19.4 -23.3 |
| ⑧    | ⑧ | 76.3 | 83.8  | -24.3 -26.6 |
| ⑨    | ⑨ | 76.3 | 83.8  | -24.3 -26.6 |
| ⑩    | ⑩ | 76.3 | 83.8  | -24.3 -26.6 |
| ⑪    | ⑪ | 37.0 | 55.5  | -11.7 -17.5 |
| ⑫    | ⑫ | 37.0 | 55.5  | -11.7 -17.5 |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |      |   |     |    |
|------|------|---|-----|----|
| ①    | -141 | 0 | -69 | OK |
| ②    | -173 | 0 | -85 | OK |
| ③    | -173 | 0 | -85 | OK |
| ④    | -137 | 0 | -68 | OK |
| ⑤    | -137 | 0 | -68 | OK |
| ⑥    | -121 | 0 | -59 | OK |
| ⑦    | -121 | 0 | -59 | OK |
| ⑧    | -137 | 0 | -68 | OK |
| ⑨    | -137 | 0 | -68 | OK |
| ⑩    | -137 | 0 | -68 | OK |
| ⑪    | -91  | 0 | -45 | OK |
| ⑫    | -91  | 0 | -45 | OK |

### SHEAR FORCES Vu (kip)

| Comb |       |      |      |    |
|------|-------|------|------|----|
| ①    | -56.1 | 28.4 | 28.1 | OK |
| ②    | -68.9 | 34.7 | 34.5 | OK |
| ③    | -68.9 | 34.7 | 34.5 | OK |
| ④    | -54.6 | 27.6 | 27.4 | OK |
| ⑤    | -54.6 | 27.6 | 27.4 | OK |
| ⑥    | -48.1 | 24.3 | 24.1 | OK |
| ⑦    | -48.1 | 24.3 | 24.1 | OK |
| ⑧    | -54.6 | 27.6 | 27.4 | OK |
| ⑨    | -54.6 | 27.6 | 27.4 | OK |
| ⑩    | -54.6 | 27.6 | 27.4 | OK |
| ⑪    | -36.1 | 18.3 | 18.1 | OK |
| ⑫    | -36.1 | 18.3 | 18.1 | OK |

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## CONCRETE BEAM DESIGN

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### BENDING STRENGTH (k-ft)

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 2#6 Cont    |      |                      |
| Bot    | 0#6x3.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0 in               |
| +As    | 0.88        | 0.88 | 0.88 in <sup>2</sup> |
| c/d    | 0.09        | 0.09 | 0.09                 |
| +φMn   | 85          | 85   | 85                   |
| Top    | 4#7 Cont    |      |                      |
| Top    | 0#5         |      | 0#5                  |
| d'     | 2.0         | 2.0  | 2.0 in               |
| -As    | 2.40        | 2.40 | 2.40 in <sup>2</sup> |
| c/d    | 0.15        | 0.15 | 0.15                 |
| -φMn   | -221        | -221 | -221                 |
| As min | 0.88        | 0.00 | 0.88 in <sup>2</sup> |

### DEFLECTIONS

|                     |       |        |                 |
|---------------------|-------|--------|-----------------|
| Comb                |       |        |                 |
| D                   | 0.03  | 0.00   | in              |
| L                   | 0.01  | 0.00   | in              |
| Lr, S               | 0.00  | 0.00   | in              |
| LS                  | 0.00  | 0.00   | in              |
| LT                  | 0.08  | 0.00   | in              |
| I <sub>eff</sub> D  | 7,359 | 14,818 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 6,509 | 14,691 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 6,997 | 14,764 | in <sup>4</sup> |
| λ                   | 2.00  | 1.38   |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### DESIGN CODES

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

### SHEAR STRENGTH (kip, in)

|          |       |       |            |
|----------|-------|-------|------------|
| φVc      | -25.0 | 25.0  | -25.0      |
| φVs      | -54.5 | 27.2  | -27.2      |
| φVn      | -79.5 | 52.3  | -52.3      |
| Av/s     | 0.055 | 0.028 | 0.028 OK   |
| Min Av/s | N.A   | 0.010 | 0.010      |
| s        | 4.0   | 8.0   | 6.0 8.0 OK |
| s max    | N.A   | 11.0  | 11.0       |

### REINFORCEMENT

|                               |       |      |    |
|-------------------------------|-------|------|----|
| Min. Steel Area As min Ratio  | ..... | 0.37 | OK |
| Max. Steel Area As max Ratio  | ....  | 0.34 | OK |
| Rebars Min Spacing Smin Ratio | ..    | 0.80 | OK |
| Rebars Max Spacing Smax Ratio |       | 0.62 | OK |
| Shear Vs/Vs max Ratio         | ..... | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio | ..... | 0.36 | OK |
| Stirrups Spacing s max Ratio  | ..... | 0.73 | OK |
| Stirrups Min. # of Legs Ratio | ..... | 0.39 | OK |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 90     | 0.00  | OK |
| B    | Live Load | 2217 | 180    | 0.08  | OK |
| C    | Long-Term | 393  | 240    | 0.61  | OK |
| D    | Long-Term | 393  | 120    | 0.31  | OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

### MATERIALS

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM R

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

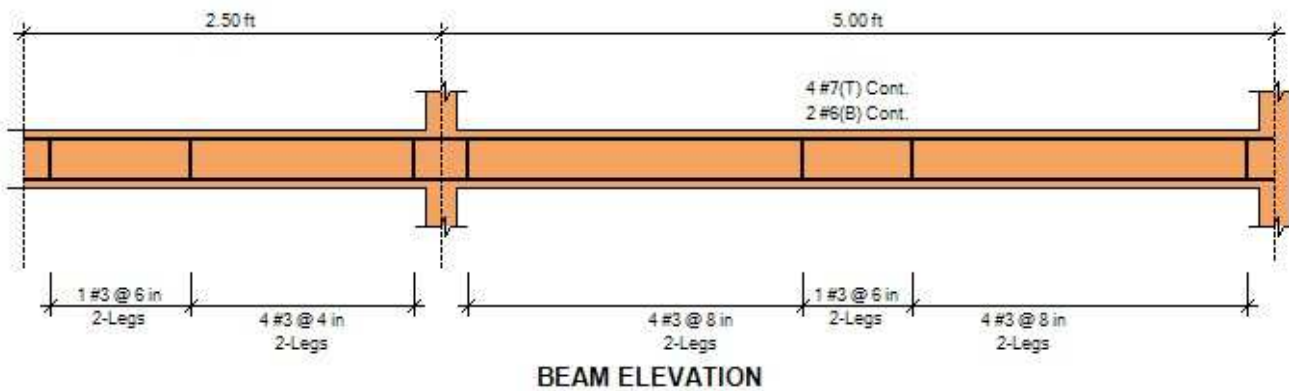
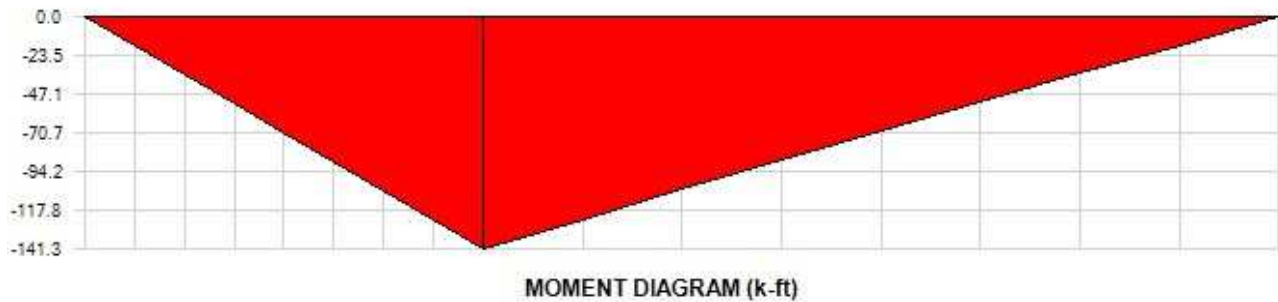
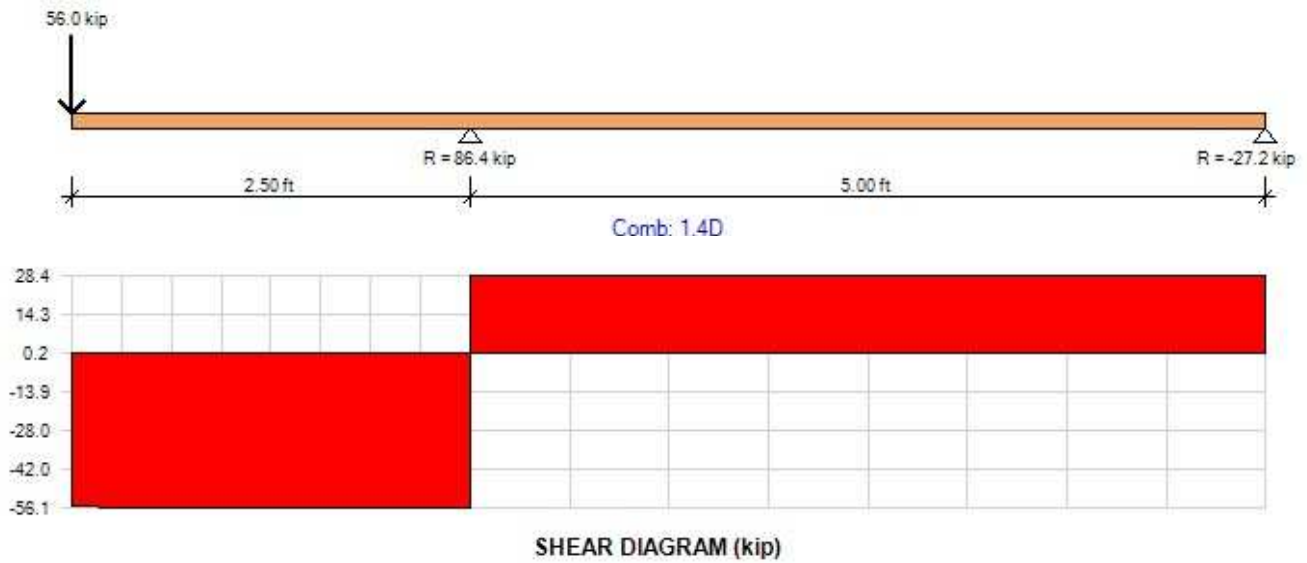
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### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |    |
|------|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | OK |



## GEOMETRY

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 24.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 1.50      | ft |
| Right Cantilever       | 1.50      | ft |

## BEAM SUPPORTS

| Number of Supports ..... |         | 3       |        |
|--------------------------|---------|---------|--------|
| Span                     | Length  | Support | Type   |
| ①                        | 4.00 ft | ①       | Pinned |
| ②                        | 4.00 ft | ②       | Pinned |
| ③                        | N.A.    | ③       | Pinned |
| ④                        | N.A.    | ④       | N.A.   |
| ⑤                        | N.A.    | ⑤       | N.A.   |
|                          |         | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |      |      |      |      |      |      |
|------|---|------|------|------|------|------|------|
| ①    | ① | 19.2 | 25.2 | -2.3 | -3.3 | 19.2 | 25.2 |
| ②    | ② | 18.0 | 23.6 | -2.3 | -2.8 | 18.0 | 23.6 |
| ③    | ③ | 18.0 | 23.6 | -2.3 | -2.8 | 18.0 | 23.6 |
| ④    | ④ | 18.9 | 22.2 | -2.3 | -2.8 | 18.9 | 22.2 |
| ⑤    | ⑤ | 18.9 | 22.2 | -2.3 | -2.8 | 18.9 | 22.2 |
| ⑥    | ⑥ | 18.0 | 21.6 | -2.3 | -2.8 | 18.0 | 21.6 |
| ⑦    | ⑦ | 18.0 | 21.6 | -2.3 | -2.8 | 18.0 | 21.6 |
| ⑧    | ⑧ | 18.9 | 22.2 | -2.3 | -2.8 | 18.9 | 22.2 |
| ⑨    | ⑨ | 18.9 | 22.2 | -2.3 | -2.8 | 18.9 | 22.2 |
| ⑩    | ⑩ | 18.9 | 22.2 | -2.3 | -2.8 | 18.9 | 22.2 |
| ⑪    | ⑪ | 10.8 | 16.2 | -1.4 | -2.1 | 10.8 | 16.2 |
| ⑫    | ⑫ | 10.8 | 16.2 | -1.4 | -2.1 | 10.8 | 16.2 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |     |   |    |   |     |    |
|------|-----|---|----|---|-----|----|
| ①    | -19 | 5 | -3 | 5 | -19 | OK |
| ②    | -18 | 5 | -2 | 5 | -18 | OK |
| ③    | -18 | 5 | -2 | 5 | -18 | OK |
| ④    | -17 | 5 | -2 | 5 | -17 | OK |
| ⑤    | -17 | 5 | -2 | 5 | -17 | OK |
| ⑥    | -17 | 4 | -2 | 4 | -17 | OK |
| ⑦    | -17 | 4 | -2 | 4 | -17 | OK |
| ⑧    | -17 | 5 | -2 | 5 | -17 | OK |
| ⑨    | -17 | 5 | -2 | 5 | -17 | OK |
| ⑩    | -17 | 5 | -2 | 5 | -17 | OK |
| ⑪    | -12 | 3 | -2 | 3 | -12 | OK |
| ⑫    | -12 | 3 | -2 | 3 | -12 | OK |

## SHEAR FORCES Vu (kip)

| Comb |       |     |     |      |      |         |
|------|-------|-----|-----|------|------|---------|
| ①    | -13.8 | 5.8 | 6.5 | -6.5 | -5.8 | 13.8 OK |
| ②    | -12.9 | 5.3 | 6.0 | -6.0 | -5.3 | 12.9 OK |
| ③    | -12.9 | 5.3 | 6.0 | -6.0 | -5.3 | 12.9 OK |
| ④    | -12.2 | 5.1 | 5.7 | -5.7 | -5.1 | 12.2 OK |
| ⑤    | -12.2 | 5.1 | 5.7 | -5.7 | -5.1 | 12.2 OK |
| ⑥    | -11.8 | 4.9 | 5.6 | -5.6 | -4.9 | 11.8 OK |
| ⑦    | -11.8 | 4.9 | 5.6 | -5.6 | -4.9 | 11.8 OK |
| ⑧    | -12.2 | 5.1 | 5.7 | -5.7 | -5.1 | 12.2 OK |
| ⑨    | -12.2 | 5.1 | 5.7 | -5.7 | -5.1 | 12.2 OK |
| ⑩    | -12.2 | 5.1 | 5.7 | -5.7 | -5.1 | 12.2 OK |
| ⑪    | -8.9  | 3.7 | 4.2 | -4.2 | -3.7 | 8.9 OK  |
| ⑫    | -8.9  | 3.7 | 4.2 | -4.2 | -3.7 | 8.9 OK  |



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## CONCRETE BEAM DESIGN

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| BENDING STRENGTH (k-ft) |             |             |      |      |                      |
|-------------------------|-------------|-------------|------|------|----------------------|
| Bot                     | 2#6 Cont    | 2#6 Cont    |      |      |                      |
| Bot                     | 0#5x2.00 ft | 0#5x2.00 ft |      |      |                      |
| d                       | 2.0         | 2.0         | 2.0  | 2.0  | 2.0 in               |
| +As                     | 0.88        | 0.88        | 0.88 | 0.88 | 0.88 in <sup>2</sup> |
| c/d                     | 0.10        | 0.10        | 0.10 | 0.10 | 0.10                 |
| +φMn                    | 83          | 83          | 83   | 83   | 83                   |
| Top                     | 2#6 Cont    | 2#6 Cont    |      |      |                      |
| Top                     | 0#5         | 0#5         | 0#5  |      |                      |
| d'                      | 2.0         | 2.0         | 2.0  | 2.0  | 2.0 in               |
| -As                     | 0.88        | 0.88        | 0.88 | 0.88 | 0.88 in <sup>2</sup> |
| c/d                     | 0.10        | 0.10        | 0.10 | 0.10 | 0.10                 |
| -φMn                    | -83         | -83         | -83  | -83  | -83                  |
| As min                  | 0.26        | 0.07        | 0.03 | 0.07 | 0.26 in <sup>2</sup> |

| DEFLECTIONS |        |        |        |                        |
|-------------|--------|--------|--------|------------------------|
| Comb        |        |        |        |                        |
| D           | 0.00   | 0.00   | 0.00   | 0.00 in                |
| L           | 0.00   | 0.00   | 0.00   | 0.00 in                |
| Lr, S       | 0.00   | 0.00   | 0.00   | 0.00 in                |
| LS          | 0.00   | 0.00   | 0.00   | 0.00 in                |
| LT          | 0.00   | 0.00   | 0.00   | 0.00 in                |
| Ieff D      | 10,456 | 10,456 | 10,456 | 10,456 in <sup>4</sup> |
| Ieff L      | 10,456 | 10,456 | 10,456 | 10,456 in <sup>4</sup> |
| Ieff LS     | 10,456 | 10,456 | 10,456 | 10,456 in <sup>4</sup> |
| λ           | 2.00   | 1.60   | 1.60   | 2.00                   |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

| DESIGN CODES            |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

| SHEAR STRENGTH (kip, in) |       |       |       |       |       |       |        |
|--------------------------|-------|-------|-------|-------|-------|-------|--------|
| φVc                      | -16.7 | 16.7  | -16.7 | 16.7  | -16.7 | 16.7  |        |
| φVs                      | -27.2 | 27.2  | -27.2 | 27.2  | -27.2 | 27.2  |        |
| φVn                      | -43.9 | 43.9  | -43.9 | 43.9  | -43.9 | 43.9  |        |
| Av/s                     | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | OK     |
| Min Av/s                 | N.A   | N.A   | N.A   | N.A   | N.A   | N.A   | 0.007  |
| s                        | 8.0   | 8.0   | 6.0   | 8.0   | 8.0   | 6.0   | 8.0 OK |
| s max                    | N.A   | N.A   | N.A   | N.A   | N.A   | N.A   | 11.0   |

| REINFORCEMENT                       |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.30 | OK |
| Max. Steel Area As max Ratio ....   | 0.22 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.25 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.24 | OK |
| Stirrups Spacing s max Ratio .....  | 0.73 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

| MAX. DEFLECTIONS L/δ |           |        |        |         |
|----------------------|-----------|--------|--------|---------|
| Type                 | Load      | L/δ    | Allow. | Ratio   |
| A                    | Lr, S, W  | ∞      | 90     | 0.00 OK |
| B                    | Live Load | 335632 | 180    | 0.00 OK |
| C                    | Long-Term | 10094  | 240    | 0.02 OK |
| D                    | Long-Term | 10094  | 120    | 0.01 OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

| MATERIALS                      |                |
|--------------------------------|----------------|
| Concrete Strength f'c .....    | 4.0 ksi        |
| Compression Strain Limit ..... | 0.003          |
| Concrete density .....         | 150 pcf        |
| Concrete Stress-Strain .....   | Hognestad      |
| Rebar Steel Strength fy .....  | 60.0 ksi       |
| Steel Stress-Strain .....      | Elasto-plastic |

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**CONCRETE BEAM DESIGN**

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**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |     |     |     |     |    |
|------|-----|-----|-----|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | OK |

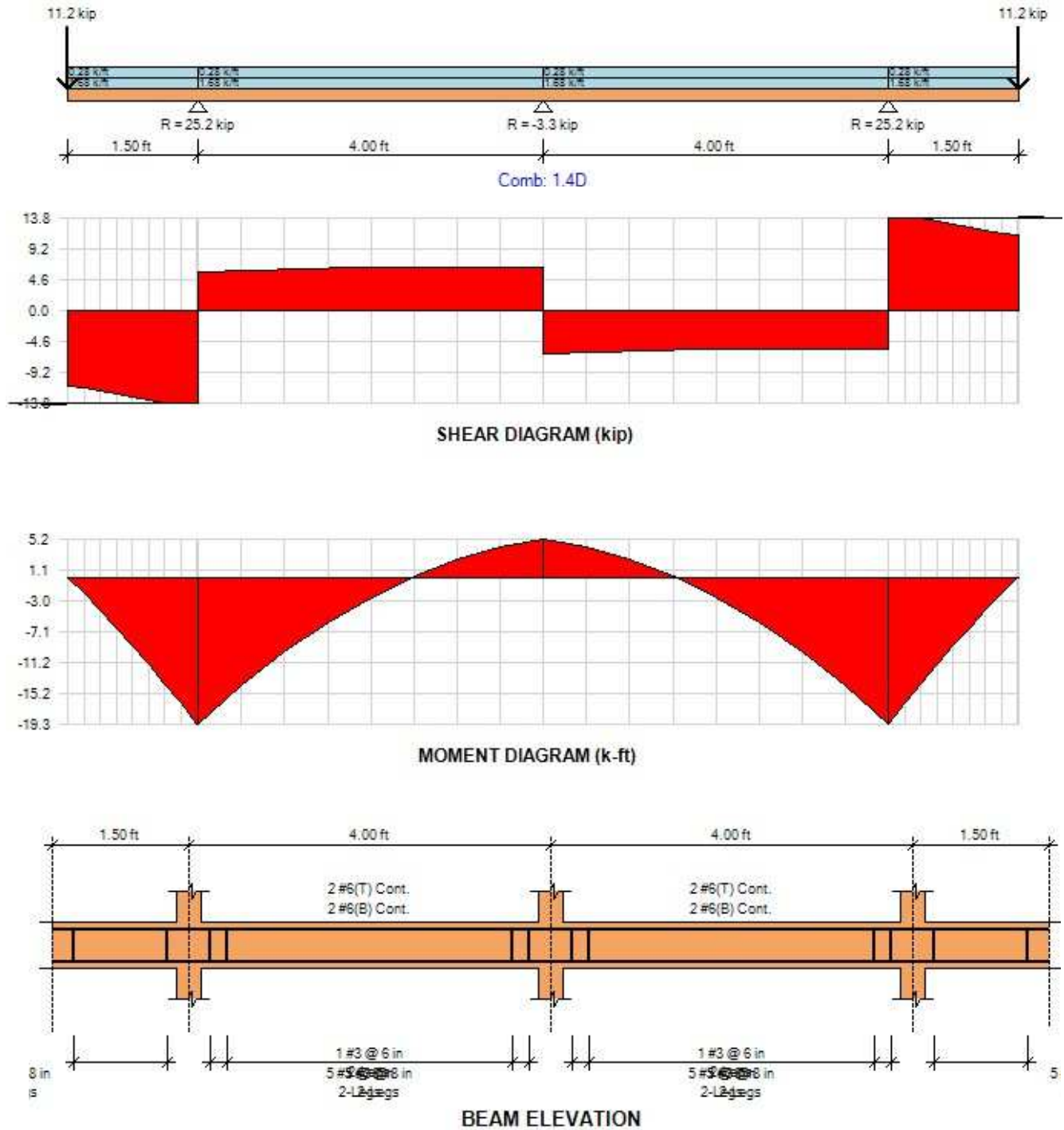
**TORSION STRENGTH (k-ft)**

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | N.A.   | OK |

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

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Project: CASA PA' FERNANDZ

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Engineer:

10/17/2024

Descrip: SECOND FLOOR BEAM V

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |           |    |
|------------------------|-----------|----|
| Type ...Rectangular    | Deep beam | NG |
| Total Height h         | 24.0      | in |
| Beam Width b           | 8.0       | in |
| Flange Thickness tf    | N.A.      |    |
| Left Flange Width bfl  | N.A.      |    |
| Right Flange Width bfr | N.A.      |    |
| Left Cantilever        | 0.00      | ft |
| Right Cantilever       | 3.50      | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |         | 2       |        |
|--------------------------|---------|---------|--------|
| Span                     | Length  | Support | Type   |
| ①                        | 6.00 ft | ①       | Pinned |
| ②                        | N.A.    | ②       | Pinned |
| ③                        | N.A.    | ③       | N.A.   |
| ④                        | N.A.    | ④       | N.A.   |
| ⑤                        | N.A.    | ⑤       | N.A.   |
|                          |         | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |      |      |           |
|------|---|------|------|-----------|
| ①    | ① | -7.2 | -9.0 | 38.8 48.7 |
| ②    | ② | -6.4 | -9.0 | 34.8 48.1 |
| ③    | ③ | -6.4 | -9.0 | 34.8 48.1 |
| ④    | ④ | -7.0 | -8.1 | 37.8 43.7 |
| ⑤    | ⑤ | -7.0 | -8.1 | 37.8 43.7 |
| ⑥    | ⑥ | -6.4 | -7.7 | 34.8 41.8 |
| ⑦    | ⑦ | -6.4 | -7.7 | 34.8 41.8 |
| ⑧    | ⑧ | -7.0 | -8.1 | 37.8 43.7 |
| ⑨    | ⑨ | -7.0 | -8.1 | 37.8 43.7 |
| ⑩    | ⑩ | -7.0 | -8.1 | 37.8 43.7 |
| ⑪    | ⑪ | -3.8 | -5.8 | 20.9 31.3 |
| ⑫    | ⑫ | -3.8 | -5.8 | 20.9 31.3 |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |     |   |     |    |
|------|-----|---|-----|----|
| ①    | -26 | 0 | -92 | OK |
| ②    | -25 | 0 | -91 | OK |
| ③    | -25 | 0 | -91 | OK |
| ④    | -23 | 0 | -82 | OK |
| ⑤    | -23 | 0 | -82 | OK |
| ⑥    | -22 | 0 | -79 | OK |
| ⑦    | -22 | 0 | -79 | OK |
| ⑧    | -23 | 0 | -82 | OK |
| ⑨    | -23 | 0 | -82 | OK |
| ⑩    | -23 | 0 | -82 | OK |
| ⑪    | -16 | 0 | -59 | OK |
| ⑫    | -16 | 0 | -59 | OK |

**SHEAR FORCES Vu (kip)**

| Comb |       |       |      |    |
|------|-------|-------|------|----|
| ①    | -13.5 | -17.0 | 25.9 | OK |
| ②    | -13.4 | -16.8 | 25.6 | OK |
| ③    | -13.4 | -16.8 | 25.6 | OK |
| ④    | -12.2 | -15.3 | 23.3 | OK |
| ⑤    | -12.2 | -15.3 | 23.3 | OK |
| ⑥    | -11.6 | -14.6 | 22.2 | OK |
| ⑦    | -11.6 | -14.6 | 22.2 | OK |
| ⑧    | -12.2 | -15.3 | 23.3 | OK |
| ⑨    | -12.2 | -15.3 | 23.3 | OK |
| ⑩    | -12.2 | -15.3 | 23.3 | OK |
| ⑪    | -8.7  | -10.9 | 16.7 | OK |
| ⑫    | -8.7  | -10.9 | 16.7 | OK |

**BENDING STRENGTH (k-ft)**

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 2#5 Cont    |      |                      |
| Bot    | 0#6x4.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0 in               |
| +As    | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d    | 0.09        | 0.09 | 0.10                 |
| +φMn   | 60          | 60   | 62                   |
| Top    | 2#6 Cont    |      |                      |
| Top    | 0#6         |      | 2#6                  |
| d'     | 3.0         | 2.0  | 3.0 in               |
| -As    | 0.88        | 0.88 | 1.76 in <sup>2</sup> |
| c/d    | 0.10        | 0.10 | 0.17                 |
| -φMn   | -83         | -83  | -157                 |
| As min | 0.36        | 0.00 | 0.59 in <sup>2</sup> |

**DEFLECTIONS**

|                     |       |       |                 |
|---------------------|-------|-------|-----------------|
| Comb                |       |       |                 |
| D                   | 0.00  | 0.06  | in              |
| L                   | 0.00  | 0.01  | in              |
| Lr, S               | 0.00  | 0.00  | in              |
| LS                  | 0.00  | 0.00  | in              |
| LT                  | 0.00  | 0.13  | in              |
| I <sub>eff</sub> D  | 9,494 | 3,604 | in <sup>4</sup> |
| I <sub>eff</sub> L  | 9,449 | 3,279 | in <sup>4</sup> |
| I <sub>eff</sub> LS | 9,478 | 3,491 | in <sup>4</sup> |
| λ                   | 1.60  | 2.00  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |              |
|----------|-------|-------|--------------|
| φVc      | 16.7  | -16.7 | 16.7         |
| φVs      | 21.8  | -21.8 | 21.8         |
| φVn      | 38.5  | -38.5 | 38.5         |
| Av/s     | 0.022 | 0.022 | 0.022 OK     |
| Min Av/s | N.A.  | N.A.  | 0.007        |
| s        | 10.0  | 6.0   | 10.0 10.0 OK |
| s max    | N.A.  | N.A.  | N.A. 11.0    |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.67 | OK |
| Max. Steel Area As max Ratio ....   | 0.22 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.53 | OK |
| Rebars Max Spacing Smax Ratio       | 0.26 | OK |
| Shear Vs/Vs max Ratio .....         | 0.54 | OK |
| Min. Stirrups Area Av/s Ratio ..... | 0.30 | OK |
| Stirrups Spacing s max Ratio .....  | 0.91 | OK |
| Stirrups Min. # of Legs Ratio ..... | 0.21 | OK |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 90     | 0.00  | OK |
| B    | Live Load | 3296 | 180    | 0.05  | OK |
| C    | Long-Term | 319  | 240    | 0.75  | OK |
| D    | Long-Term | 319  | 120    | 0.38  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM V

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## CONCRETE BEAM DESIGN

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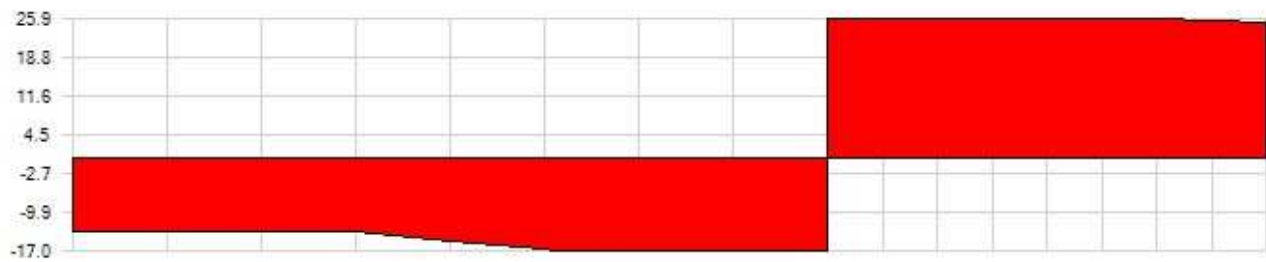
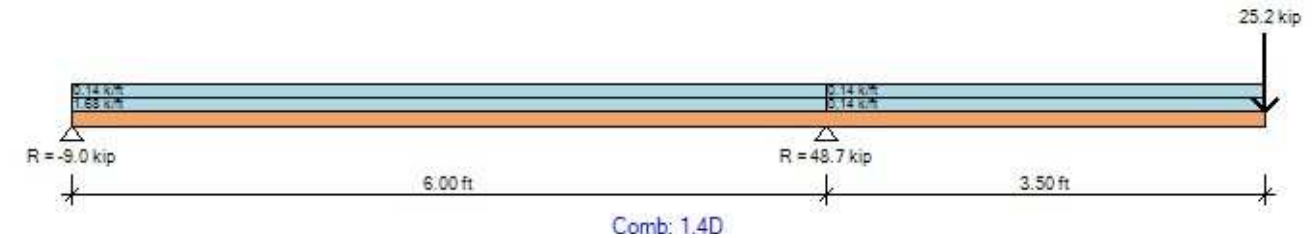
### TORSION MOMENTS $T_u$ (k-ft)

| Comb |     |     |     |    |
|------|-----|-----|-----|----|
| ①    | 0.0 | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | 0.0 | OK |

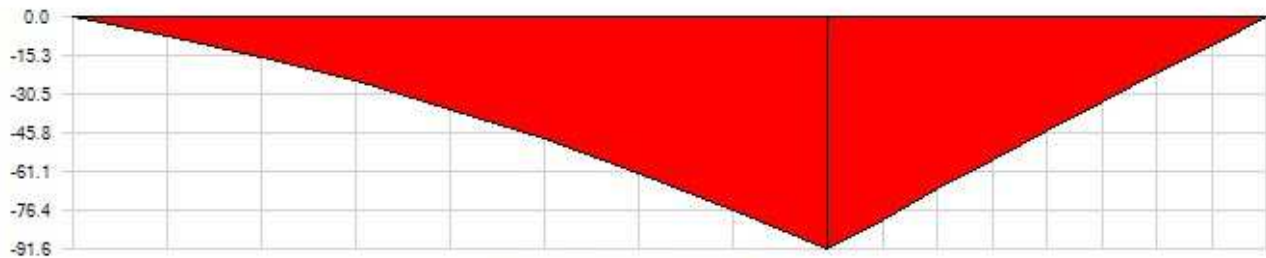
### TORSION STRENGTH (k-ft)

| At/s (in)             | 0.0000 | 0.0000 | 0.0000 |    |
|-----------------------|--------|--------|--------|----|
| AI (in <sup>2</sup> ) | 0.00   | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | N.A.   | OK |

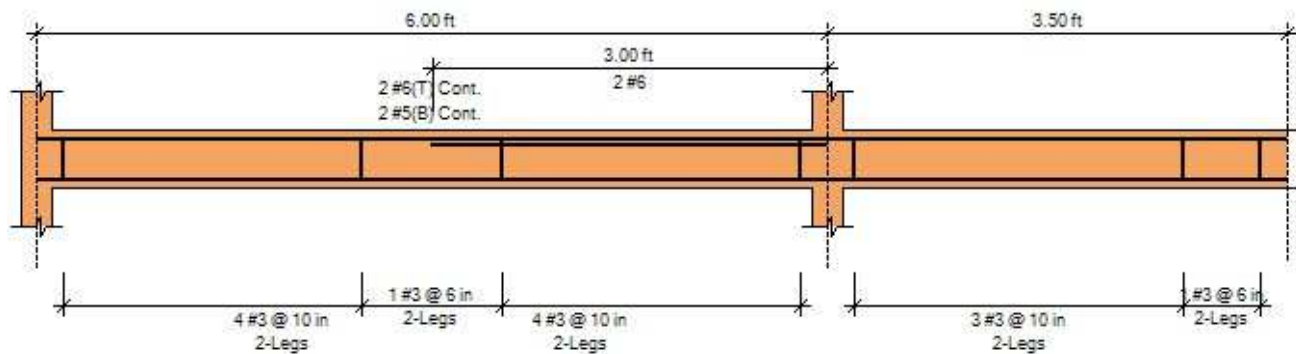




SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ  
 Engineer:  
 Descrip: SECOND FLOOR BEAM W

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

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### GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 24.0          | in |
| Beam Width b           | 8.0           | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

### BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 10.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

### SUPPORT REACTIONS (kip)

| Comb |   |     |      |     |      |
|------|---|-----|------|-----|------|
| ①    | ① | 8.2 | 10.5 | 8.2 | 10.5 |
| ②    | ② | 7.5 | 10.1 | 7.5 | 10.1 |
| ③    | ③ | 7.5 | 10.1 | 7.5 | 10.1 |
| ④    | ④ | 8.0 | 9.3  | 8.0 | 9.4  |
| ⑤    | ⑤ | 8.0 | 9.3  | 8.0 | 9.4  |
| ⑥    | ⑥ | 7.5 | 9.0  | 7.5 | 9.0  |
| ⑦    | ⑦ | 7.5 | 9.0  | 7.5 | 9.0  |
| ⑧    | ⑧ | 8.0 | 9.3  | 8.0 | 9.4  |
| ⑨    | ⑨ | 8.0 | 9.3  | 8.0 | 9.4  |
| ⑩    | ⑩ | 8.0 | 9.3  | 8.0 | 9.4  |
| ⑪    | ⑪ | 4.5 | 6.7  | 4.5 | 6.8  |
| ⑫    | ⑫ | 4.5 | 6.7  | 4.5 | 6.8  |

### LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

### BENDING MOMENTS Mu (k-ft)

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 26 | 0 | OK |  |
| ②    | 0 | 25 | 0 | OK |  |
| ③    | 0 | 25 | 0 | OK |  |
| ④    | 0 | 23 | 0 | OK |  |
| ⑤    | 0 | 23 | 0 | OK |  |
| ⑥    | 0 | 22 | 0 | OK |  |
| ⑦    | 0 | 22 | 0 | OK |  |
| ⑧    | 0 | 23 | 0 | OK |  |
| ⑨    | 0 | 23 | 0 | OK |  |
| ⑩    | 0 | 23 | 0 | OK |  |
| ⑪    | 0 | 17 | 0 | OK |  |
| ⑫    | 0 | 17 | 0 | OK |  |

### SHEAR FORCES Vu (kip)

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 5.9 | -6.0 | OK |  |  |
| ②    | 5.7 | -5.7 | OK |  |  |
| ③    | 5.7 | -5.7 | OK |  |  |
| ④    | 5.3 | -5.3 | OK |  |  |
| ⑤    | 5.3 | -5.3 | OK |  |  |
| ⑥    | 5.1 | -5.1 | OK |  |  |
| ⑦    | 5.1 | -5.1 | OK |  |  |
| ⑧    | 5.3 | -5.3 | OK |  |  |
| ⑨    | 5.3 | -5.3 | OK |  |  |
| ⑩    | 5.3 | -5.3 | OK |  |  |
| ⑪    | 3.8 | -3.8 | OK |  |  |
| ⑫    | 3.8 | -3.8 | OK |  |  |

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## CONCRETE BEAM DESIGN

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### BENDING STRENGTH (k-ft)

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 2#5 Cont    |      |                      |
| Bot    | 0#6x4.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0 in               |
| +As    | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d    | 0.08        | 0.08 | 0.08                 |
| +φMn   | 60          | 60   | 60                   |
| Top    | 2#5 Cont    |      |                      |
| Top    | 0#5         |      |                      |
| d'     | 2.0         | 2.0  | 2.0 in               |
| -As    | 0.62        | 0.62 | 0.62 in <sup>2</sup> |
| c/d    | 0.08        | 0.08 | 0.08                 |
| -φMn   | -60         | -60  | -60                  |
| As min | 0.00        | 0.38 | 0.00 in <sup>2</sup> |

### DEFLECTIONS

|         |        |  |                 |
|---------|--------|--|-----------------|
| Comb    |        |  |                 |
| D       | 0.01   |  | in              |
| L       | 0.00   |  | in              |
| Lr, S   | 0.00   |  | in              |
| LS      | 0.00   |  | in              |
| LT      | 0.02   |  | in              |
| Ieff D  | 10,090 |  | in <sup>4</sup> |
| Ieff L  | 10,090 |  | in <sup>4</sup> |
| Ieff LS | 10,090 |  | in <sup>4</sup> |
| λ       | 1.70   |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

### DESIGN CODES

|                   |              |
|-------------------|--------------|
| Concrete Design   | ACI 318-19   |
| Load Combinations | ASCE 7-10/16 |

### SHEAR STRENGTH (kip, in)

|          |       |             |
|----------|-------|-------------|
| φVc      | 16.7  | -16.7       |
| φVs      | 21.8  | -21.8       |
| φVn      | 38.5  | -38.5       |
| Av/s     | 0.022 | 0.022 OK    |
| Min Av/s | N.A.  | N.A.        |
| s        | 10.0  | 6.0 10.0 OK |
| s max    | N.A.  | N.A.        |

### REINFORCEMENT

|                               |      |    |
|-------------------------------|------|----|
| Min. Steel Area As min Ratio  | 0.61 | OK |
| Max. Steel Area As max Ratio  | 0.17 | OK |
| Rebars Min Spacing Smin Ratio | 0.53 | OK |
| Rebars Max Spacing Smax Ratio | 0.26 | OK |
| Shear Vs/Vs max Ratio         | N.A. |    |
| Min. Stirrups Area Av/s Ratio | N.A. |    |
| Stirrups Spacing s max Ratio  | N.A. |    |
| Stirrups Min. # of Legs Ratio | N.A. |    |

### MAX. DEFLECTIONS L/δ

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.00  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 7023 | 480    | 0.07  | OK |
| D    | Long-Term | 7023 | 240    | 0.03  | OK |

A - Roofs not attached to non-structural elements.  
 B - Floors not attached to non-structural elements.  
 C - Attached to elements likely to be damaged.  
 D - Attached to elements not likely to be damaged.

### MATERIALS

|                          |                |     |
|--------------------------|----------------|-----|
| Concrete Strength f'c    | 4.0            | ksi |
| Compression Strain Limit | 0.003          |     |
| Concrete density         | 150            | pcf |
| Concrete Stress-Strain   | Hognestad      |     |
| Rebar Steel Strength fy  | 60.0           | ksi |
| Steel Stress-Strain      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ  
Engineer:  
Descrip: SECOND FLOOR BEAM W

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ASDIP Concrete 5.4.2.2

## CONCRETE BEAM DESIGN

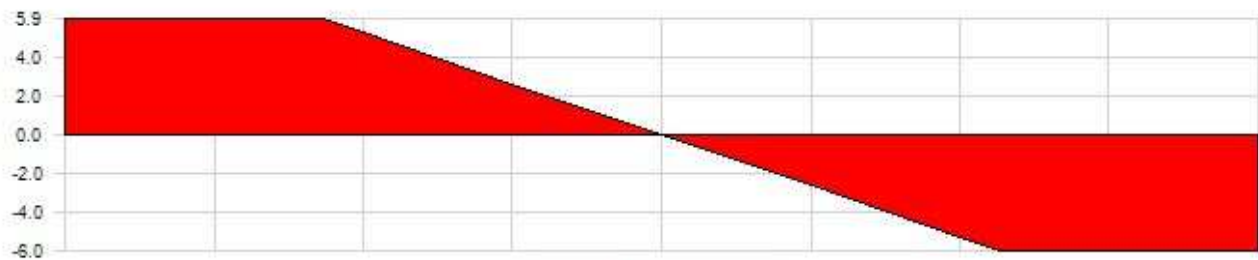
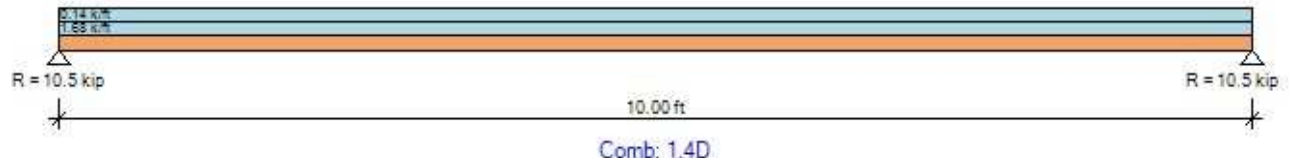
www.asdipsoft.com

### TORSION MOMENTS $T_u$ (k-ft)

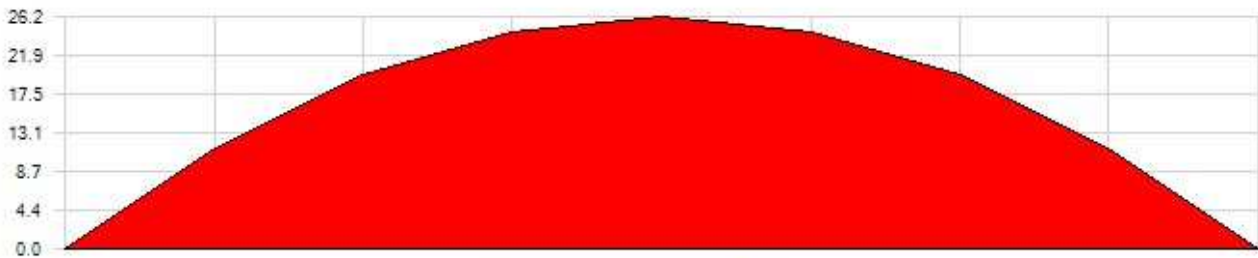
| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

### TORSION STRENGTH (k-ft)

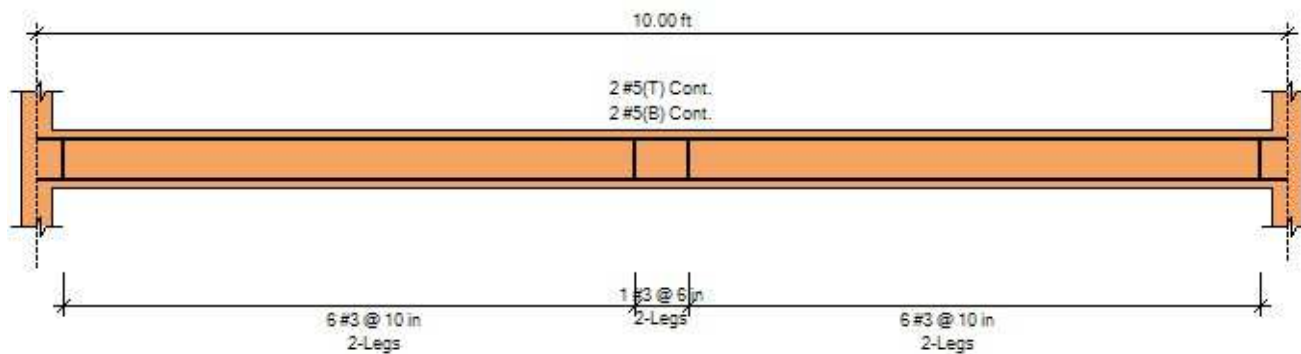
|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

Project: CASA PA' FERNANDZ

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Descrip: SECOND FLOOR FLOATING SLAB T

ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**

www.asdipsoft.com

**GEOMETRY**

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 8.0           | in |
| Beam Width b           | 54.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

**BEAM SUPPORTS**

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 15.00 ft | ①       | Fixed  |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

**SUPPORT REACTIONS (kip)**

| Comb |   |     |     |     |     |
|------|---|-----|-----|-----|-----|
| ①    | ① | 6.1 | 8.5 | 3.7 | 5.1 |
| ②    | ② | 7.4 | 7.9 | 4.4 | 4.8 |
| ③    | ③ | 6.1 | 7.3 | 3.7 | 4.4 |
| ④    | ④ | 7.0 | 9.3 | 4.2 | 5.6 |
| ⑤    | ⑤ | 6.1 | 7.3 | 3.7 | 4.4 |
| ⑥    | ⑥ | 6.1 | 9.3 | 3.7 | 5.6 |
| ⑦    | ⑦ | 6.1 | 7.3 | 3.7 | 4.4 |
| ⑧    | ⑧ | 7.0 | 7.9 | 4.2 | 4.8 |
| ⑨    | ⑨ | 6.1 | 7.3 | 3.7 | 4.4 |
| ⑩    | ⑩ | 6.1 | 7.3 | 3.7 | 4.4 |
| ⑪    | ⑪ | 3.7 | 5.5 | 2.2 | 3.3 |
| ⑫    | ⑫ | 3.7 | 5.5 | 2.2 | 3.3 |

**LOAD COMBINATIONS**

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

**BENDING MOMENTS Mu (k-ft)**

| Comb |     |    |   |    |  |
|------|-----|----|---|----|--|
| ①    | -26 | 14 | 0 | OK |  |
| ②    | -24 | 13 | 0 | OK |  |
| ③    | -22 | 12 | 0 | OK |  |
| ④    | -28 | 16 | 0 | OK |  |
| ⑤    | -22 | 12 | 0 | OK |  |
| ⑥    | -28 | 16 | 0 | OK |  |
| ⑦    | -22 | 12 | 0 | OK |  |
| ⑧    | -24 | 13 | 0 | OK |  |
| ⑨    | -22 | 12 | 0 | OK |  |
| ⑩    | -22 | 12 | 0 | OK |  |
| ⑪    | -16 | 9  | 0 | OK |  |
| ⑫    | -16 | 9  | 0 | OK |  |

**SHEAR FORCES Vu (kip)**

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 7.6 | -4.2 | OK |  |  |
| ②    | 7.1 | -3.9 | OK |  |  |
| ③    | 6.5 | -3.6 | OK |  |  |
| ④    | 8.3 | -4.6 | OK |  |  |
| ⑤    | 6.5 | -3.6 | OK |  |  |
| ⑥    | 8.3 | -4.6 | OK |  |  |
| ⑦    | 6.5 | -3.6 | OK |  |  |
| ⑧    | 7.1 | -3.9 | OK |  |  |
| ⑨    | 6.5 | -3.6 | OK |  |  |
| ⑩    | 6.5 | -3.6 | OK |  |  |
| ⑪    | 4.9 | -2.7 | OK |  |  |
| ⑫    | 4.9 | -2.7 | OK |  |  |



**BENDING STRENGTH (k-ft)**

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 6#6 Cont    |      |                      |
| Bot    | 0#6x3.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0 in               |
| +As    | 2.64        | 2.64 | 2.64 in <sup>2</sup> |
| c/d    | 0.25        | 0.25 | 0.25                 |
| +φMn   | 71          | 71   | 71                   |
| Top    | 6#6 Cont    |      |                      |
| Top    | 0#5         |      |                      |
| d'     | 2.0         | 2.0  | 2.0 in               |
| -As    | 2.64        | 2.64 | 2.64 in <sup>2</sup> |
| c/d    | 0.25        | 0.25 | 0.25                 |
| -φMn   | -71         | -71  | -71                  |
| As min | 1.08        | 0.96 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|         |       |  |                 |
|---------|-------|--|-----------------|
| Comb    |       |  |                 |
| D       | 0.03  |  | in              |
| L       | 0.00  |  | in              |
| Lr, S   | 0.01  |  | in              |
| LS      | 0.00  |  | in              |
| LT      | 0.05  |  | in              |
| Ieff D  | 2,453 |  | in <sup>4</sup> |
| Ieff L  | 2,453 |  | in <sup>4</sup> |
| Ieff LS | 2,453 |  | in <sup>4</sup> |
| λ       | 1.42  |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |       |        |
|----------|-------|-------|--------|
| φVc      | 25.1  | -25.1 |        |
| φVs      | 0.0   | 0.0   |        |
| φVn      | 25.1  | -25.1 |        |
| Av/s     | 0.028 | 0.028 | OK     |
| Min Av/s | N.A.  | N.A.  |        |
| s        | 8.0   | 6.0   | 8.0 OK |
| s max    | N.A.  | N.A.  | N.A.   |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.41 | OK |
| Max. Steel Area As max Ratio ....   | 0.44 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.11 | OK |
| Rebars Max Spacing Smax Ratio       | 0.89 | OK |
| Shear Vs/Vs max Ratio .....         | N.A. |    |
| Min. Stirrups Area Av/s Ratio ..... | N.A. |    |
| Stirrups Spacing s max Ratio .....  | N.A. |    |
| Stirrups Min. # of Legs Ratio ..... | N.A. |    |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 9999 | 180    | 0.01  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 3472 | 480    | 0.14  | OK |
| D    | Long-Term | 3472 | 240    | 0.07  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

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Descrip: SECOND FLOOR FLOATING SLAB T

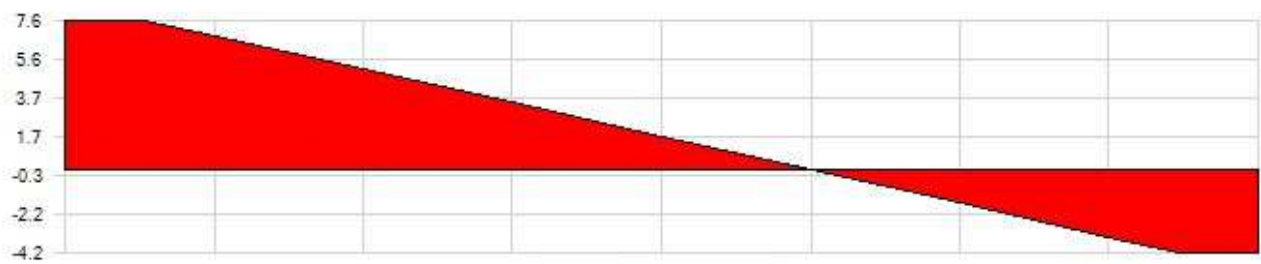
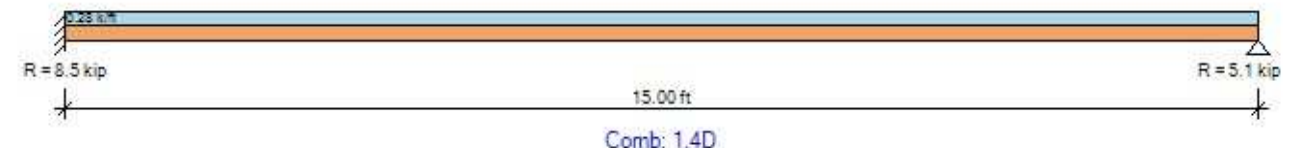
ASDIP Concrete 5.4.2.2

**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

**TORSION STRENGTH (k-ft)**

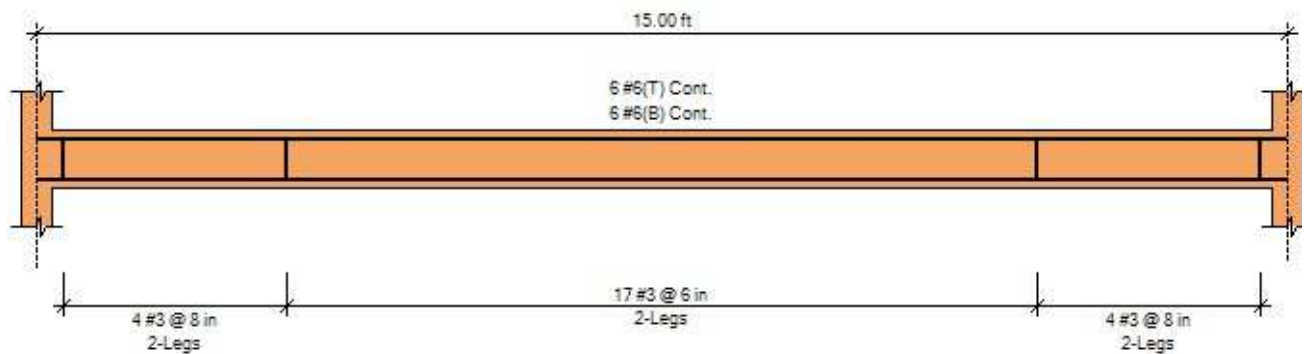
|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION

## GEOMETRY

|                        |               |    |
|------------------------|---------------|----|
| Type ...Rectangular    | Not deep beam | OK |
| Total Height h         | 12.0          | in |
| Beam Width b           | 24.0          | in |
| Flange Thickness tf    | N.A.          |    |
| Left Flange Width bfl  | N.A.          |    |
| Right Flange Width bfr | N.A.          |    |
| Left Cantilever        | 0.00          | ft |
| Right Cantilever       | 0.00          | ft |

## BEAM SUPPORTS

| Number of Supports ..... |          | 2       |        |
|--------------------------|----------|---------|--------|
| Span                     | Length   | Support | Type   |
| ①                        | 23.00 ft | ①       | Pinned |
| ②                        | N.A.     | ②       | Pinned |
| ③                        | N.A.     | ③       | N.A.   |
| ④                        | N.A.     | ④       | N.A.   |
| ⑤                        | N.A.     | ⑤       | N.A.   |
|                          |          | ⑥       | N.A.   |

## SUPPORT REACTIONS (kip)

| Comb |   |     |     |     |     |
|------|---|-----|-----|-----|-----|
| ①    | ① | 0.0 | 0.0 | 0.0 | 0.0 |
| ②    | ② | 5.1 | 2.5 | 5.1 | 2.5 |
| ③    | ③ | 0.0 | 0.0 | 0.0 | 0.0 |
| ④    | ④ | 3.8 | 8.1 | 3.8 | 8.1 |
| ⑤    | ⑤ | 0.0 | 0.0 | 0.0 | 0.0 |
| ⑥    | ⑥ | 0.0 | 8.1 | 0.0 | 8.1 |
| ⑦    | ⑦ | 0.0 | 0.0 | 0.0 | 0.0 |
| ⑧    | ⑧ | 3.8 | 2.5 | 3.8 | 2.5 |
| ⑨    | ⑨ | 0.0 | 0.0 | 0.0 | 0.0 |
| ⑩    | ⑩ | 0.0 | 0.0 | 0.0 | 0.0 |
| ⑪    | ⑪ | 0.0 | 0.0 | 0.0 | 0.0 |
| ⑫    | ⑫ | 0.0 | 0.0 | 0.0 | 0.0 |

## LOAD COMBINATIONS

| SERVICE                | FACTORED            |
|------------------------|---------------------|
| ① D+L                  | ① 1.4D              |
| ② D+Lr                 | ② 1.2D+1.6L+0.5Lr   |
| ③ D+S                  | ③ 1.2D+1.6L+0.5S    |
| ④ D+0.75L+0.75Lr       | ④ 1.2D+0.5L+1.6Lr   |
| ⑤ D+0.75L+0.75S        | ⑤ 1.2D+0.5L+1.6S    |
| ⑥ D+0.6W               | ⑥ 1.2D+1.6Lr+0.5W   |
| ⑦ D+0.7E               | ⑦ 1.2D+1.6S+0.5W    |
| ⑧ D+0.75L+0.75Lr+0.45W | ⑧ 1.2D+0.5L+0.5Lr+W |
| ⑨ D+0.75L+0.75S+0.45W  | ⑨ 1.2D+0.5L+0.5S+W  |
| ⑩ D+0.75L+0.75S+0.525E | ⑩ 1.2D+0.5L+0.2S+E  |
| ⑪ 0.6D+0.6W            | ⑪ 0.9D+W            |
| ⑫ 0.6D+0.7E            | ⑫ 0.9D+E            |

## BENDING MOMENTS Mu (k-ft)

| Comb |   |    |   |    |  |
|------|---|----|---|----|--|
| ①    | 0 | 0  | 0 | OK |  |
| ②    | 0 | 15 | 0 | OK |  |
| ③    | 0 | 0  | 0 | OK |  |
| ④    | 0 | 47 | 0 | OK |  |
| ⑤    | 0 | 0  | 0 | OK |  |
| ⑥    | 0 | 47 | 0 | OK |  |
| ⑦    | 0 | 0  | 0 | OK |  |
| ⑧    | 0 | 15 | 0 | OK |  |
| ⑨    | 0 | 0  | 0 | OK |  |
| ⑩    | 0 | 0  | 0 | OK |  |
| ⑪    | 0 | 0  | 0 | OK |  |
| ⑫    | 0 | 0  | 0 | OK |  |

## SHEAR FORCES Vu (kip)

| Comb |     |      |    |  |  |
|------|-----|------|----|--|--|
| ①    | 0.0 | 0.0  | OK |  |  |
| ②    | 2.2 | -2.2 | OK |  |  |
| ③    | 0.0 | 0.0  | OK |  |  |
| ④    | 7.2 | -7.2 | OK |  |  |
| ⑤    | 0.0 | 0.0  | OK |  |  |
| ⑥    | 7.2 | -7.2 | OK |  |  |
| ⑦    | 0.0 | 0.0  | OK |  |  |
| ⑧    | 2.2 | -2.2 | OK |  |  |
| ⑨    | 0.0 | 0.0  | OK |  |  |
| ⑩    | 0.0 | 0.0  | OK |  |  |
| ⑪    | 0.0 | 0.0  | OK |  |  |
| ⑫    | 0.0 | 0.0  | OK |  |  |

**BENDING STRENGTH (k-ft)**

|        |             |      |                      |
|--------|-------------|------|----------------------|
| Bot    | 3#8 Cont    |      |                      |
| Bot    | 0#6x3.00 ft |      |                      |
| d      | 2.0         | 4.0  | 2.0 in               |
| +As    | 2.37        | 2.37 | 2.37 in <sup>2</sup> |
| c/d    | 0.20        | 0.20 | 0.20                 |
| +φMn   | 97          | 97   | 97                   |
| Top    | 3#8 Cont    |      |                      |
| Top    | 0#5         |      |                      |
| d'     | 2.0         | 2.0  | 2.0 in               |
| -As    | 2.37        | 2.37 | 2.37 in <sup>2</sup> |
| c/d    | 0.20        | 0.20 | 0.20                 |
| -φMn   | -97         | -97  | -97                  |
| As min | 0.00        | 0.80 | 0.00 in <sup>2</sup> |

**DEFLECTIONS**

|         |       |  |                 |
|---------|-------|--|-----------------|
| Comb    |       |  |                 |
| D       | 0.00  |  | in              |
| L       | 0.00  |  | in              |
| Lr, S   | 0.24  |  | in              |
| LS      | 0.06  |  | in              |
| LT      | 0.08  |  | in              |
| Ieff D  | 3,990 |  | in <sup>4</sup> |
| Ieff L  | 3,990 |  | in <sup>4</sup> |
| Ieff LS | 3,990 |  | in <sup>4</sup> |
| λ       | 1.34  |  |                 |

$$LS = 0.30(L+Lr) \quad LT = L+Lr+\lambda(D+LS)$$

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**SHEAR STRENGTH (kip, in)**

|          |       |            |
|----------|-------|------------|
| φVc      | 19.8  | -19.8      |
| φVs      | 0.0   | 0.0        |
| φVn      | 19.8  | -19.8      |
| Av/s     | 0.020 | 0.020 OK   |
| Min Av/s | N.A.  | N.A.       |
| s        | 8.0   | 6.0 8.0 OK |
| s max    | N.A.  | N.A.       |

**REINFORCEMENT**

|                                     |      |    |
|-------------------------------------|------|----|
| Min. Steel Area As min Ratio .....  | 0.34 | OK |
| Max. Steel Area As max Ratio ....   | 0.41 | OK |
| Rebars Min Spacing Smin Ratio ..    | 0.11 | OK |
| Rebars Max Spacing Smax Ratio       | 0.93 | OK |
| Shear Vs/Vs max Ratio .....         | N.A. |    |
| Min. Stirrups Area Av/s Ratio ..... | N.A. |    |
| Stirrups Spacing s max Ratio .....  | N.A. |    |
| Stirrups Min. # of Legs Ratio ..... | N.A. |    |

**MAX. DEFLECTIONS L/δ**

| Type | Load      | L/δ  | Allow. | Ratio |    |
|------|-----------|------|--------|-------|----|
| A    | Lr, S, W  | 1166 | 180    | 0.15  | OK |
| B    | Live Load | 9999 | 360    | 0.00  | OK |
| C    | Long-Term | 3565 | 480    | 0.13  | OK |
| D    | Long-Term | 3565 | 240    | 0.07  | OK |

A - Roofs not attached to non-structural elements.

B - Floors not attached to non-structural elements.

C - Attached to elements likely to be damaged.

D - Attached to elements not likely to be damaged.

**MATERIALS**

|                                |                |     |
|--------------------------------|----------------|-----|
| Concrete Strength f'c .....    | 4.0            | ksi |
| Compression Strain Limit ..... | 0.003          |     |
| Concrete density .....         | 150            | pcf |
| Concrete Stress-Strain .....   | Hognestad      |     |
| Rebar Steel Strength fy .....  | 60.0           | ksi |
| Steel Stress-Strain .....      | Elasto-plastic |     |

Project: CASA PA' FERNANDZ

Page # \_\_\_\_

Engineer:

10/17/2024

Descrip: SECOND FLOOR WIND BEAMS S

ASDIP Concrete 5.4.2.2

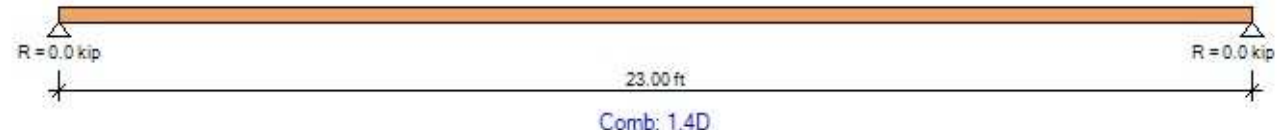
**CONCRETE BEAM DESIGN**[www.asdipsoft.com](http://www.asdipsoft.com)**TORSION MOMENTS  $T_u$  (k-ft)**

| Comb |     |     |    |
|------|-----|-----|----|
| ①    | 0.0 | 0.0 | OK |
| ②    | 0.0 | 0.0 | OK |
| ③    | 0.0 | 0.0 | OK |
| ④    | 0.0 | 0.0 | OK |
| ⑤    | 0.0 | 0.0 | OK |
| ⑥    | 0.0 | 0.0 | OK |
| ⑦    | 0.0 | 0.0 | OK |
| ⑧    | 0.0 | 0.0 | OK |
| ⑨    | 0.0 | 0.0 | OK |
| ⑩    | 0.0 | 0.0 | OK |
| ⑪    | 0.0 | 0.0 | OK |
| ⑫    | 0.0 | 0.0 | OK |

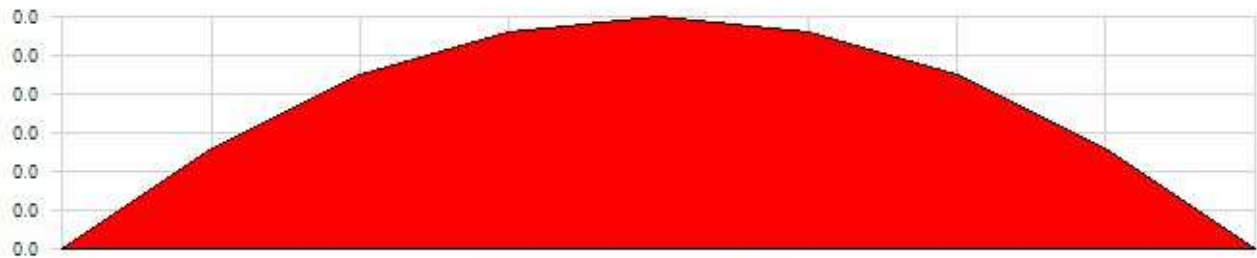
**TORSION STRENGTH (k-ft)**

|                       |        |        |    |
|-----------------------|--------|--------|----|
| At/s (in)             | 0.0000 | 0.0000 |    |
| Al (in <sup>2</sup> ) | 0.00   | 0.00   |    |
| $\phi T_n$ (kip)      | 0.0    | 0.0    |    |
| Stress (psi)          | N.A.   | N.A.   | OK |
| Total At/s (in)       | N.A.   | N.A.   | OK |





SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)



BEAM ELEVATION



## *Canopies Design*

# Front Canopy

Thickness:

$$\text{cant } h = \frac{l}{10} \rightarrow \frac{7.2}{10} = 8.6''$$

Make it 9"  $d = 7.5''$

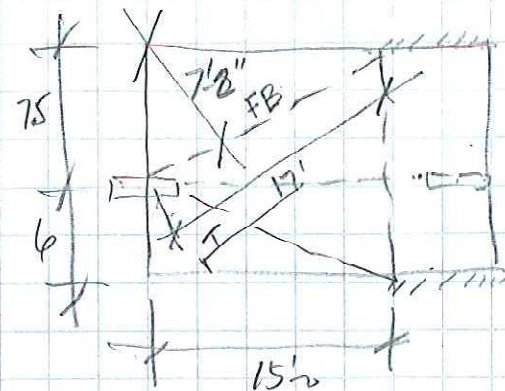
$$DL = 112 \text{ psf} \quad A_{DL} = 8 \text{ psf}$$

$$DL = 120 \text{ psf} \quad LL = 20 \text{ psf}$$

$$UTL \approx 180 \text{ psf}$$

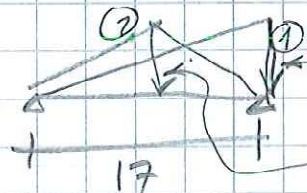
$$\text{Top Reinf: } M = \frac{180 \times 7.5^2}{2} = 5.06 \text{ k/F}$$

$$A_s = \frac{5.06}{4 \times 7.5} = 0.18 \text{ in}^2/\text{F} \quad \#5 @ 12' \text{ OK}$$



$$\text{Slab } h = \frac{l}{20} = \frac{15}{20} = 0.75' = 9''$$

Flat Beam FB



$$UD = 7.5' \times 120 \times 1.2 = 1.17 \text{ k/F}$$

$$UL = 7.5' \times 20 \times 1.6 = 0.24 \text{ k/F}$$

$$UD = 7.2' \times 120 \times 1.2 = 1.1 \text{ k/F}$$

$$UL = 7.2' \times 20 \times 1.6 = 0.2 \text{ k/F}$$

$$M_u = M_F^{(2)} + M_F^{(1)}$$

$$= \frac{W_u l}{6} + 0.1283 W_u l$$

$$= \frac{11 \times 17}{6} + 0.1283 \times 11.9 \times 17 = 57 \text{ k}$$

$$A_s = \frac{57}{4 \times 7.5} = 1.90 \text{ in}^2 \rightarrow 5 \#6$$

$$W_u^{(2)} = 1.3 \times 17 \times 0.5 = 11 \text{ k}$$

$$W_u^{(1)} = 1.4 \times 17 \times 0.5 = 11.9 \text{ k}$$

Reaction at Front Column:

$$R_u = 120 \times 7.5' \times 13.5' = 13 \text{ k}$$

$$R_L = 20 \times 7.5' \times 13.5' = 2 \text{ k}$$



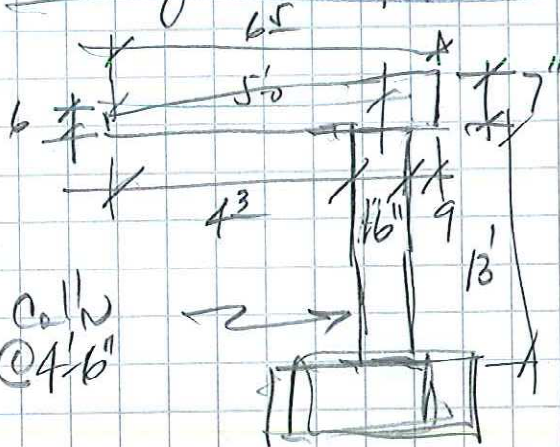
# (T) Floating slab

slab Thickness one way  $t = \frac{l}{24} = \frac{16}{24} = 0.66$

8" THK → DL 100  
 LL 30  
 ASD 45 psf  
 6#6 T & B  
 #3 @

$R_D = 6"$   
 $R_L = 2"$

## Walkway Canopy



DL = 85 psf  
 LL = 20 psf } UTL = 135 psf

$P_d = 85 \times 6.5' = 560 \text{ plf}$

$P_L = 20 \times 6.5' = 130 \text{ plf}$

Col'n  $8 \times 16 \rightarrow$   
 $D = \frac{8 \times 16}{144} \times 150 \times 13' = 1.8' \text{ } ^{12}$

Canopy/col'n  $D = 560 \times 4.3' = 2.6' \text{ } ^{12}$   
 $L = 130 \times 4.3' = 0.6' \text{ } ^{12}$

$w_{wt+LW} = (-73 + 67) \times 0.6 = 84 \text{ psf}$

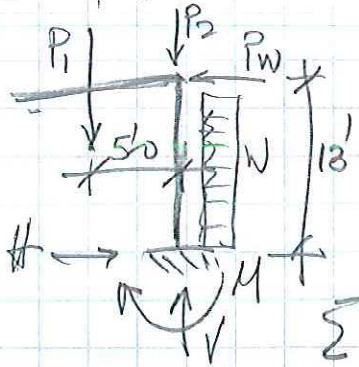
wind on canopy edge

$w_w = 84 \text{ psf} \times 0.58 = 50 \text{ plf}$   $P_w = 225 \#$

$P_w = 84 \times 0.66 = 55 \text{ plf on column}$

$M_u = \frac{1.35 \times 5^2}{2} = 1.69' \text{ } ^{12}/\text{f}$   $f = \frac{1.69}{4 \times 4} = 0.11' \text{ } ^{12}/\text{f} \rightarrow \#4 @ 12" \text{ OK}$   
 slab cant.

Canopy (Cont.)



$$P_{1D} = 2.6^k$$

$$P_{2D} = 1.8^k$$

$$P_{1L} = 0.6^k$$

$$P_W = 0.23^k$$

$$W = 0.06 \text{ klf}$$

$$\sum M = \frac{0.06^k \times 13' \times 6.5'}{2} + 0.23^k \times 13' + 2.6^k \times 5' = 24^k$$

$$M_W = 8.06^k$$

$$M_D = 13^k$$

$$M_L = 3^k$$

$$V_D = 4.4^k$$

$$V_L = 0.6^k$$

$$H_W = 1.01^k$$

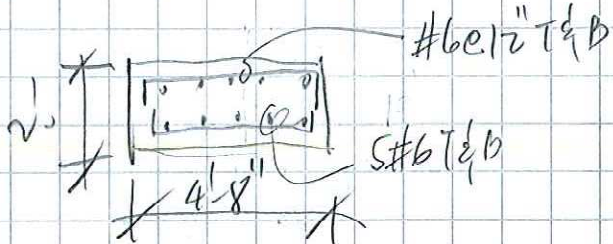
Controlling Com B

$$1.2D + 0.5L + 1W$$

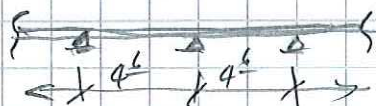
$$1.0D + 0.75L + 0.45W$$

$$M_u = 1.2 \times 13 + 0.5 \times 3 + \frac{8.06}{0.6} \approx 31^k$$

$$A_g = \frac{31}{4 \times 14} = 0.55 \text{ in}^2 \text{ on face of column } \underline{4\#6 \text{ OK}}$$



Canopy Slab



$$C = 4.5'$$

c/c col N

$$M_u = \frac{0.35 \times 4.5^2}{8} = 0.34^k$$

$$A_s = \frac{0.3}{4 \times 4} = 0.02$$

$$A_{smin} = 0.0033 \times 54 \times 5 = 0.89 \text{ in}^2$$

Provide 3#5 @ Col N c/c



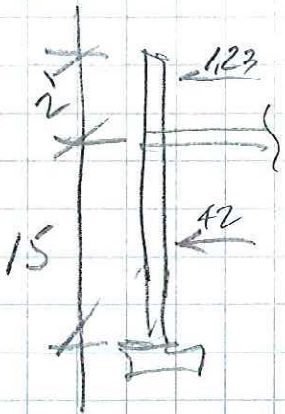


## *Masonry Walls*

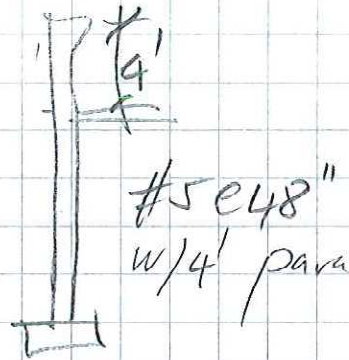


Walls

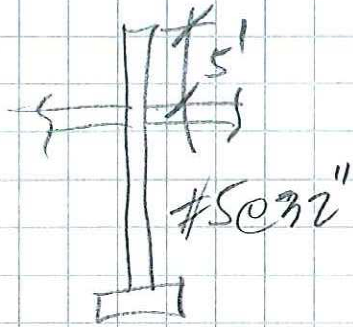
Cabana



W1: #5@48"  
w/2' parapet

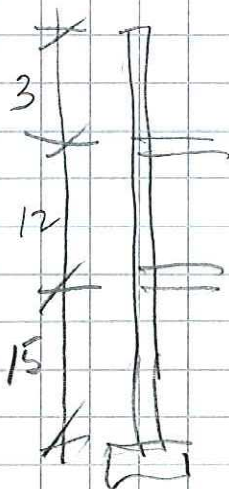


#5@48"  
w/4' para



#5@32"

House



# Front Screen Wall

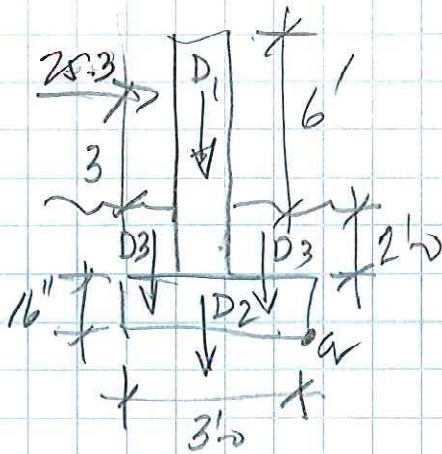
$L = 29'$

Wind

0 → 6'  
6' → 12'  
12' → 18'  
18' → 29'

51.1 psf × 0.6 = 30.7 psf  
33 = 19.8 psf  
23.7 = 14.2 psf  
17.6 = 10.6 psf

ASD  
Avg = 25.3 psf



$$D_1 = 8 \times 9 \text{ psf} = 720 \text{ plf}$$

$$D_2 = 3 \times 1.33 \times 150 = 600 \text{ plf}$$

$$D_3 = 2 \times 2.2 \times 110 = 484 \text{ plf}$$

$$M_R = 2.71 \text{ k} \times 0.6 = 1.63 \text{ k}$$

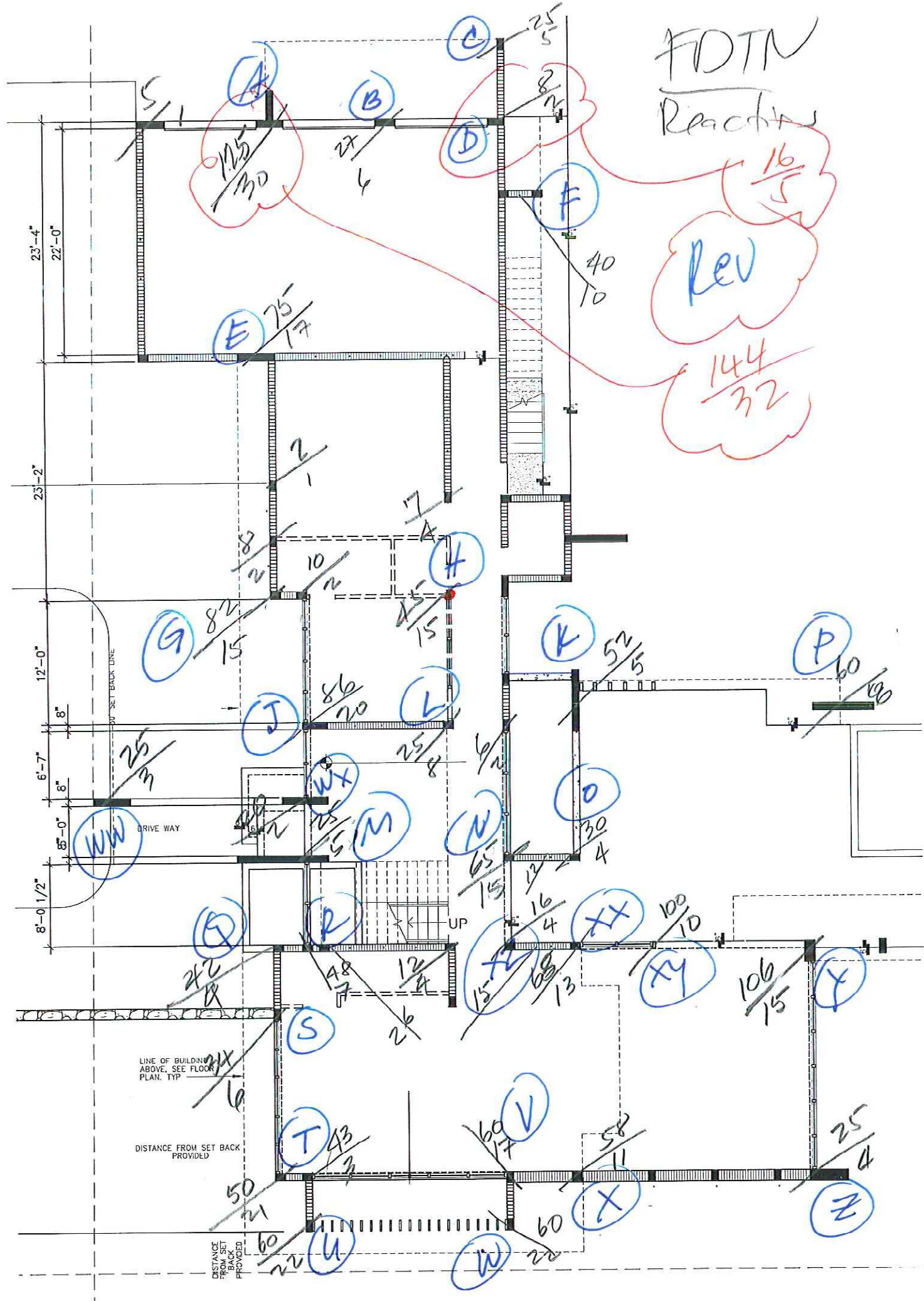
$$M_{OT} = 25.3 \times 6 \times 6.33 = 960 \text{ k} < M_R$$

Wall  $M_F = 25.3 \times 6 \times 5' = 759 \text{ k}$   
= 9108 in-k → #5 @ 32" OK



## *Foundation*





# Footings

144 Rev

✓ (A)  $P_d = 125^k$   
 $P_L = 30^k$  →  $F 8^0 \times 16''$  w/ 8 #6 EW  $F_8$

✓ (B)  $P_d = 30^k$   
 $P_L = 6^k$  →  $3^0 \times 16''$  w/ 5 #5 EW  $F_{3.7}$

✓ (C)  $P_d = 25^k$   
 $P_L = 5^k$  →  $3^0 \times 16''$  w/ 4 #5 EW  $F_{3.5}$

✓ (D)  $P_d = 10^k$   
 $P_L = 2^k$  →  $2^0 \times 16''$  w/ 3 #5  $F_2$  (WF)

✓ (E)  $P_d = 75^k$   
 $P_L = 17^k$  →  $4' \times 16''$  w/ 11 #5 & 5 #5  $F_{94}$

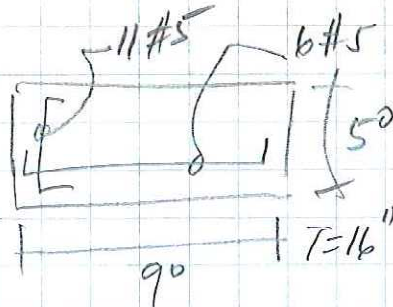
✓ (F)  $P_d = 42^k$   
 $P_L = 10^k$  →  $3' \times 16''$  w/ 8 #5 & 4 #5  $F_{73}$



✓ (G)

$$P_d = 100^k$$

$$P_L = 17^k \rightarrow$$



F95

✓ (H)

$$P_d = 45^k$$

$$P_L = 15^k \rightarrow$$

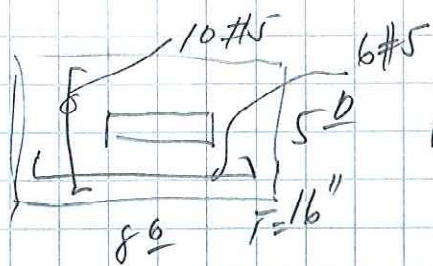
5' x 16" w/ 6 #5 cw

F5

✓ (J)

$$P_d = 86^k$$

$$P_L = 20^k \rightarrow$$

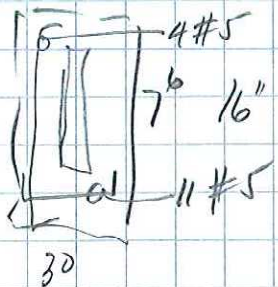


F85

✓ (K)

$$P_d = 52^k$$

$$P_L = 5^k \rightarrow$$

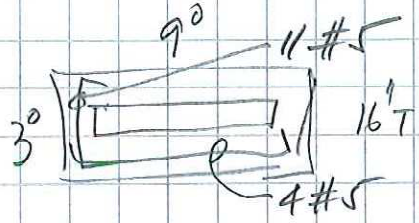


F753

✓ (P)

$$P_d = 60^k$$

$$P_L = 8^k \rightarrow$$



F93

✓ (L)

$$P_d = 25^k$$

$$P_L = 8^k \rightarrow$$

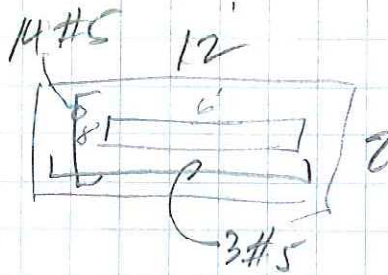
F3.7 3' x 16" w/ 5 #5



✓ (M)

$$P_d = 25^k$$

$$P_L = 5^k$$

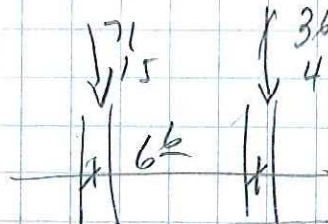


F122

✓ (N)

$$P_d = 65 + 6 = 71^k$$

$$P_L = 15$$

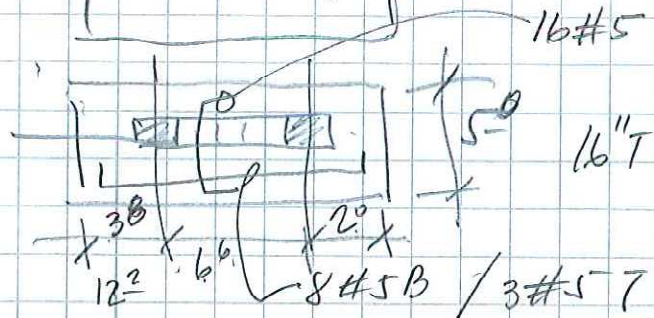


F125

(O)

$$P_d = 30 + 6 = 36^k$$

$$P_L = 4$$

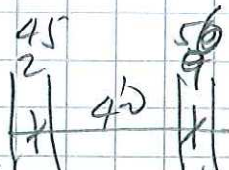


16" T

✓ (Q)

$$P_d = 45^k$$

$$P_L = 4^k$$

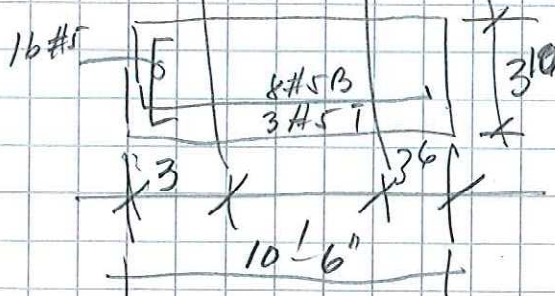


16" T

(R)

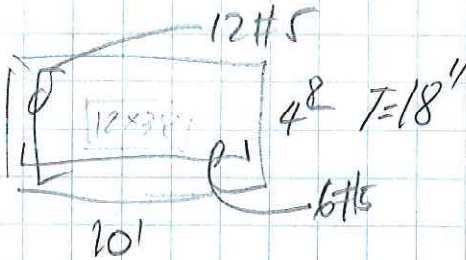
$$P_d = 50^k$$

$$P_L = 7^k$$

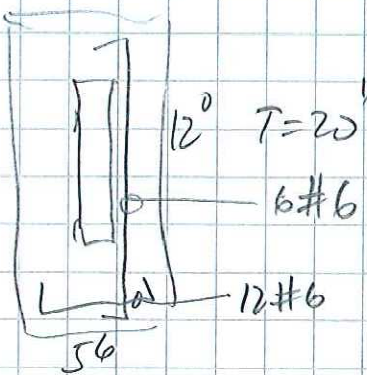


F105

✓ (S)  $P_d = 34''$   
 $P_L = 6'' \rightarrow 4'' \times 16''$  F2  
 w/ 5#5 EW

✓ (T)  $P_d = 93''$   
 $P_L = 24'' \rightarrow$   F104

✓ (U)  $P_d = 60$   
 $P_L = 22 \rightarrow 5'' \times 16''$  F5.7  
 w/ 5#6 EW

✓ (V)  $P_d = 60$   
 $P_L = 17 \rightarrow P_d = 127$   
 (W)  $P_d = 60$   
 $P_L = 22 \rightarrow P_L = 39$   F125

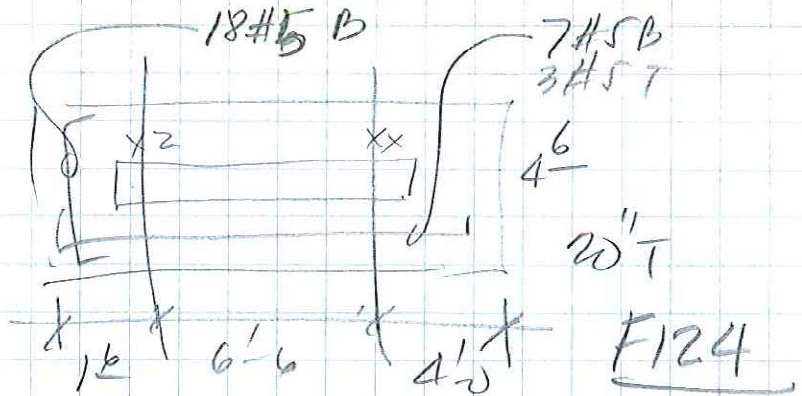
✓ (X)  $P_d = 58$   
 $P_L = 11 \rightarrow 5'' \times 16''$  F5.3  
 5#6 EW

✓ (XY)  $P_d = 100$   
 $P_L = 10 \rightarrow 6'' \times 16''$  F6.6  
 w/ 6#6 EW



✓ (XX)  $P_d = 68+8$   
 $P_L = 13$

(XZ)  $P_d = 16+8$   
 $P_L = 15$



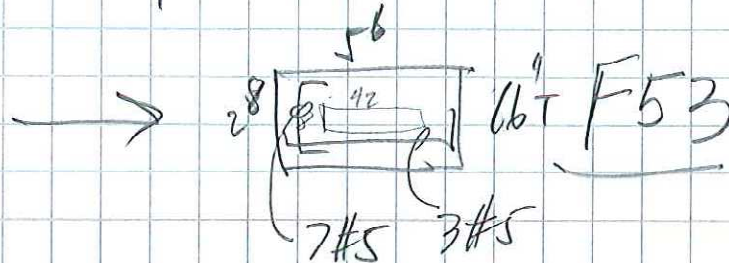
✓ (Y)  $P_d = 107^k$   
 $P_L = 15^k \rightarrow 9' \times 16"$   
w/ 6#6

F7

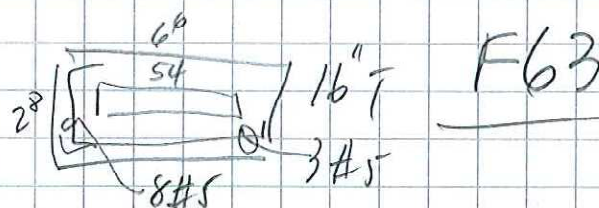
✓ (Z)  $P_d = 25^k$   
 $P_L = 4^k \rightarrow 4' \times 16"$   
w/ 5#5

F4.5

✓ (WW)  $P_d = 25$   
 $P_L = 3$



✓ (WX)  $P_d = 20$   
 $P_L = 2$



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 8.50  | ft |    |
| Footing Width (Z-dir) .....  | 8.50  | ft |    |
| Footing Thickness .....      | 18.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 16.0  | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.96  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

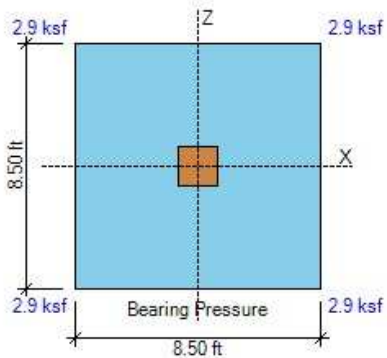
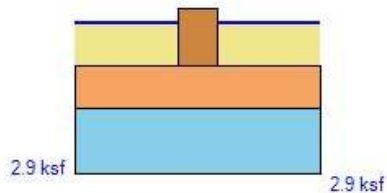
## APPLIED LOADS

|                      | Dead  | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|-------|------|-------|------|------|---------|------|
| Axial Force P .....  | 144.0 | 32.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 9.8   | 4.25 | 41.5   |
| Shear Force Vz ....         | 0.0   | 1.50  | 0.0    | Column Weight ..    | 0.0   | 4.25 | 0.0    |
| Passive Pressure            | 0.0   | 0.60  | 0.0    | Soil Cover .....    | 14.0  | 4.25 | 59.3   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 86.4  | 4.25 | 367.2  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -4.1  | 4.25 | -17.2  |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 106.0 | RM = | 450.7  |
| Shear Force Vx ....         | 0.0   | 1.50  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.60  | 0.0    | Footing Weight ..   | 9.8   | 4.25 | 41.5   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 4.25 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 14.0  | 4.25 | 59.3   |
| Arm of Vertical Resultant = | 4.25  | 4.25  | ft     | Axial Force P ..... | 86.4  | 4.25 | 367.2  |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -4.1  | 4.25 | -17.2  |
|                             |       |       |        | Rv =                | 106.0 | RM = | 450.7  |

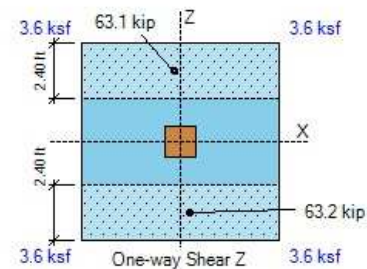
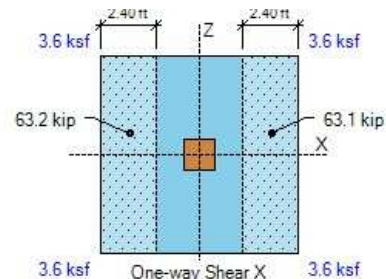
OK

**SLIDING (combDlg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 47.7       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 22.7       | 22.7        |
| Horiz. Resisting Force            | 70.5       | 70.5        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 9.8   | kip   |
| Soil Cover Weight .....    | 14.0  | kip   |
| Downward Force W .....     | 23.7  | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |               |     |
|--------------------------------------------|---------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.40          |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.40          |     |
| Punching Shear due to Axial ....           | 118.5         | psi |
| Punching Shear due to $M_x$ .....          | 0.0           | psi |
| Punching Shear due to $M_z$ .....          | 0.0           | psi |
| Punching Shear Stress $V_u$ .....          | 118.5         | psi |
| Effective Perimeter $b_o$ .....            | 121.0         | in  |
| Average Effective Depth $d$ .....          | 14.3          | in  |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |     |
| Column Aspect Ratio $\beta$ .....          | 1.00          |     |
| Punching Shear Strength $\phi V_c$ ..      | 164.3         | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.72          | OK  |



**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 63.2   | 63.1   | kip |
| One-way Shear $V_{uz}$ ...                 | 63.2   | 63.1   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 66.6   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 64.3   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.98   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing*

*Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 75.4 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 75.4 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 169.4  | 169.4  | k-ft |
| Bending Moment $+M_{uz}$ ... | 169.4  | 169.4  | k-ft |

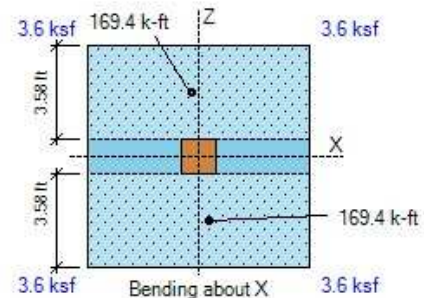
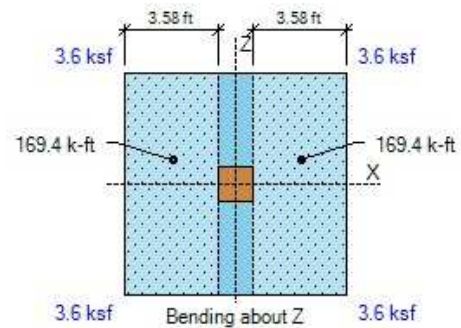
*Use 8 #6 Bars Parallel to X (Bot) ,  $d = 14.6$  in*

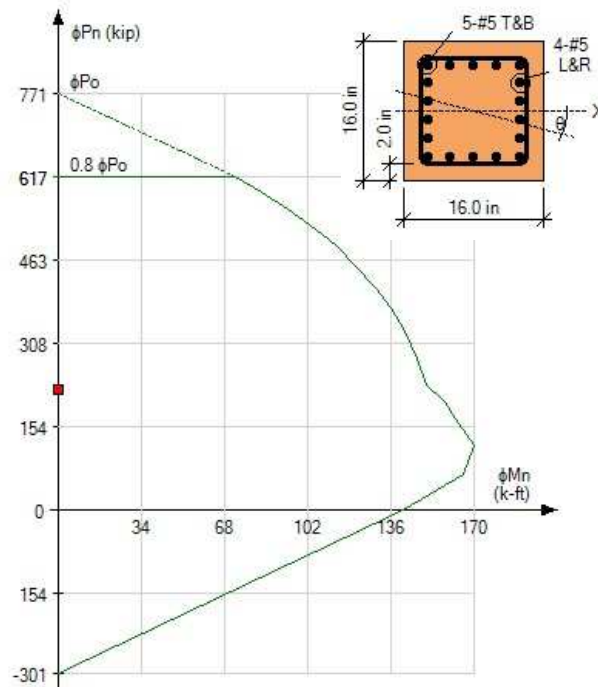
*Use 8 #6 Bars Parallel to Z (Bot) ,  $d = 13.9$  in*

|                                          |       |         |
|------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..       | 0.37  | OK      |
| Z-Bars Development Length Ratio ..       | 0.39  | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.94  | OK      |
| Under-strength $\phi$ Factor .....       | 0.90  |         |
| Bending Strength $+\phi M_{nx}$ .....    | 213.3 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 225.2 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.79  | OK      |
| Max. Bar Spacing Ratio .....             | 0.76  | OK      |

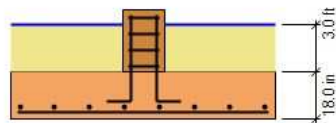
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.9   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.84  | OK                 |

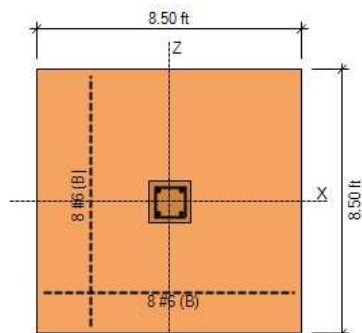




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN

## DESIGN CODES

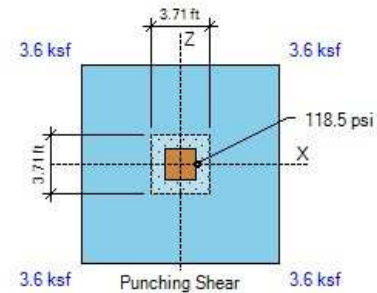
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 224.0 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 614.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 151.7 | k-ft |
| Biaxial Strength Ratio .....       | 0.36  | OK   |



Punching Shear

## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 3.75  | ft |    |
| Footing Width (Z-dir) .....  | 3.75  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 8.0   | in |    |
| Column Width (Z-dir) .....   | 24.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 3.0   | ksf |    |
| Bearing Pressure Ratio .....       | 0.99  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

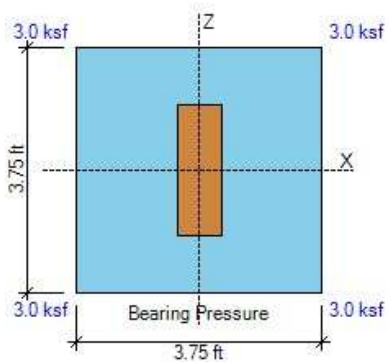
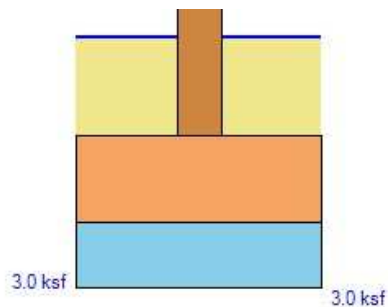
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 30.0 | 6.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 1.7   | 1.88 | 3.2    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 1.88 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 2.5   | 1.88 | 4.7    |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 18.0  | 1.88 | 33.8   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.7  | 1.88 | -1.3   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 21.5  | RM = | 40.3   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 1.7   | 1.88 | 3.2    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 1.88 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 2.5   | 1.88 | 4.7    |
|                             |       |       |        | Axial Force P ..... | 18.0  | 1.88 | 33.8   |
|                             |       |       |        | Water Buoyancy .    | -0.7  | 1.88 | -1.3   |
| Arm of Vertical Resultant = |       |       |        | Rv =                | 21.5  | RM = | 40.3   |
| Overturning Safety Factor = |       |       |        |                     |       |      |        |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 9.7        | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 8.7        | 8.7         |
| Horiz. Resisting Force            | 18.4       | 18.4        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

**UPLIFT (Comb: 0.6D+0.6W)**

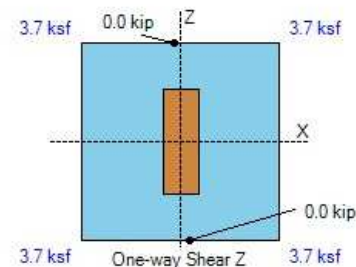
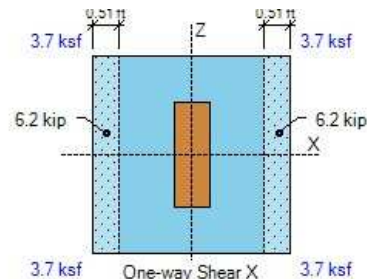
|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 1.7   | kip   |
| Soil Cover Weight .....    | 2.5   | kip   |
| Downward Force W .....     | 4.2   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |           |
|--------------------------------------------|-----------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.49      |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.32      |
| Punching Shear due to Axial ....           | 23.2      |
| Punching Shear due to $M_x$ .....          | 0.0       |
| Punching Shear due to $M_z$ .....          | 0.0       |
| Punching Shear Stress $V_u$ .....          | 23.2      |
| Effective Perimeter $b_o$ .....            | 101.8     |
| Average Effective Depth $d$ .....          | 12.4      |
| Column Location Factor $\alpha_s$ ....     | 30 (Edge) |
| Column Aspect Ratio $\beta$ .....          | 3.00      |
| Punching Shear Strength $\phi V_c$ ..      | 136.9     |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.17      |

OK



**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 6.2    | 6.2    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 26.7   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 25.8   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.23   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | N.A. |         |
| Z-Bars Development Length Ratio ..        | N.A. |         |
| Min. Top Steel Area Ratio .....           | N.A. |         |
| Under-strength $\phi$ Factor .....        | 0.60 |         |
| Bending Strength - $\phi M_{nx}$ .....    | 26.3 | k-ft OK |
| Bending Strength - $\phi M_{nz}$ .....    | 26.3 | k-ft OK |
| Max. Bending Ratio - $M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....              | N.A. |         |

**- Bottom Bars -**

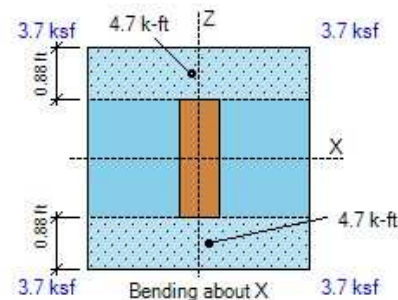
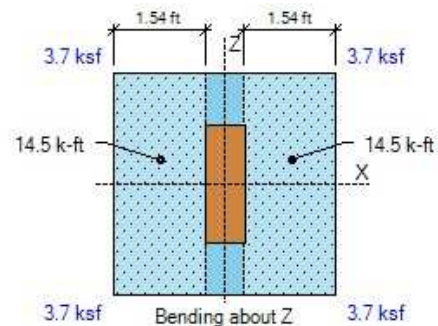
|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ... | 4.7    | 4.7    | k-ft |
| Bending Moment + $M_{uz}$ ... | 14.5   | 14.5   | k-ft |

*Use 5 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 5 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

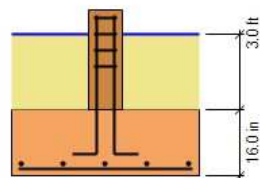
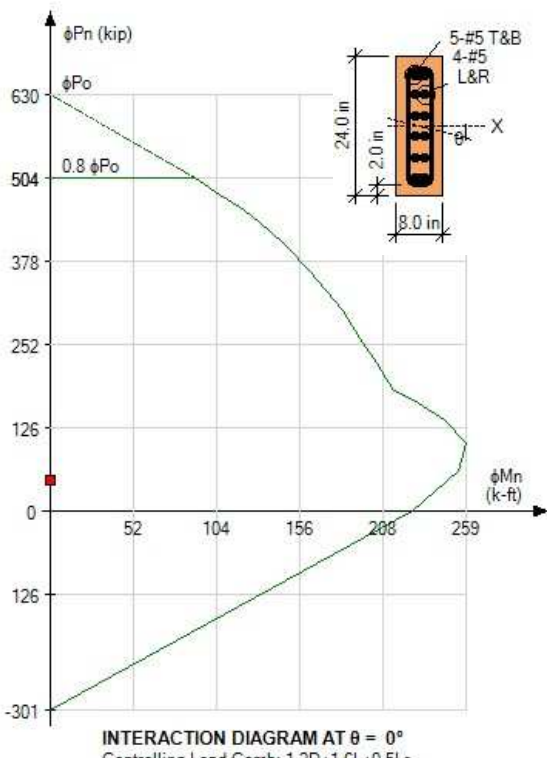
|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | 0.49 | OK      |
| Z-Bars Development Length Ratio ..        | 0.98 | OK      |
| Min. Bottom Steel Area Ratio .....        | 0.84 | OK      |
| Under-strength $\phi$ Factor .....        | 0.90 |         |
| Bending Strength + $\phi M_{nx}$ .....    | 81.3 | k-ft OK |
| Bending Strength + $\phi M_{nz}$ .....    | 85.7 | k-ft OK |
| Max. Bending Ratio + $M_u/\phi M_n$ ..... | 0.17 | OK      |
| Max. Bar Spacing Ratio .....              | 0.54 | OK      |

**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

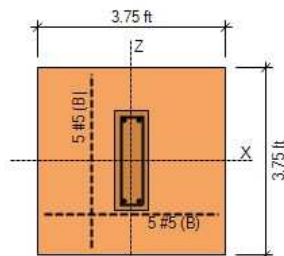
|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.2   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.3   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.4   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 1.92  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |







ELEVATION



PLAN

## DESIGN CODES

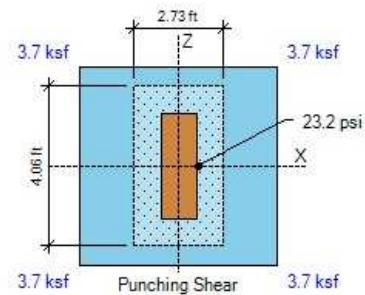
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 45.6  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 503.1 | kip  |
| Flexural Strength $\phi M_n$ ..... | 245.0 | k-ft |
| Biaxial Strength Ratio .....       | 0.09  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 3.50  | ft |    |
| Footing Width (Z-dir) .....  | 3.50  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 8.0   | in |    |
| Column Width (Z-dir) .....   | 24.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.95  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

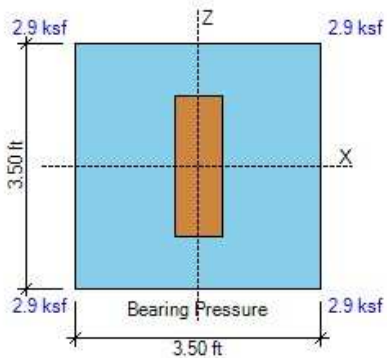
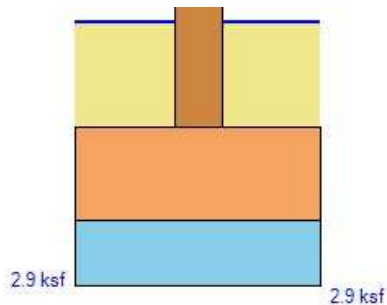
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 25.0 | 5.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 1.5   | 1.75 | 2.6    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 1.75 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 2.2   | 1.75 | 3.8    |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 15.0  | 1.75 | 26.3   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.6  | 1.75 | -1.1   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 18.0  | RM = | 31.5   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 1.5   | 1.75 | 2.6    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 1.75 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 2.2   | 1.75 | 3.8    |
| Arm of Vertical Resultant = | 1.75  | 1.75  | ft     | Axial Force P ..... | 15.0  | 1.75 | 26.3   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -0.6  | 1.75 | -1.1   |
|                             |       |       |        | Rv =                | 18.0  | RM = | 31.5   |

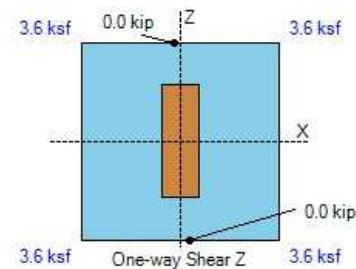
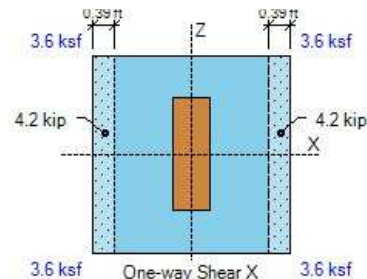
OK

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 8.1        | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 8.1        | 8.1         |
| Horiz. Resisting Force            | 16.2       | 16.2        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 1.5   | kip   |
| Soil Cover Weight .....    | 2.2   | kip   |
| Downward Force W .....     | 3.6   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |             |     |
|--------------------------------------------|-------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.43        |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.37        |     |
| Punching Shear due to Axial ....           | 27.2        | psi |
| Punching Shear due to $M_x$ .....          | 0.0         | psi |
| Punching Shear due to $M_z$ .....          | 0.0         | psi |
| Punching Shear Stress $V_u$ .....          | 27.2        | psi |
| Effective Perimeter $b_o$ .....            | 70.4        | in  |
| Average Effective Depth $d$ .....          | 12.4        | in  |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |     |
| Column Aspect Ratio $\beta$ .....          | 3.00        |     |
| Punching Shear Strength $\phi V_c$ ..      | 136.9       | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.20        | OK  |

**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 4.2    | 4.2    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 23.7   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 22.9   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.18   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | N.A. |         |
| Z-Bars Development Length Ratio ..        | N.A. |         |
| Min. Top Steel Area Ratio .....           | N.A. |         |
| Under-strength $\phi$ Factor .....        | 0.60 |         |
| Bending Strength - $\phi M_{nx}$ .....    | 24.5 | k-ft OK |
| Bending Strength - $\phi M_{nz}$ .....    | 24.5 | k-ft OK |
| Max. Bending Ratio - $M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....              | N.A. |         |

**- Bottom Bars -**

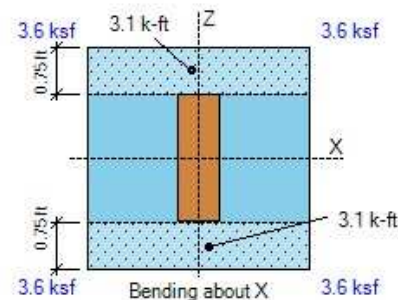
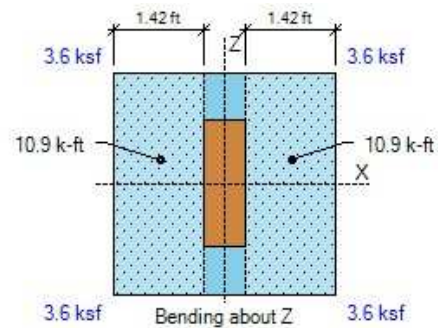
|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ... | 3.1    | 3.1    | k-ft |
| Bending Moment + $M_{uz}$ ... | 10.9   | 10.9   | k-ft |

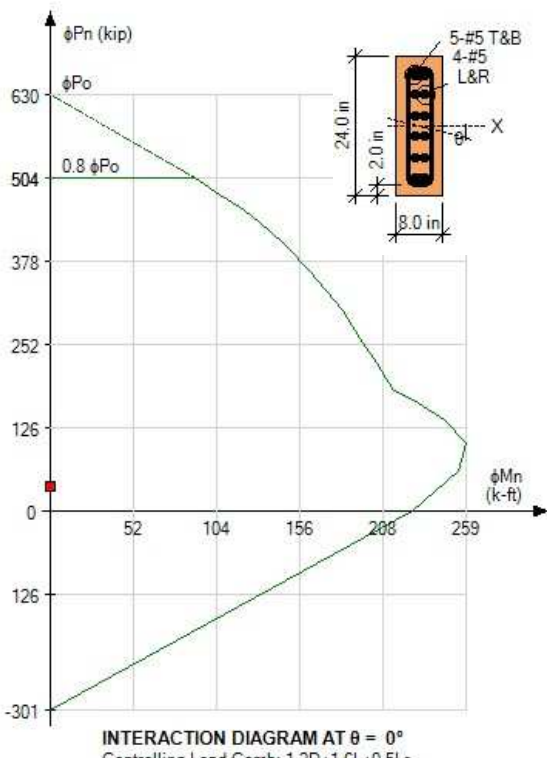
*Use 4 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 4 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | 0.54 | OK      |
| Z-Bars Development Length Ratio ..        | 1.21 | NG      |
| Min. Bottom Steel Area Ratio .....        | 0.98 | OK      |
| Under-strength $\phi$ Factor .....        | 0.90 |         |
| Bending Strength + $\phi M_{nx}$ .....    | 65.4 | k-ft OK |
| Bending Strength + $\phi M_{nz}$ .....    | 68.9 | k-ft OK |
| Max. Bending Ratio + $M_u/\phi M_n$ ..... | 0.16 | OK      |
| Max. Bar Spacing Ratio .....              | 0.67 | OK      |

**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.2   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.3   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.4   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 1.92  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |





## DESIGN CODES

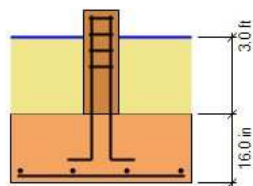
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

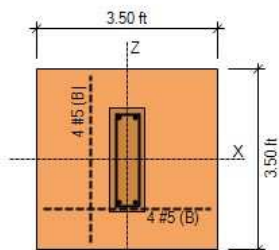
|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

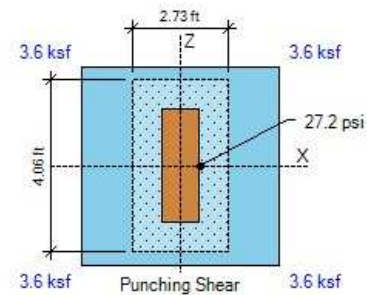
|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 38.0  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 503.1 | kip  |
| Flexural Strength $\phi M_n$ ..... | 243.8 | k-ft |
| Biaxial Strength Ratio .....       | 0.08  | OK   |



ELEVATION



PLAN



Punching Shear



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 2.00  | ft |    |
| Footing Width (Z-dir) .....  | 2.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 8.0   | in |    |
| Column Width (Z-dir) .....   | 24.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.8   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.8   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.8   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.8   | ksf |    |
| Bearing Pressure Ratio .....       | 0.95  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

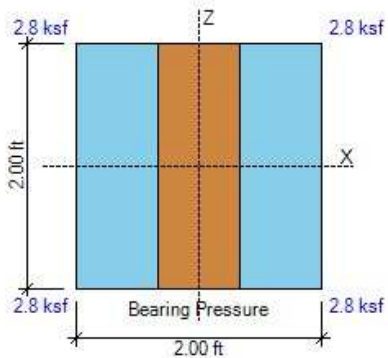
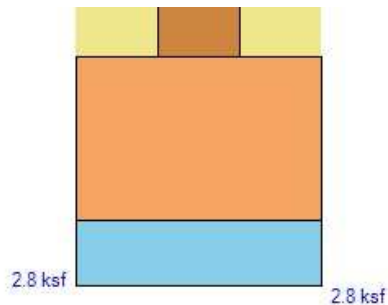
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 8.0  | 2.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 0.5   | 1.00 | 0.5    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 1.00 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 0.5   | 1.00 | 0.5    |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 4.8   | 1.00 | 4.8    |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.2  | 1.00 | -0.2   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 5.6   | RM = | 5.6    |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 0.5   | 1.00 | 0.5    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 1.00 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 0.5   | 1.00 | 0.5    |
| Arm of Vertical Resultant = | 1.00  | 1.00  | ft     | Axial Force P ..... | 4.8   | 1.00 | 4.8    |
| Overturning Safety Factor = | 56.08 | 56.08 | > 1.5  | Water Buoyancy .    | -0.2  | 1.00 | -0.2   |
|                             |       |       |        | Rv =                | 5.6   | RM = | 5.6    |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 2.5        | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 4.7        | 4.7         |
| Horiz. Resisting Force            | 7.2        | 7.2         |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 71.76      | 71.76 > 1.5 |

OK

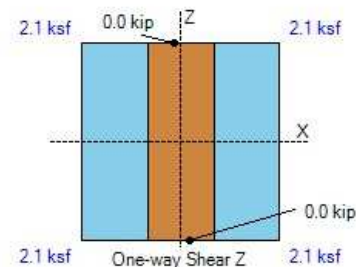
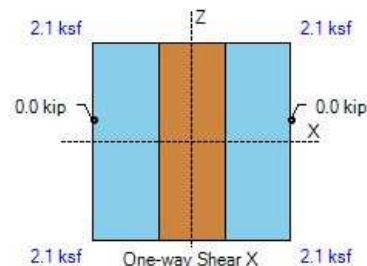
**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 0.5   | kip   |
| Soil Cover Weight .....    | 0.5   | kip   |
| Downward Force W .....     | 1.0   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |             |     |
|--------------------------------------------|-------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.44        |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.36        |     |
| Punching Shear due to Axial ....           | 1.1         | psi |
| Punching Shear due to $M_x$ .....          | 0.0         | psi |
| Punching Shear due to $M_z$ .....          | 0.0         | psi |
| Punching Shear Stress $V_u$ .....          | 1.1         | psi |
| Effective Perimeter $b_o$ .....            | 52.4        | in  |
| Average Effective Depth $d$ .....          | 12.4        | in  |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |     |
| Column Aspect Ratio $\beta$ .....          | 3.00        |     |
| Punching Shear Strength $\phi V_c$ ..      | 136.9       | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.01        | OK  |



**ONE-WAY SHEAR (Comb: 0.9D+E)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 0.0    | 0.0    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 16.3   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 15.7   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.00   |        | OK  |

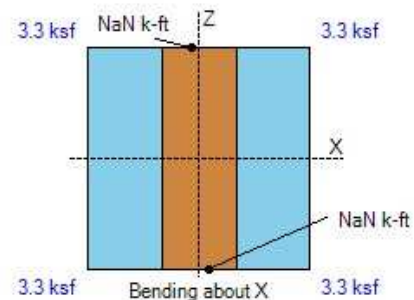
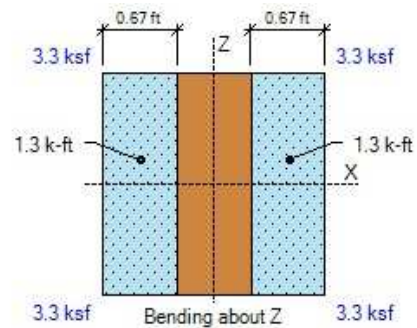
**FLEXURE (Comb: 1.4D)**

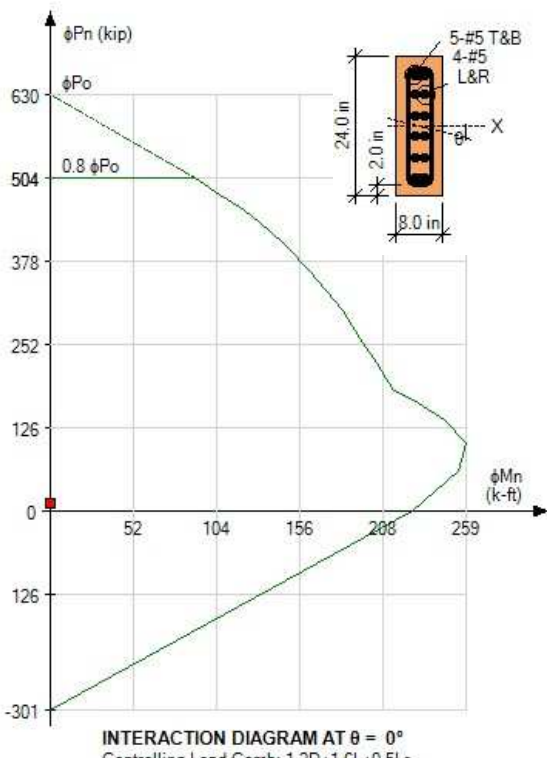
| - Top Bars -                                        | - Side | + Side |      |
|-----------------------------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ...                        | NaN    | NaN    | k-ft |
| Bending Moment $-M_{uz}$ ...                        | 0.0    | 0.0    | k-ft |
| <i>No Top Reinforcement Provided at the Footing</i> |        |        |      |
| <i>Use Plain Concrete Flexural Strength at Top</i>  |        |        |      |
| X-Bars Development Length Ratio ..                  | N.A.   |        |      |
| Z-Bars Development Length Ratio ..                  | N.A.   |        |      |
| Min. Top Steel Area Ratio .....                     | N.A.   |        |      |
| Under-strength $\phi$ Factor .....                  | 0.60   |        |      |
| Bending Strength $-\phi M_{nx}$ .....               | 14.0   | k-ft   | OK   |
| Bending Strength $-\phi M_{nz}$ .....               | 14.0   | k-ft   | OK   |
| Max. Bending Ratio $-M_u/\phi M_n$ .....            | NaN    |        | OK   |
| Max. Bar Spacing Ratio .....                        | N.A.   |        |      |

| - Bottom Bars -                                                     | - Side | + Side |      |
|---------------------------------------------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ...                                        | NaN    | NaN    | k-ft |
| Bending Moment $+M_{uz}$ ...                                        | 1.3    | 1.3    | k-ft |
| <i>Use 4 #5 Bars Parallel to X (Bot) , <math>d = 12.7</math> in</i> |        |        |      |
| <i>Use 4 #5 Bars Parallel to Z (Bot) , <math>d = 12.1</math> in</i> |        |        |      |
| X-Bars Development Length Ratio ..                                  | 1.43   |        | NG   |
| Z-Bars Development Length Ratio ..                                  | -3.15  |        | OK   |
| Min. Bottom Steel Area Ratio .....                                  | 0.56   |        | OK   |
| Under-strength $\phi$ Factor .....                                  | 0.90   |        |      |
| Bending Strength $+\phi M_{nx}$ .....                               | 63.9   | k-ft   | OK   |
| Bending Strength $+\phi M_{nz}$ .....                               | 67.4   | k-ft   | OK   |
| Max. Bending Ratio $+M_u/\phi M_n$ .....                            | NaN    |        | OK   |
| Max. Bar Spacing Ratio .....                                        | 0.33   |        | OK   |

**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.1   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.3   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 2.8   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 1.92  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |





## DESIGN CODES

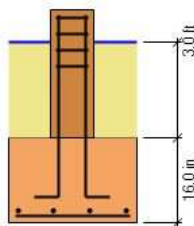
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

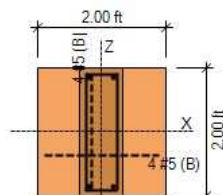
|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

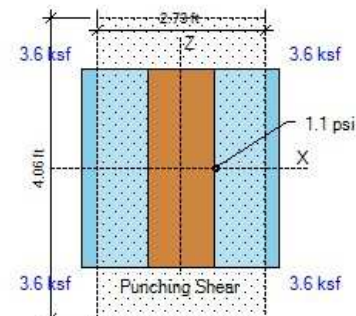
|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 12.8  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 503.1 | kip  |
| Flexural Strength $\phi M_n$ ..... | 231.8 | k-ft |
| Biaxial Strength Ratio .....       | 0.03  | OK   |



ELEVATION



PLAN



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 9.00  | ft |    |
| Footing Width (Z-dir) .....  | 4.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 44.0  | in |    |
| Column Width (Z-dir) .....   | 8.0   | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 3.0   | ksf |    |
| Bearing Pressure Ratio .....       | 0.99  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

## APPLIED LOADS

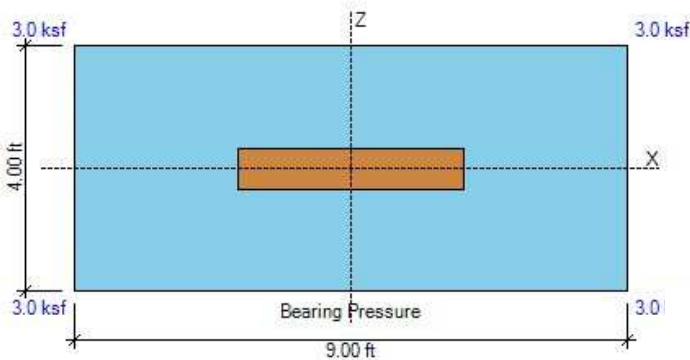
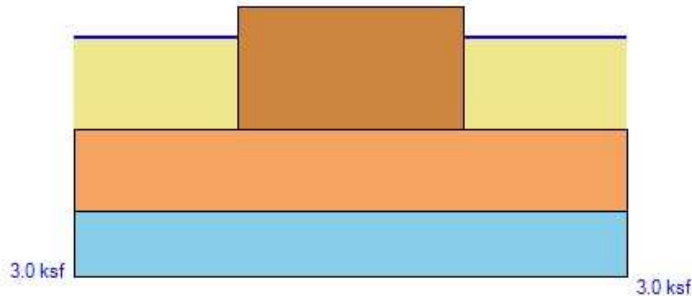
|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 75.0 | 17.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 4.3   | 2.00 | 8.6    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.00 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 6.6   | 2.00 | 13.3   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 45.0  | 2.00 | 90.0   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.8  | 2.00 | -3.6   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 54.2  | RM = | 108.3  |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 4.3   | 4.50 | 19.4   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 4.50 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 6.6   | 4.50 | 29.9   |
|                             |       |       |        | Axial Force P ..... | 45.0  | 4.50 | 202.5  |
| Arm of Vertical Resultant = | 2.00  | 4.50  | ft     | Water Buoyancy .    | -1.8  | 2.00 | -3.6   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Rv =                | 54.2  | RM = | 243.8  |

OK





**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

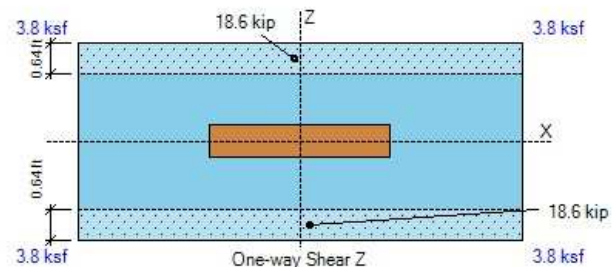
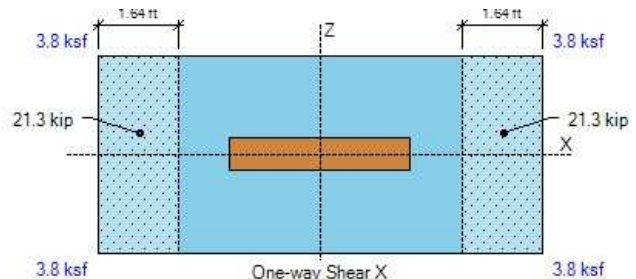
|                                            |       |            |
|--------------------------------------------|-------|------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.29  |            |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.53  |            |
| Punching Shear due to Axial ....           | 48.0  | psi        |
| Punching Shear due to $M_x$ .....          | 0.0   | psi        |
| Punching Shear due to $M_z$ .....          | 0.0   | psi        |
| Punching Shear Stress $V_u$ .....          | 48.0  | psi        |
| Effective Perimeter $b_o$ .....            | 153.5 | in         |
| Average Effective Depth $d$ .....          | 12.4  | in         |
| Column Location Factor $\alpha_s$ ....     | 40    | (Interior) |
| Column Aspect Ratio $\beta$ .....          | 5.50  |            |
| Punching Shear Strength $\phi V_c$ ..      | 112.0 | psi        |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.43  | OK         |

### SLIDING (combDlg. 0.6D+0.6W)

|                                    |                |                |          |
|------------------------------------|----------------|----------------|----------|
| Footings-Soil Friction Coeff. .... | 0.45           |                |          |
| Friction Force at Base .....       | 24.4           | kip            |          |
| Passive Pressure Coeff. Kp ....    | 4.33           |                |          |
|                                    | <del>X-X</del> | <del>Z-Z</del> |          |
| Passive Force @ Ftg ...            | 9.3            | 20.9           | kip      |
| Horiz. Resisting Force             | 33.7           | 45.3           | kip      |
| Horiz. Sliding Force .....         | 0.0            | 0.0            | kip      |
| Sliding Safety Factor ...          | 99.99          | 99.99          | > 1.5 OK |

### UPLIFT (Comb: 0.6D+0.6W)

|                            |       |          |
|----------------------------|-------|----------|
| Uplift Force P .....       | 0.0   | kip      |
| Pedestal Selfweight .....  | 0.0   | kip      |
| Footing Selfweight .....   | 4.3   | kip      |
| Soil Cover Weight .....    | 6.6   | kip      |
| Downward Force W .....     | 11.0  | kip      |
| Uplift Safety Factor ..... | 99.99 | > 1.0 OK |



**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 21.3   | 21.3   | kip |
| One-way Shear $V_{uz}$ ...                 | 18.6   | 18.6   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$ ..... | 27.9   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$ ..... | 60.2   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.76   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | N.A. |         |
| Z-Bars Development Length Ratio ..        | N.A. |         |
| Min. Top Steel Area Ratio .....           | N.A. |         |
| Under-strength $\phi$ Factor .....        | 0.60 |         |
| Bending Strength - $\phi M_{nx}$ .....    | 63.1 | k-ft OK |
| Bending Strength - $\phi M_{nz}$ .....    | 28.0 | k-ft OK |
| Max. Bending Ratio - $M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....              | N.A. |         |

**- Bottom Bars -**

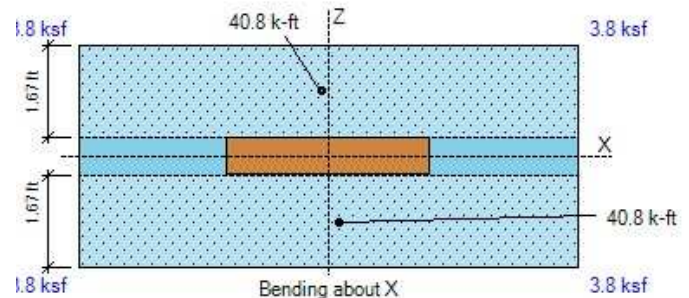
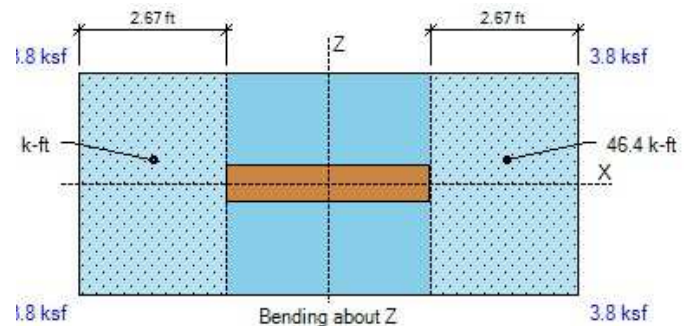
|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ... | 40.8   | 40.8   | k-ft |
| Bending Moment + $M_{uz}$ ... | 46.4   | 46.4   | k-ft |

*Use 5 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 11 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                           |       |         |
|-------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..        | 0.27  | OK      |
| Z-Bars Development Length Ratio ..        | 0.45  | OK      |
| Min. Bottom Steel Area Ratio .....        | 0.91  | OK      |
| Under-strength $\phi$ Factor .....        | 0.90  |         |
| Bending Strength + $\phi M_{nx}$ .....    | 130.7 | k-ft OK |
| Bending Strength + $\phi M_{nz}$ .....    | 85.8  | k-ft OK |
| Max. Bending Ratio + $M_u/\phi M_n$ ..... | 0.54  | OK      |
| Max. Bar Spacing Ratio .....              | 0.58  | OK      |

**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.3   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.8   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 3.9   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 3.52  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |



## DESIGN CODES

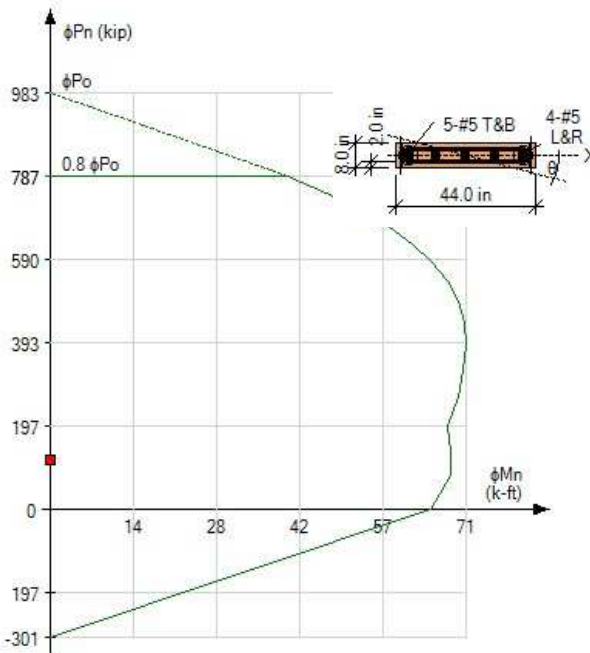
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

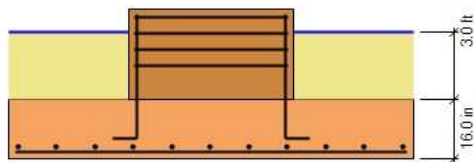
|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

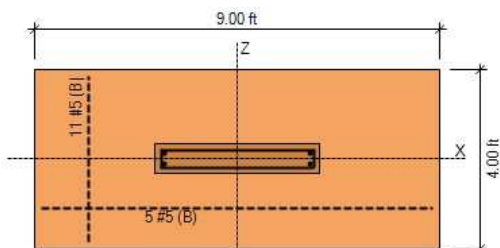
|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 117.2 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 786.6 | kip  |
| Flexural Strength $\phi M_n$ ..... | 68.0  | k-ft |
| Biaxial Strength Ratio .....       | 0.15  | OK   |



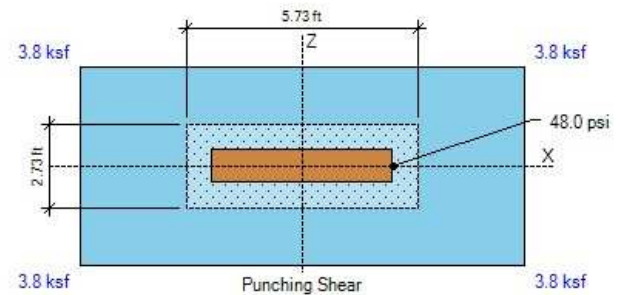
INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 3.00  | ft |    |
| Footing Width (Z-dir) .....  | 7.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 8.0   | in |    |
| Column Width (Z-dir) .....   | 52.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.96  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

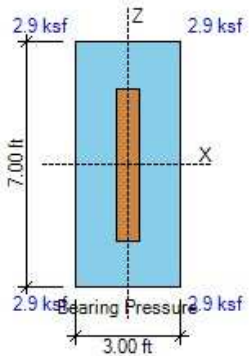
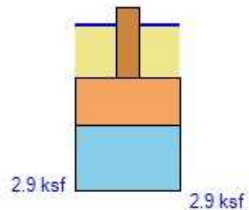
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 42.0 | 10.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |       |        |
|-----------------------------|-------|-------|--------|---------------------|-------|-------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm   | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft    | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 2.5   | 3.50  | 8.8    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 3.50  | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 3.6   | 3.50  | 12.6   |
| Rh = 0.0                    | OTM = | 0.0   |        | Axial Force P ..... | 25.2  | 3.50  | 88.2   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.0  | 3.50  | -3.7   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv = 30.3           | RM =  | 105.9 |        |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |       |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 2.5   | 1.50  | 3.8    |
| Rh = 0.0                    | OTM = | 0.0   |        | Column Weight ..    | 0.0   | 1.50  | 0.0    |
|                             |       |       |        | Soil Cover .....    | 3.6   | 1.50  | 5.4    |
|                             |       |       |        | Axial Force P ..... | 25.2  | 1.50  | 37.8   |
|                             |       |       |        | Water Buoyancy .    | -1.0  | 3.50  | -3.7   |
| Arm of Vertical Resultant = | 3.50  | 1.50  | ft     | Rv = 30.3           | RM =  | 45.4  |        |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  |                     |       |       |        |

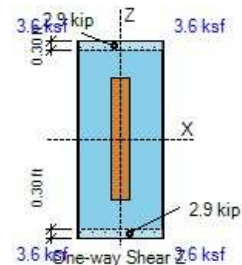
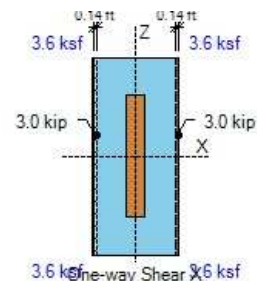
OK

**SLIDING (combDlg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 13.6       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 16.3       | 7.0         |
| Horiz. Resisting Force            | 29.9       | 20.6        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 2.5   | kip   |
| Soil Cover Weight .....    | 3.6   | kip   |
| Downward Force W .....     | 6.1   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |             |     |
|--------------------------------------------|-------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.52        |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.29        |     |
| Punching Shear due to Axial ....           | 31.7        | psi |
| Punching Shear due to $M_x$ .....          | 0.0         | psi |
| Punching Shear due to $M_z$ .....          | 0.0         | psi |
| Punching Shear Stress $V_u$ .....          | 31.7        | psi |
| Effective Perimeter $b_o$ .....            | 102.4       | in  |
| Average Effective Depth $d$ .....          | 12.4        | in  |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |     |
| Column Aspect Ratio $\beta$ .....          | 6.50        |     |
| Punching Shear Strength $\phi V_c$ ..      | 107.4       | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.30        | OK  |



**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 3.0    | 3.0    | kip |
| One-way Shear $V_{uz}$ ...                 | 2.9    | 2.9    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 47.4   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 20.6   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.14   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 21.0 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 49.1 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

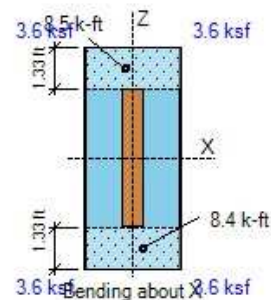
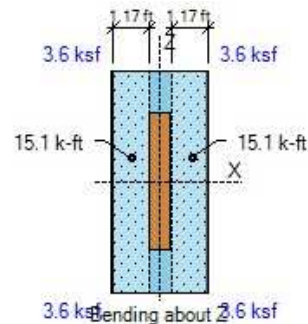
|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 8.4    | 8.5    | k-ft |
| Bending Moment $+M_{uz}$ ... | 15.1   | 15.1   | k-ft |

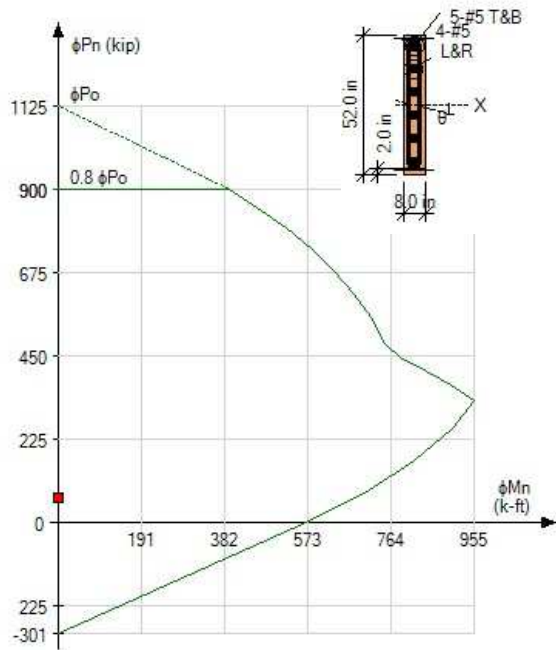
*Use 8 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 4 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | 0.68 | OK      |
| Z-Bars Development Length Ratio ..       | 0.58 | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.98 | OK      |
| Under-strength $\phi$ Factor .....       | 0.90 |         |
| Bending Strength $+\phi M_{nx}$ .....    | 65.0 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 99.2 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.15 | OK      |
| Max. Bar Spacing Ratio .....             | 0.62 | OK      |

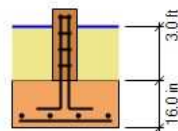
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.2   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.7   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 3.8   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 4.16  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

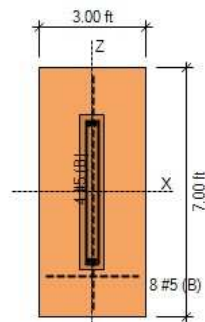




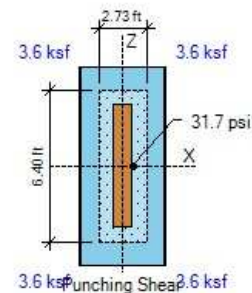
INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN



Punching Shear

## DESIGN CODES

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 66.4  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 894.8 | kip  |
| Flexural Strength $\phi M_n$ ..... | 667.0 | k-ft |
| Biaxial Strength Ratio .....       | 0.07  | OK   |

## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 4.00  | ft |    |
| Footing Width (Z-dir) .....  | 4.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 2.00  | ft |    |
| Column Length (X-dir) .....  | 16.0  | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+0.75L+0.75Lr)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.97  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

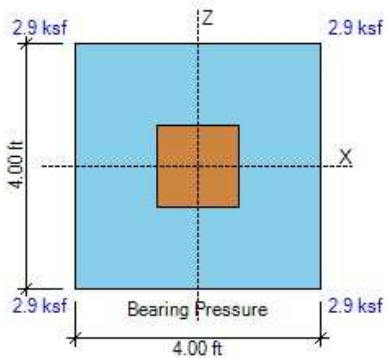
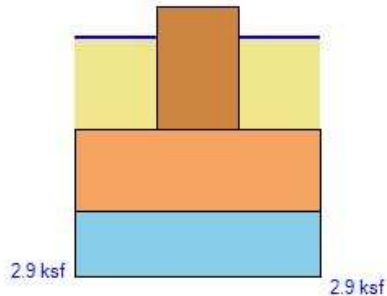
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 38.0 | 3.0  | 2.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 1.9   | 2.00 | 3.8    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.00 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 1.9   | 2.00 | 3.8    |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 22.8  | 2.00 | 45.6   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.8  | 2.00 | -1.6   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 25.8  | RM = | 51.6   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 1.9   | 2.00 | 3.8    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 2.00 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 1.9   | 2.00 | 3.8    |
|                             |       |       |        | Axial Force P ..... | 22.8  | 2.00 | 45.6   |
|                             |       |       |        | Water Buoyancy .    | -0.8  | 2.00 | -1.6   |
| Arm of Vertical Resultant = | X-X   | Z-Z   | ft     | Rv =                | 25.8  | RM = | 51.6   |
| Overturing Safety Factor =  | 99.99 | 99.99 | > 1.5  |                     |       |      |        |

OK

**PUNCHING SHEAR (Comb: 1.4D)**

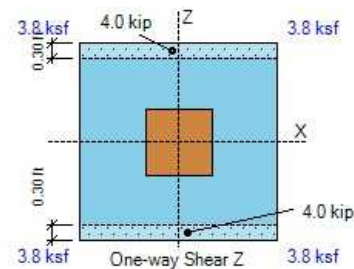
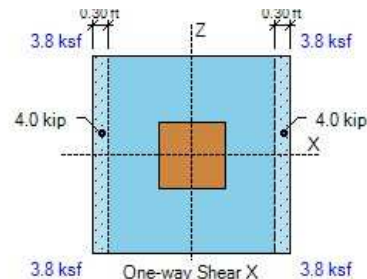
|                                            |             |
|--------------------------------------------|-------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.40        |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.40        |
| Punching Shear due to Axial ....           | 38.7 psi    |
| Punching Shear due to $M_x$ .....          | 0.0 psi     |
| Punching Shear due to $M_z$ .....          | 0.0 psi     |
| Punching Shear Stress $V_u$ .....          | 38.7 psi    |
| Effective Perimeter $b_o$ .....            | 76.4 in     |
| Average Effective Depth $d$ .....          | 12.4 in     |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |
| Column Aspect Ratio $\beta$ .....          | 1.00        |
| Punching Shear Strength $\phi V_c$ ..      | 164.3 psi   |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.24 OK     |

**SLIDING (combDIg. 0.6D+0.6W)**

|                                    |                       |
|------------------------------------|-----------------------|
| Footing-Soil Friction Coeff. ....  | 0.45                  |
| Friction Force at Base .....       | 11.6 kip              |
| Passive Pressure Coeff. $K_p$ .... | 4.33                  |
|                                    | <b>X-X</b> <b>Z-Z</b> |
| Passive Force @ Ftg ...            | 6.8 6.8 kip           |
| Horiz. Resisting Force             | 18.4 18.4 kip         |
| Horiz. Sliding Force .....         | 0.0 0.0 kip           |
| Sliding Safety Factor ...          | 99.99 99.99 > 1.5 OK  |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |                |
|----------------------------|----------------|
| Uplift Force $P$ .....     | 0.0 kip        |
| Pedestal Selfweight .....  | 0.0 kip        |
| Footing Selfweight .....   | 1.9 kip        |
| Soil Cover Weight .....    | 1.9 kip        |
| Downward Force $W$ .....   | 3.8 kip        |
| Uplift Safety Factor ..... | 99.99 > 1.0 OK |



**ONE-WAY SHEAR (Comb: 1.4D)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 4.0    | 4.0    | kip |
| One-way Shear $V_{uz}$ ...                 | 4.0    | 4.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 27.9   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 26.9   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.15   |        | OK  |

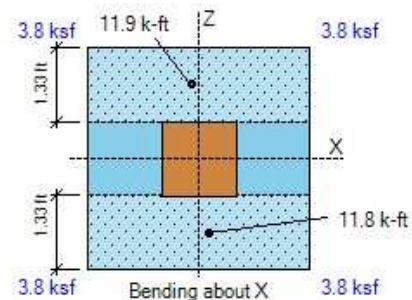
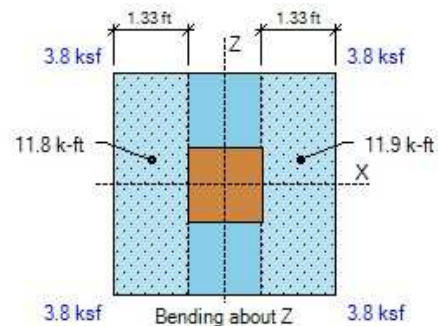
**FLEXURE (Comb: 1.4D)**

| - Top Bars -                                        | - Side | + Side |      |
|-----------------------------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ...                        | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ...                        | 0.0    | 0.0    | k-ft |
| <i>No Top Reinforcement Provided at the Footing</i> |        |        |      |
| <i>Use Plain Concrete Flexural Strength at Top</i>  |        |        |      |
| X-Bars Development Length Ratio ..                  | N.A.   |        |      |
| Z-Bars Development Length Ratio ..                  | N.A.   |        |      |
| Min. Top Steel Area Ratio .....                     | N.A.   |        |      |
| Under-strength $\phi$ Factor .....                  | 0.60   |        |      |
| Bending Strength $-\phi M_{nx}$ .....               | 28.0   | k-ft   | OK   |
| Bending Strength $-\phi M_{nz}$ .....               | 28.0   | k-ft   | OK   |
| Max. Bending Ratio $-M_u/\phi M_n$ .....            | 0.00   |        | OK   |
| Max. Bar Spacing Ratio .....                        | N.A.   |        |      |

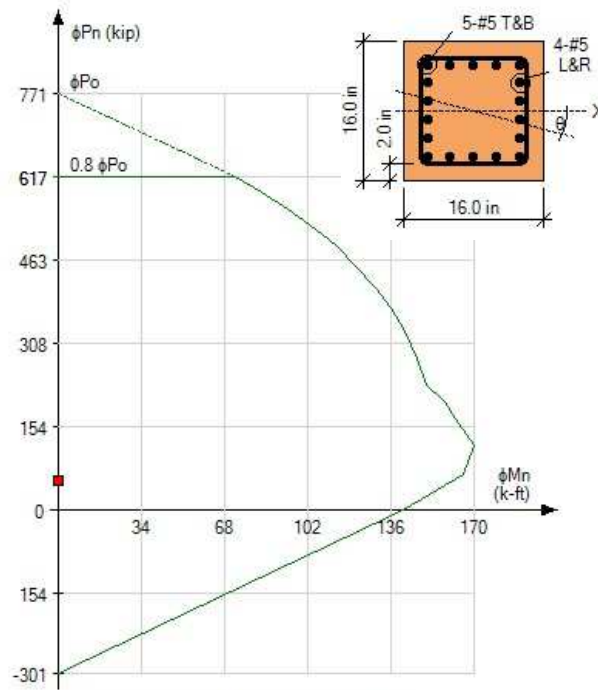
| - Bottom Bars -                                                     | - Side | + Side |      |
|---------------------------------------------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ...                                        | 11.8   | 11.9   | k-ft |
| Bending Moment $+M_{uz}$ ...                                        | 11.8   | 11.9   | k-ft |
| <i>Use 5 #5 Bars Parallel to X (Bot) , <math>d = 12.7</math> in</i> |        |        |      |
| <i>Use 5 #5 Bars Parallel to Z (Bot) , <math>d = 12.1</math> in</i> |        |        |      |
| X-Bars Development Length Ratio ..                                  | 0.58   |        | OK   |
| Z-Bars Development Length Ratio ..                                  | 0.58   |        | OK   |
| Min. Bottom Steel Area Ratio .....                                  | 0.89   |        | OK   |
| Under-strength $\phi$ Factor .....                                  | 0.90   |        |      |
| Bending Strength $+\phi M_{nx}$ .....                               | 81.5   | k-ft   | OK   |
| Bending Strength $+\phi M_{nz}$ .....                               | 85.8   | k-ft   | OK   |
| Max. Bending Ratio $+M_u/\phi M_n$ .....                            | 0.15   |        | OK   |
| Max. Bar Spacing Ratio .....                                        | 0.58   |        | OK   |

**TRANSFER (Comb: 1.4D)**

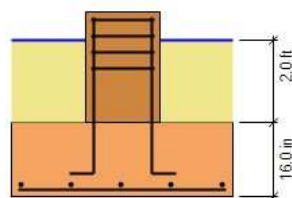
|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.2   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |



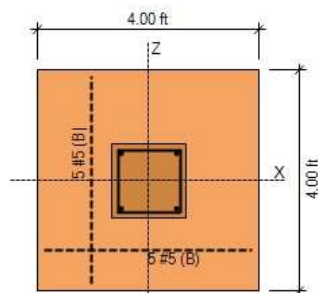




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.4D



ELEVATION



PLAN

## DESIGN CODES

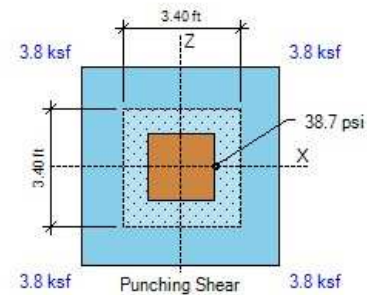
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.4D)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 53.2  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 614.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 160.8 | k-ft |
| Biaxial Strength Ratio .....       | 0.09  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 9.00  | ft |    |
| Footing Width (Z-dir) .....  | 5.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 46.0  | in |    |
| Column Width (Z-dir) .....   | 8.0   | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 3.0   | ksf |    |
| Bearing Pressure Ratio .....       | 1.01  |     | NG |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

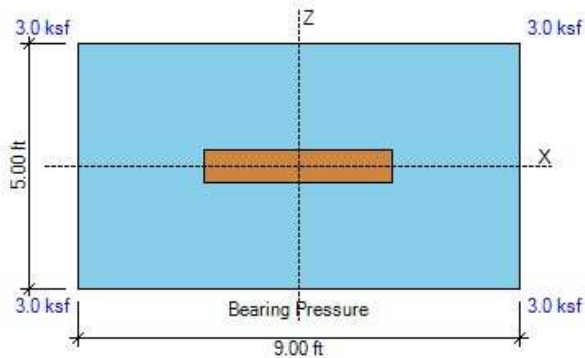
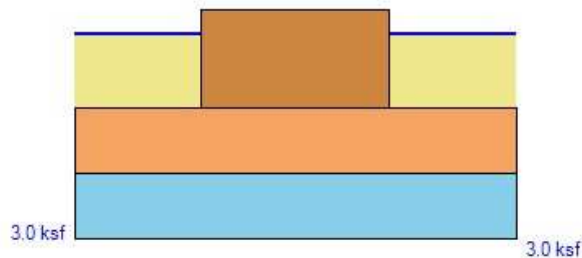
## APPLIED LOADS

|                      | Dead  | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|-------|------|-------|------|------|---------|------|
| Axial Force P .....  | 100.0 | 17.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 5.4   | 2.50 | 13.5   |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.50 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 8.4   | 2.50 | 21.0   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 60.0  | 2.50 | 150.0  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -2.2  | 2.50 | -5.6   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 71.6  | RM = | 178.9  |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 5.4   | 4.50 | 24.3   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 4.50 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 8.4   | 4.50 | 37.8   |
|                             |       |       |        | Axial Force P ..... | 60.0  | 4.50 | 270.0  |
|                             |       |       |        | Water Buoyancy .    | -2.2  | 2.50 | -5.6   |
| Arm of Vertical Resultant = | 2.50  | 4.50  | ft     | Rv =                | 71.6  | RM = | 322.0  |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  |                     |       |      |        |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

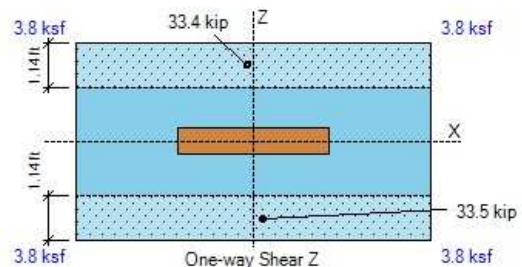
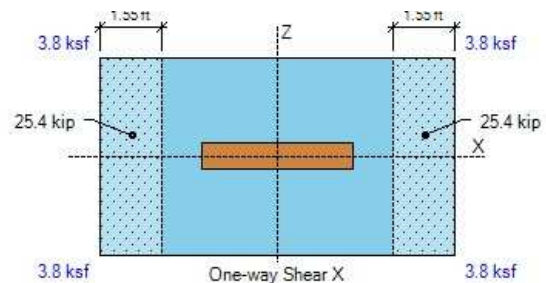
|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 32.2       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 11.6       | 20.9        |
| Horiz. Resisting Force            | 43.8       | 53.1        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 5.4   | kip   |
| Soil Cover Weight .....    | 8.4   | kip   |
| Downward Force W .....     | 13.8  | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |       |            |
|--------------------------------------------|-------|------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.28  |            |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.53  |            |
| Punching Shear due to Axial ....           | 61.7  | psi        |
| Punching Shear due to $M_x$ .....          | 0.0   | psi        |
| Punching Shear due to $M_z$ .....          | 0.0   | psi        |
| Punching Shear Stress $V_u$ .....          | 61.7  | psi        |
| Effective Perimeter $b_o$ .....            | 157.5 | in         |
| Average Effective Depth $d$ .....          | 12.4  | in         |
| Column Location Factor $\alpha_s$ ....     | 40    | (Interior) |
| Column Aspect Ratio $\beta$ .....          | 5.75  |            |
| Punching Shear Strength $\phi V_c$ ..      | 110.7 | psi        |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.56  | OK         |

**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 25.4   | 25.4   | kip |
| One-way Shear $V_{uz}$ ...                 | 33.5   | 33.4   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 34.4   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 60.2   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.74   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | N.A. |         |
| Z-Bars Development Length Ratio ..        | N.A. |         |
| Min. Top Steel Area Ratio .....           | N.A. |         |
| Under-strength $\phi$ Factor .....        | 0.60 |         |
| Bending Strength - $\phi M_{nx}$ .....    | 63.1 | k-ft OK |
| Bending Strength - $\phi M_{nz}$ .....    | 35.1 | k-ft OK |
| Max. Bending Ratio - $M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....              | N.A. |         |

**- Bottom Bars -**

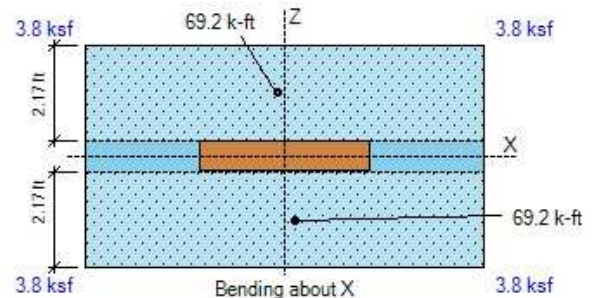
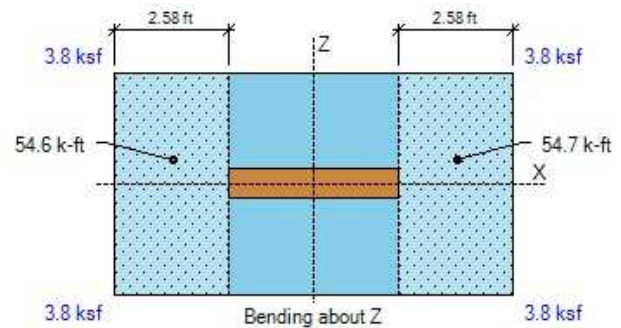
|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ... | 69.2   | 69.2   | k-ft |
| Bending Moment + $M_{uz}$ ... | 54.6   | 54.7   | k-ft |

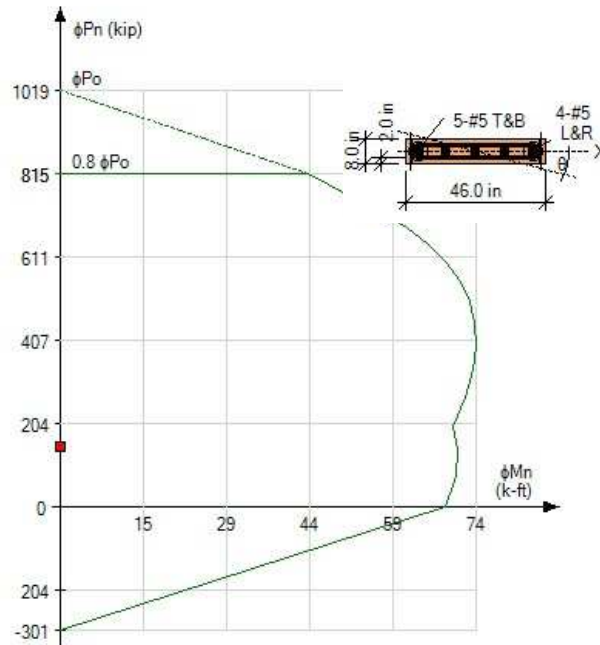
*Use 6 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 11 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                           |       |         |
|-------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..        | 0.28  | OK      |
| Z-Bars Development Length Ratio ..        | 0.34  | OK      |
| Min. Bottom Steel Area Ratio .....        | 0.93  | OK      |
| Under-strength $\phi$ Factor .....        | 0.90  |         |
| Bending Strength + $\phi M_{nx}$ .....    | 140.5 | k-ft OK |
| Bending Strength + $\phi M_{nz}$ .....    | 103.1 | k-ft OK |
| Max. Bending Ratio + $M_u/\phi M_n$ ..... | 0.53  | OK      |
| Max. Bar Spacing Ratio .....              | 0.60  | OK      |

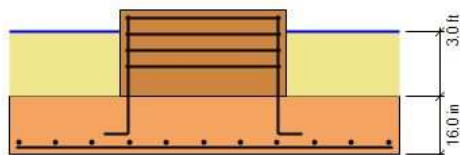
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.4   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.8   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 3.9   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 3.68  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

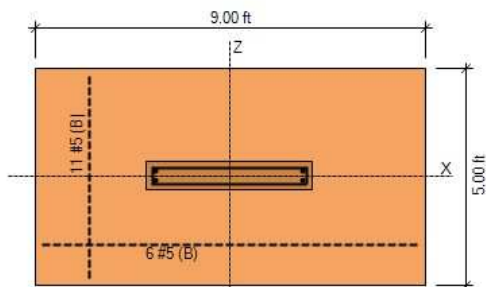




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN

## DESIGN CODES

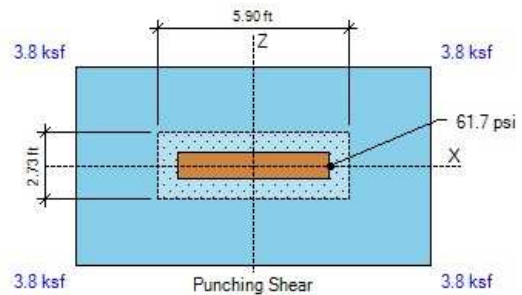
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 147.2 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 807.6 | kip  |
| Flexural Strength $\phi M_n$ ..... | 70.0  | k-ft |
| Biaxial Strength Ratio .....       | 0.18  | OK   |





## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 5.00  | ft |    |
| Footing Width (Z-dir) .....  | 5.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 16.0  | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.97  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

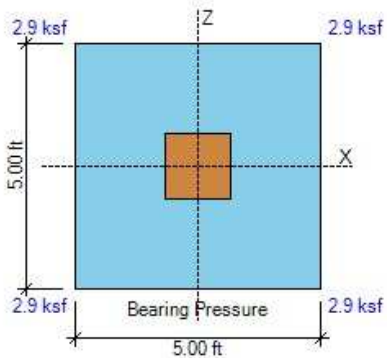
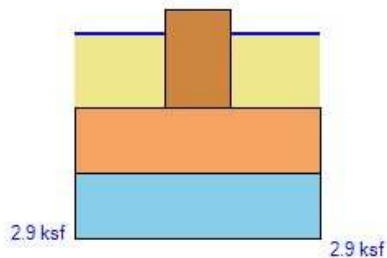
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 45.0 | 17.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 3.0   | 2.50 | 7.5    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.50 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 4.6   | 2.50 | 11.5   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 27.0  | 2.50 | 67.5   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.2  | 2.50 | -3.1   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 33.4  | RM = | 83.4   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 3.0   | 2.50 | 7.5    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 2.50 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 4.6   | 2.50 | 11.5   |
| Arm of Vertical Resultant = | 2.50  | 2.50  | ft     | Axial Force P ..... | 27.0  | 2.50 | 67.5   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -1.2  | 2.50 | -3.1   |
|                             |       |       |        | Rv =                | 33.4  | RM = | 83.4   |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

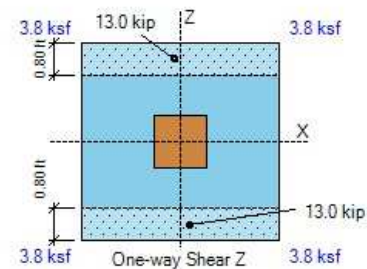
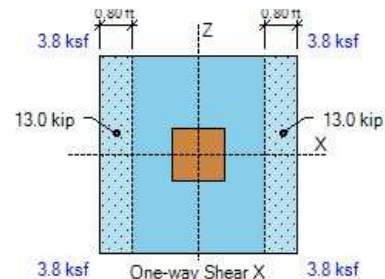
|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 15.0       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 11.6       | 11.6        |
| Horiz. Resisting Force            | 26.6       | 26.6        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 3.0   | kip   |
| Soil Cover Weight .....    | 4.6   | kip   |
| Downward Force W .....     | 7.6   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |               |     |
|--------------------------------------------|---------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.40          |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.40          |     |
| Punching Shear due to Axial ....           | 44.9          | psi |
| Punching Shear due to $M_x$ .....          | 0.0           | psi |
| Punching Shear due to $M_z$ .....          | 0.0           | psi |
| Punching Shear Stress $V_u$ .....          | 44.9          | psi |
| Effective Perimeter $b_o$ .....            | 113.5         | in  |
| Average Effective Depth $d$ .....          | 12.4          | in  |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |     |
| Column Aspect Ratio $\beta$ .....          | 1.00          |     |
| Punching Shear Strength $\phi V_c$ ..      | 164.3         | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.27          | OK  |

**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 13.0   | 13.0   | kip |
| One-way Shear $V_{uz}$ ...                 | 13.0   | 13.0   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 34.4   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 33.2   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.39   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 35.1 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 35.1 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

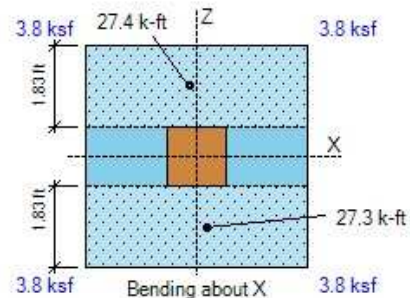
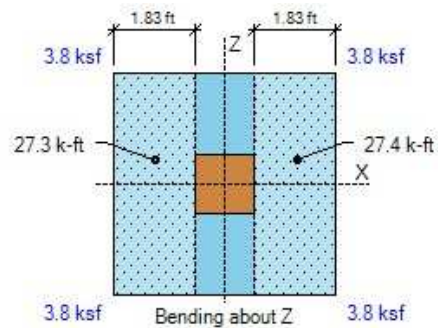
|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 27.3   | 27.4   | k-ft |
| Bending Moment $+M_{uz}$ ... | 27.3   | 27.4   | k-ft |

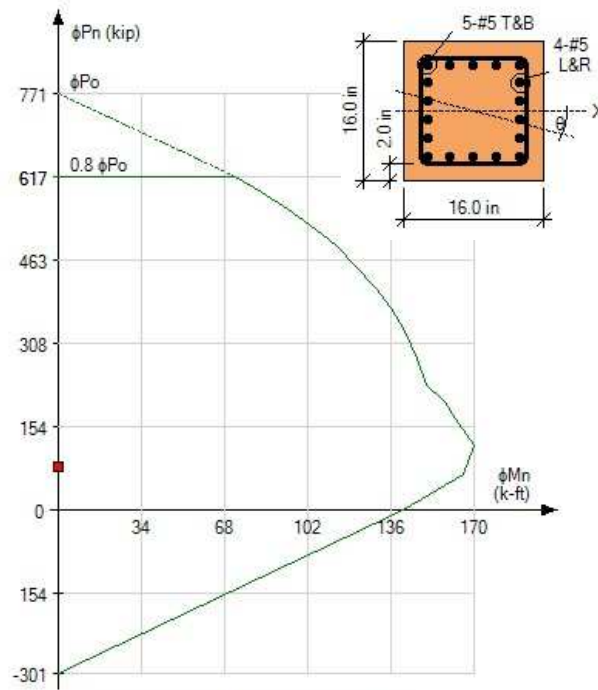
*Use 6 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 6 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                          |       |         |
|------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..       | 0.40  | OK      |
| Z-Bars Development Length Ratio ..       | 0.40  | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.93  | OK      |
| Under-strength $\phi$ Factor .....       | 0.90  |         |
| Bending Strength $+\phi M_{nx}$ .....    | 97.9  | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 103.1 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.28  | OK      |
| Max. Bar Spacing Ratio .....             | 0.60  | OK      |

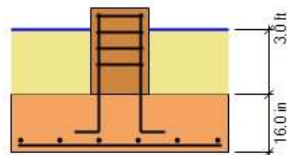
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.3   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

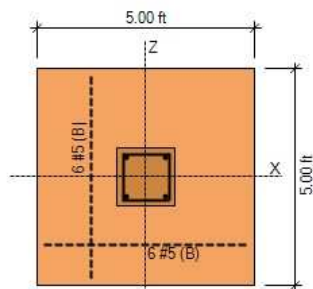




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN

## DESIGN CODES

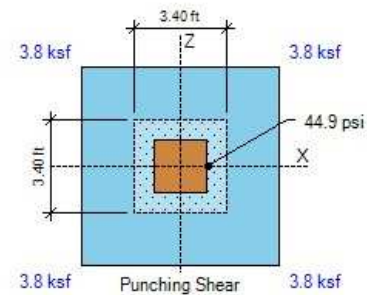
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 81.2  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 614.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 169.3 | k-ft |
| Biaxial Strength Ratio .....       | 0.13  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 8.50  | ft |    |
| Footing Width (Z-dir) .....  | 5.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 30.0  | in |    |
| Column Width (Z-dir) .....   | 8.0   | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.98  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

## APPLIED LOADS

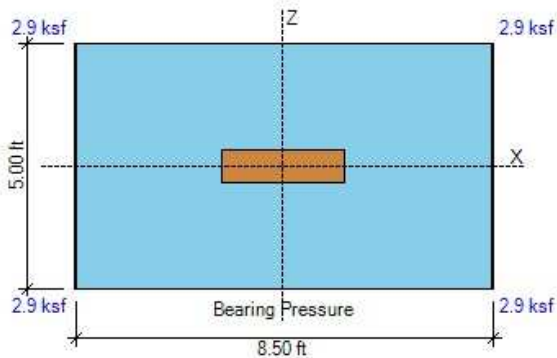
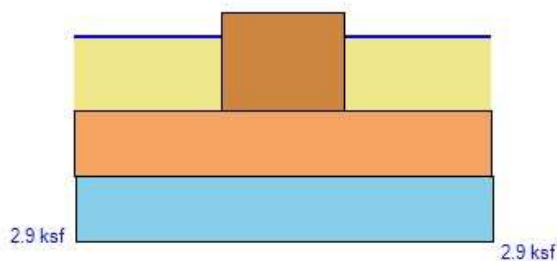
|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 86.0 | 20.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 5.1   | 2.50 | 12.8   |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.50 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 8.1   | 2.50 | 20.2   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 51.6  | 2.50 | 129.0  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -2.1  | 2.50 | -5.3   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 62.7  | RM = | 156.7  |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 5.1   | 4.25 | 21.7   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 4.25 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 8.1   | 4.25 | 34.4   |
|                             |       |       |        | Axial Force P ..... | 51.6  | 4.25 | 219.3  |
|                             |       |       |        | Water Buoyancy .    | -2.1  | 2.50 | -5.3   |
| Arm of Vertical Resultant = |       |       |        | Rv =                | 62.7  | RM = | 266.3  |
| Overturing Safety Factor =  |       |       |        |                     |       |      |        |

OK

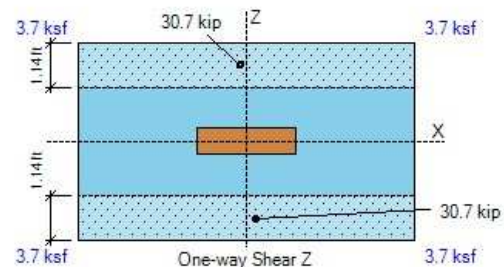
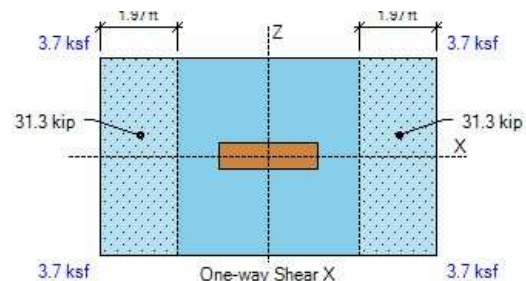


**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 28.2       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 11.6       | 19.8        |
| Horiz. Resisting Force            | 39.8       | 48.0        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |             |     |
|----------------------------|-------------|-----|
| Uplift Force P .....       | 0.0         | kip |
| Pedestal Selfweight .....  | 0.0         | kip |
| Footing Selfweight .....   | 5.1         | kip |
| Soil Cover Weight .....    | 8.1         | kip |
| Downward Force W .....     | 13.2        | kip |
| Uplift Safety Factor ..... | 99.99 > 1.0 | OK  |

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |               |     |
|--------------------------------------------|---------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.32          |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.49          |     |
| Punching Shear due to Axial ....           | 74.8          | psi |
| Punching Shear due to $M_x$ .....          | 0.0           | psi |
| Punching Shear due to $M_z$ .....          | 0.0           | psi |
| Punching Shear Stress $V_u$ .....          | 74.8          | psi |
| Effective Perimeter $b_o$ .....            | 125.5         | in  |
| Average Effective Depth $d$ .....          | 12.4          | in  |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |     |
| Column Aspect Ratio $\beta$ .....          | 3.75          |     |
| Punching Shear Strength $\phi V_c$ ..      | 126.0         | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.59          | OK  |

**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 31.3   | 31.3   | kip |
| One-way Shear $V_{uz}$ ...                 | 30.7   | 30.7   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 34.4   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 56.1   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.91   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | N.A. |         |
| Z-Bars Development Length Ratio ..        | N.A. |         |
| Min. Top Steel Area Ratio .....           | N.A. |         |
| Under-strength $\phi$ Factor .....        | 0.60 |         |
| Bending Strength - $\phi M_{nx}$ .....    | 59.6 | k-ft OK |
| Bending Strength - $\phi M_{nz}$ .....    | 35.1 | k-ft OK |
| Max. Bending Ratio - $M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....              | N.A. |         |

**- Bottom Bars -**

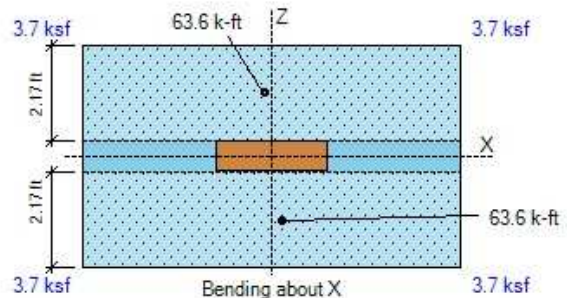
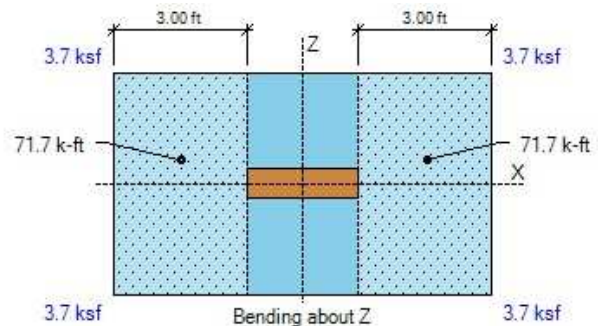
|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ... | 63.6   | 63.6   | k-ft |
| Bending Moment + $M_{uz}$ ... | 71.7   | 71.7   | k-ft |

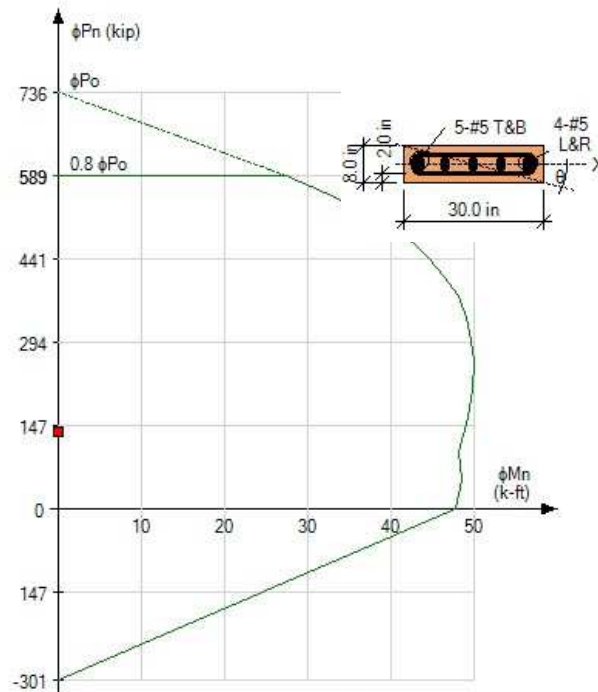
*Use 6 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 10 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                           |       |         |
|-------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..        | 0.24  | OK      |
| Z-Bars Development Length Ratio ..        | 0.34  | OK      |
| Min. Bottom Steel Area Ratio .....        | 0.95  | OK      |
| Under-strength $\phi$ Factor .....        | 0.90  |         |
| Bending Strength + $\phi M_{nx}$ .....    | 130.5 | k-ft OK |
| Bending Strength + $\phi M_{nz}$ .....    | 103.1 | k-ft OK |
| Max. Bending Ratio + $M_u/\phi M_n$ ..... | 0.70  | OK      |
| Max. Bar Spacing Ratio .....              | 0.60  | OK      |

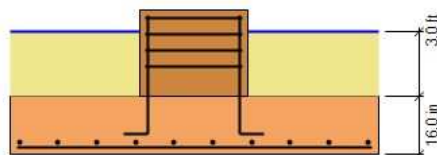
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.6   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.40  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.42  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

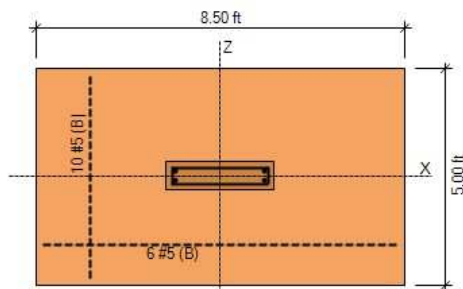




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN

## DESIGN CODES

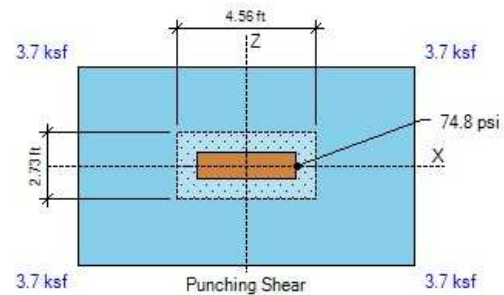
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 135.2 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 588.5 | kip  |
| Flexural Strength $\phi M_n$ ..... | 48.9  | k-ft |
| Biaxial Strength Ratio .....       | 0.23  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 3.00  | ft |    |
| Footing Width (Z-dir) .....  | 7.50  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 8.0   | in |    |
| Column Width (Z-dir) .....   | 72.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.97  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

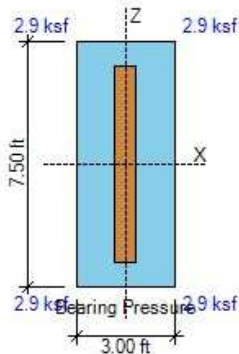
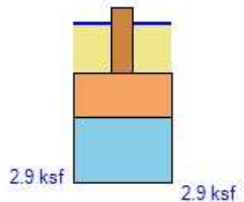
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 52.0 | 5.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 2.7   | 3.75 | 10.1   |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 3.75 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 3.7   | 3.75 | 13.7   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 31.2  | 3.75 | 117.0  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.1  | 3.75 | -4.2   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 36.4  | RM = | 136.6  |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 2.7   | 1.50 | 4.1    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 1.50 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 3.7   | 1.50 | 5.5    |
| Arm of Vertical Resultant = | 3.75  | 1.50  | ft     | Axial Force P ..... | 31.2  | 1.50 | 46.8   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -1.1  | 3.75 | -4.2   |
|                             |       |       |        | Rv =                | 36.4  | RM = | 54.7   |

OK

**PUNCHING SHEAR (Comb: 1.4D)**

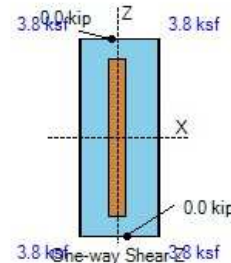
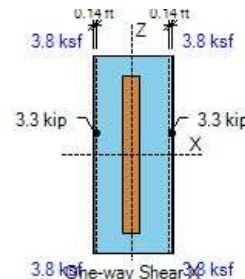
|                                            |             |
|--------------------------------------------|-------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.54        |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.27        |
| Punching Shear due to Axial ....           | 25.9 psi    |
| Punching Shear due to $M_x$ .....          | 0.0 psi     |
| Punching Shear due to $M_z$ .....          | 0.0 psi     |
| Punching Shear Stress $V_u$ .....          | 25.9 psi    |
| Effective Perimeter $b_o$ .....            | 115.4 in    |
| Average Effective Depth $d$ .....          | 12.4 in     |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |
| Column Aspect Ratio $\beta$ .....          | 9.00        |
| Punching Shear Strength $\phi V_c$ ..      | 100.4 psi   |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.26 OK     |

**SLIDING (combDlg. 0.6D+0.6W)**

|                                    |                       |
|------------------------------------|-----------------------|
| Footing-Soil Friction Coeff. ....  | 0.45                  |
| Friction Force at Base .....       | 16.4 kip              |
| Passive Pressure Coeff. $K_p$ .... | 4.33                  |
|                                    | <b>X-X</b> <b>Z-Z</b> |
| Passive Force @ Ftg ...            | 17.4 7.0 kip          |
| Horiz. Resisting Force             | 33.8 23.4 kip         |
| Horiz. Sliding Force .....         | 0.0 0.0 kip           |
| Sliding Safety Factor ...          | 99.99 99.99 > 1.5 OK  |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |                |
|----------------------------|----------------|
| Uplift Force $P$ .....     | 0.0 kip        |
| Pedestal Selfweight .....  | 0.0 kip        |
| Footing Selfweight .....   | 2.7 kip        |
| Soil Cover Weight .....    | 3.7 kip        |
| Downward Force $W$ .....   | 6.4 kip        |
| Uplift Safety Factor ..... | 99.99 > 1.0 OK |





**ONE-WAY SHEAR (Comb: 1.4D)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 3.3    | 3.3    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$ ..... | 55.1   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$ ..... | 20.6   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.06   |        | OK  |

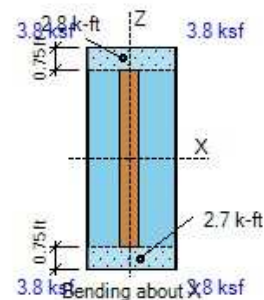
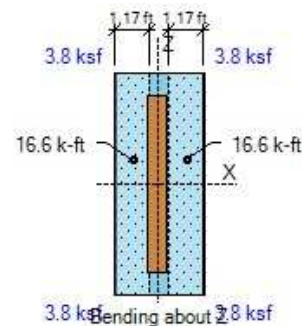
**FLEXURE (Comb: 1.4D)**

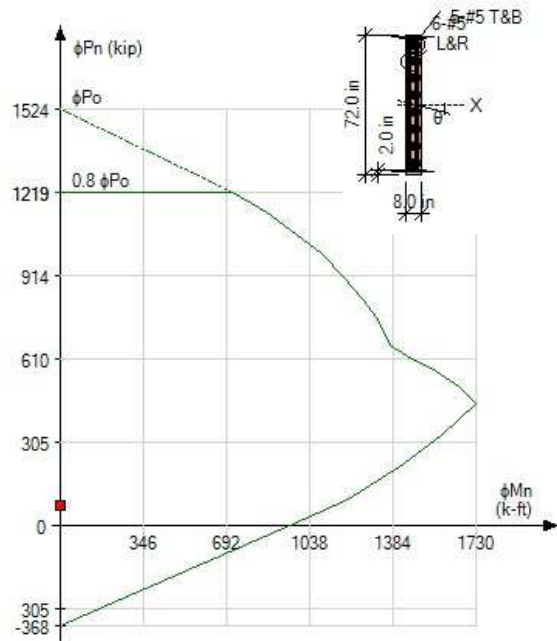
| - Top Bars -                                        | - Side | + Side |      |
|-----------------------------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ...                       | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ...                       | 0.0    | 0.0    | k-ft |
| <i>No Top Reinforcement Provided at the Footing</i> |        |        |      |
| <i>Use Plain Concrete Flexural Strength at Top</i>  |        |        |      |
| X-Bars Development Length Ratio ..                  | N.A.   |        |      |
| Z-Bars Development Length Ratio ..                  | N.A.   |        |      |
| Min. Top Steel Area Ratio .....                     | N.A.   |        |      |
| Under-strength $\phi$ Factor .....                  | 0.60   |        |      |
| Bending Strength - $\phi M_{nx}$ .....              | 21.0   | k-ft   | OK   |
| Bending Strength - $\phi M_{nz}$ .....              | 52.6   | k-ft   | OK   |
| Max. Bending Ratio - $M_u/\phi M_n$ .....           | 0.00   |        | OK   |
| Max. Bar Spacing Ratio .....                        | N.A.   |        |      |

| - Bottom Bars -                                                      | - Side | + Side |      |
|----------------------------------------------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ...                                        | 2.7    | 2.8    | k-ft |
| Bending Moment + $M_{uz}$ ...                                        | 16.6   | 16.6   | k-ft |
| <i>Use 11 #5 Bars Parallel to X (Bot) , <math>d = 12.7</math> in</i> |        |        |      |
| <i>Use 4 #5 Bars Parallel to Z (Bot) , <math>d = 12.1</math> in</i>  |        |        |      |
| X-Bars Development Length Ratio ..                                   | 0.68   |        | OK   |
| Z-Bars Development Length Ratio ..                                   | 1.21   |        | NG   |
| Min. Bottom Steel Area Ratio .....                                   | 0.84   |        | OK   |
| Under-strength $\phi$ Factor .....                                   | 0.90   |        |      |
| Bending Strength + $\phi M_{nx}$ .....                               | 65.0   | k-ft   | OK   |
| Bending Strength + $\phi M_{nz}$ .....                               | 132.9  | k-ft   | OK   |
| Max. Bending Ratio + $M_u/\phi M_n$ .....                            | 0.12   |        | OK   |
| Max. Bar Spacing Ratio .....                                         | 0.56   |        | OK   |

**TRANSFER (Comb: 1.4D)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 22 #5 x 3.00 ft hooked dowels , <math>A_s = 6.82</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.1   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.7   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 3.8   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 184.1 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 5.76  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |





INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.4D

## DESIGN CODES

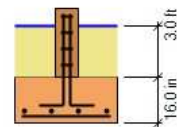
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

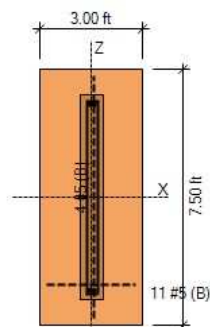
|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.4D)

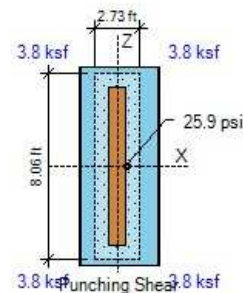
|                                    |        |      |
|------------------------------------|--------|------|
| Axial Load $P_u$ .....             | 72.8   | kip  |
| Bending Moment $M_u$ .....         | 0.0    | k-ft |
| Axial Strength $\phi P_n$ .....    | 1219.1 | kip  |
| Flexural Strength $\phi M_n$ ..... | 1151.0 | k-ft |
| Biaxial Strength Ratio .....       | 0.06   | OK   |



ELEVATION



PLAN



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 3.75  | ft |    |
| Footing Width (Z-dir) .....  | 3.75  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 8.0   | in |    |
| Column Width (Z-dir) .....   | 24.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.97  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

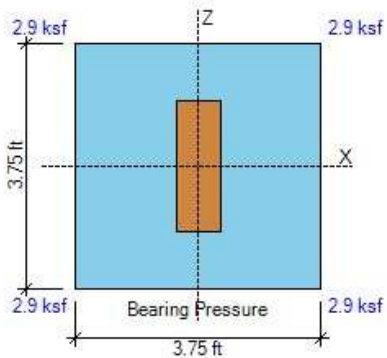
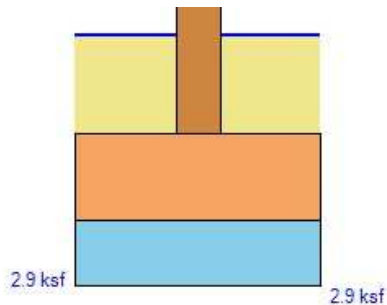
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 25.0 | 10.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 1.7   | 1.88 | 3.2    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 1.88 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 2.5   | 1.88 | 4.7    |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 15.0  | 1.88 | 28.1   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.7  | 1.88 | -1.3   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 18.5  | RM = | 34.7   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 1.7   | 1.88 | 3.2    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 1.88 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 2.5   | 1.88 | 4.7    |
| Arm of Vertical Resultant = | 1.88  | 1.88  | ft     | Axial Force P ..... | 15.0  | 1.88 | 28.1   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -0.7  | 1.88 | -1.3   |
|                             |       |       |        | Rv =                | 18.5  | RM = | 34.7   |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

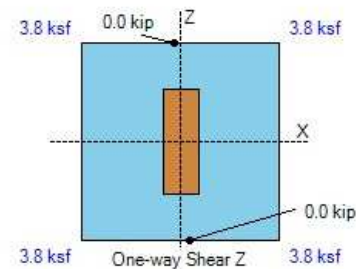
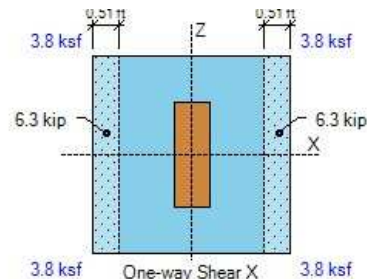
|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 8.3        | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 8.7        | 8.7         |
| Horiz. Resisting Force            | 17.1       | 17.1        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 1.7   | kip   |
| Soil Cover Weight .....    | 2.5   | kip   |
| Downward Force W .....     | 4.2   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |           |     |
|--------------------------------------------|-----------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.49      |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.32      |     |
| Punching Shear due to Axial ....           | 23.4      | psi |
| Punching Shear due to $M_x$ .....          | 0.0       | psi |
| Punching Shear due to $M_z$ .....          | 0.0       | psi |
| Punching Shear Stress $V_u$ .....          | 23.4      | psi |
| Effective Perimeter $b_o$ .....            | 101.8     | in  |
| Average Effective Depth $d$ .....          | 12.4      | in  |
| Column Location Factor $\alpha_s$ ....     | 30 (Edge) |     |
| Column Aspect Ratio $\beta$ .....          | 3.00      |     |
| Punching Shear Strength $\phi V_c$ ..      | 136.9     | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.17      | OK  |

**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 6.3    | 6.3    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 26.7   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 25.8   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.23   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 26.3 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 26.3 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

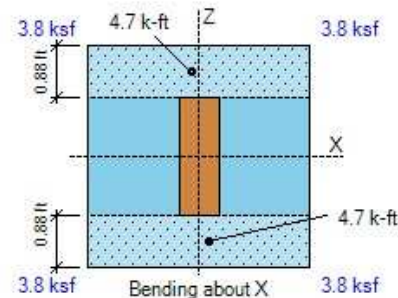
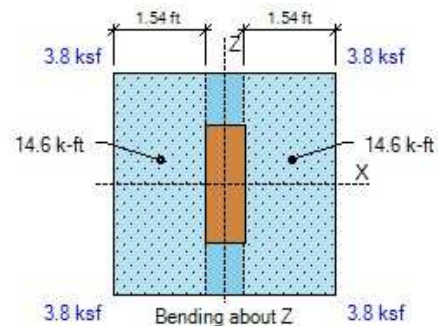
|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 4.7    | 4.7    | k-ft |
| Bending Moment $+M_{uz}$ ... | 14.6   | 14.6   | k-ft |

*Use 5 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 5 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

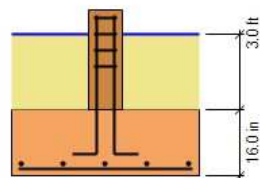
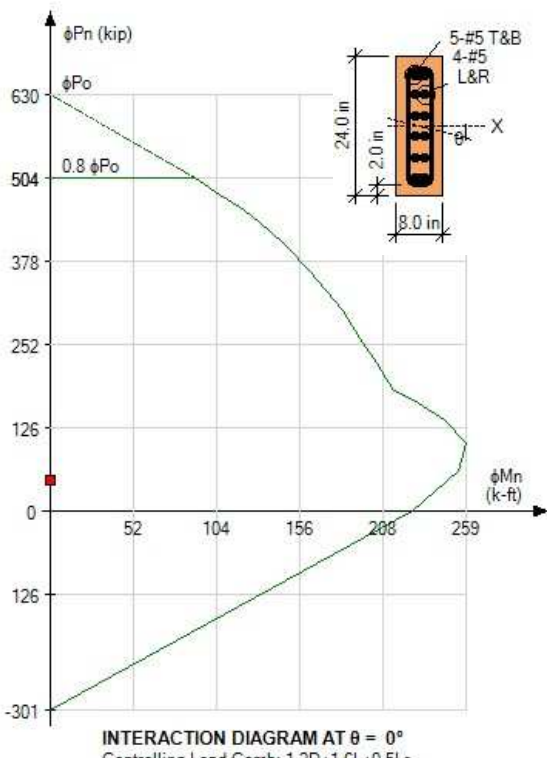
|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | 0.49 | OK      |
| Z-Bars Development Length Ratio ..       | 0.98 | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.84 | OK      |
| Under-strength $\phi$ Factor .....       | 0.90 |         |
| Bending Strength $+\phi M_{nx}$ .....    | 81.3 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 85.7 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.17 | OK      |
| Max. Bar Spacing Ratio .....             | 0.54 | OK      |

**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

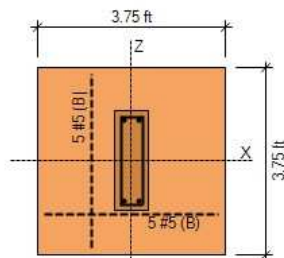
|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.2   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.3   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.4   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 1.92  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |







ELEVATION



PLAN

## DESIGN CODES

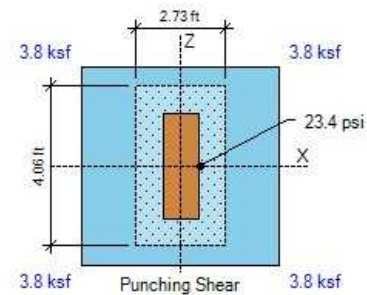
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

COLUMN (Comb: 1.2D+1.6L+0.5L<sub>r</sub>)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 46.0  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 503.1 | kip  |
| Flexural Strength $\phi M_n$ ..... | 245.0 | k-ft |
| Biaxial Strength Ratio .....       | 0.09  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 12.00 | ft |    |
| Footing Width (Z-dir) .....  | 2.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 108.0 | in |    |
| Column Width (Z-dir) .....   | 8.0   | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.0   | ksf |    |
| Bearing Pressure Ratio .....       | 0.68  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 30.0 | 10.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 2.9   | 1.00 | 2.9    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 1.00 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 3.6   | 1.00 | 3.6    |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 18.0  | 1.00 | 18.0   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.2  | 1.00 | -1.2   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 23.2  | RM = | 23.2   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 2.9   | 6.00 | 17.3   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 6.00 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 3.6   | 6.00 | 21.4   |
|                             |       |       |        | Axial Force P ..... | 18.0  | 6.00 | 108.0  |
|                             |       |       |        | Water Buoyancy .    | -1.2  | 1.00 | -1.2   |
| Arm of Vertical Resultant = | X-X   | Z-Z   | ft     | Rv =                | 23.2  | RM = | 139.5  |
| Overturing Safety Factor =  | 99.99 | 99.99 | > 1.5  |                     |       |      |        |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

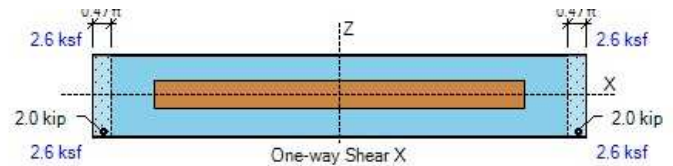
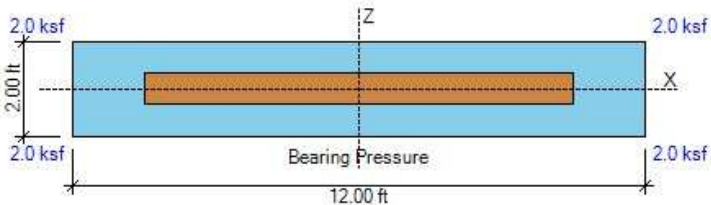
|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 10.5       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 4.7        | 27.9        |
| Horiz. Resisting Force            | 15.1       | 38.4        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

**UPLIFT (Comb: 0.6D+0.6W)**

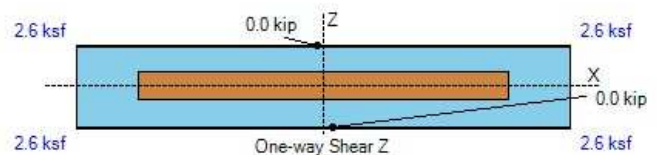
|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 2.9   | kip   |
| Soil Cover Weight .....    | 3.6   | kip   |
| Downward Force W .....     | 6.4   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |             |
|--------------------------------------------|-------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.21        |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.62        |
| Punching Shear due to Axial ....           | 8.7         |
| Punching Shear due to $M_x$ .....          | 0.0         |
| Punching Shear due to $M_z$ .....          | 0.0         |
| Punching Shear Stress $V_u$ .....          | 8.7         |
| Effective Perimeter $b_o$ .....            | 154.4       |
| Average Effective Depth $d$ .....          | 12.4        |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |
| Column Aspect Ratio $\beta$ .....          | 13.50       |
| Punching Shear Strength $\phi V_c$ ..      | 94.3        |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.09        |

OK



**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 2.0    | 2.0    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$ ..... | 14.8   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$ ..... | 79.0   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.14   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 84.1 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 14.0 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

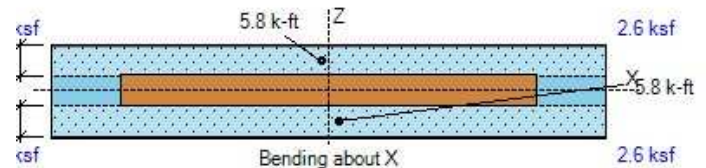
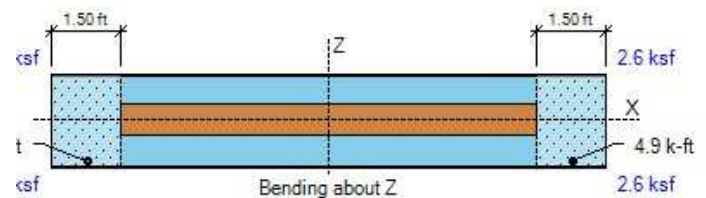
|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 5.8    | 5.8    | k-ft |
| Bending Moment $+M_{uz}$ ... | 4.9    | 4.9    | k-ft |

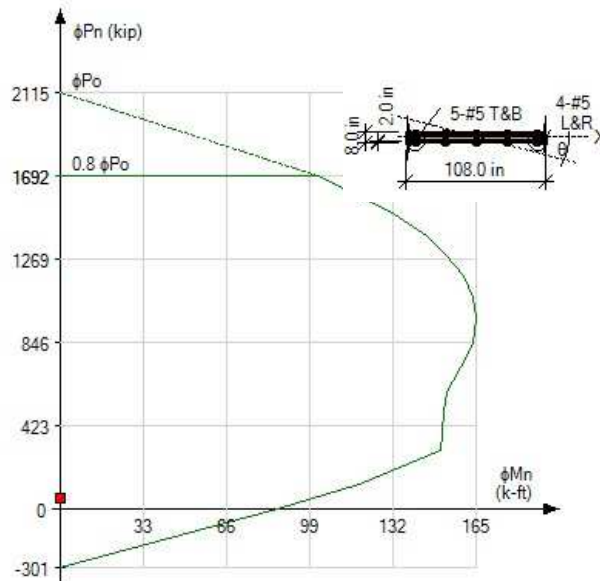
*Use 3 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 14 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                          |       |         |
|------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..       | 0.51  | OK      |
| Z-Bars Development Length Ratio ..       | 1.43  | NG      |
| Min. Bottom Steel Area Ratio .....       | 0.96  | OK      |
| Under-strength $\phi$ Factor .....       | 0.90  |         |
| Bending Strength $+\phi M_{nx}$ .....    | 135.1 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 51.2  | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.10  | OK      |
| Max. Bar Spacing Ratio .....             | 0.59  | OK      |

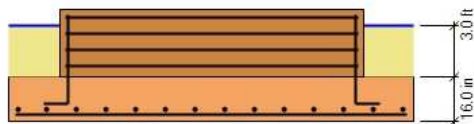
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.1   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.5   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 3.3   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 8.64  | in <sup>2</sup> NG |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

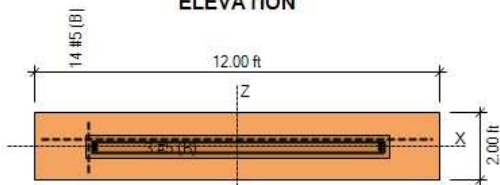




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN

## DESIGN CODES

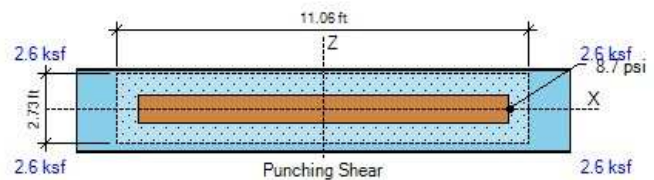
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |        |      |
|------------------------------------|--------|------|
| Axial Load $P_u$ .....             | 52.0   | kip  |
| Bending Moment $M_u$ .....         | 0.0    | k-ft |
| Axial Strength $\phi P_n$ .....    | 1685.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 99.7   | k-ft |
| Biaxial Strength Ratio .....       | 0.03   | OK   |



**GEOMETRY**

|                                |                 |                 |       |
|--------------------------------|-----------------|-----------------|-------|
| Column to Column Distance .... | 6.50            | ft              |       |
|                                | <u>Exterior</u> | <u>Interior</u> |       |
| Column Length (X) ....         | 24.0            | 24.0            | in    |
| Column Width (Z) .....         | 8.0             | 8.0             | in    |
| Edge Distance (X) ....         | 3.60            | 2.00            | ft OK |
| Footing Width (Z) .....        | 5.00            | 5.00            | ft    |
| Footing Thickness .....        | 16.0            | in              | OK    |
| Soil Cover .....               | 3.00            | ft              |       |
| Pedestal Height .....          | N. A.           |                 |       |

**SOIL PRESSURES (D+L)**

|                                        |                 |                 |     |
|----------------------------------------|-----------------|-----------------|-----|
| Gross Allow. Soil Pressure .....       | 3.00            | ksf             |     |
| Overburden Pressure .....              | 0.46            | ksf             |     |
| Reaction Force .....                   | 153.9           | kip             |     |
| Eccentricity X = 0.32 ft , Z = 0.00 ft |                 |                 |     |
|                                        | <u>Exterior</u> | <u>Interior</u> |     |
| Bearing Pressure .....                 | 2.94            | 2.14            | ksf |
| Bearing Ratio .....                    | 0.98            | 0.71            | OK  |

**APPLIED LOADS**

|                        |             |             |              |             |             |                |      |
|------------------------|-------------|-------------|--------------|-------------|-------------|----------------|------|
| <u>- Exterior Col.</u> | <u>Dead</u> | <u>Live</u> | <u>RLive</u> | <u>Snow</u> | <u>Wind</u> | <u>Seismic</u> |      |
| Axial Force P .....    | 71.0        | 15.0        | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Moment about X Mx      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Moment about Z Mz      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Shear Force Vx .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Shear Force Vz .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| <u>- Interior Col.</u> | <u>Dead</u> | <u>Live</u> | <u>RLive</u> | <u>Snow</u> | <u>Wind</u> | <u>Seismic</u> |      |
| Axial Force P .....    | 36.0        | 4.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Moment about X Mx      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Moment about Z Mz      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Shear Force Vx .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Shear Force Vz .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |

**MATERIALS**

|                          |                |                |     |
|--------------------------|----------------|----------------|-----|
|                          | <u>Columns</u> | <u>Footing</u> |     |
| Concrete f'c .....       | 4.0            | 3.0            | ksi |
| Reinf. Steel fy .....    | 60.0           | 60.0           | ksi |
| Soil Cover Density ..... | 120.0          | pcf            |     |

**SLIDING (comb: 0.6D+0.6W)**

|                                   |            |                |
|-----------------------------------|------------|----------------|
| Footing-Soil Friction Coeff. .... | 0.45       |                |
| Friction Force at Base .....      | 36.4       | kip            |
| Passive Pressure Coeff. Kp ....   | 4.33       |                |
|                                   | <u>X-X</u> | <u>Z-Z</u>     |
| Passive Force @ Ftg ...           | 12.7       | 30.7 kip       |
| Horiz. Resisting Force            | 49.1       | 67.1 kip       |
| Horiz. Sliding Force .....        | 0.0        | 0.0 kip        |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 OK |

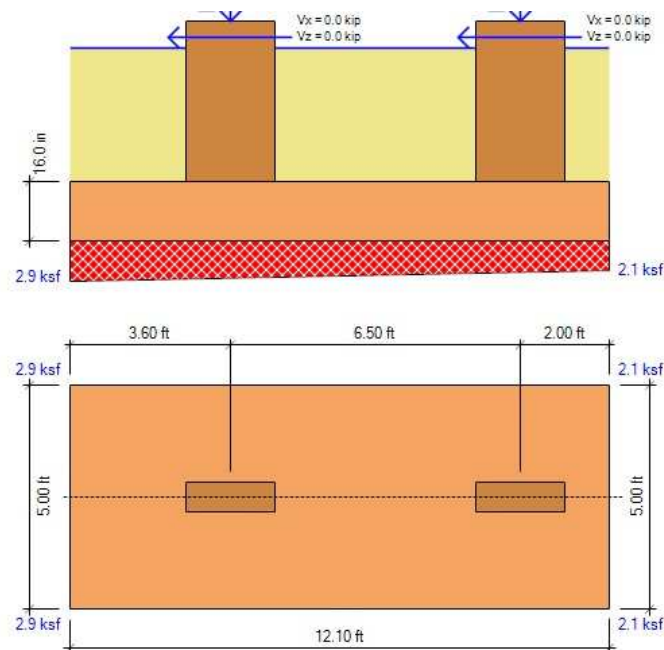
**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |



**OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)**

| OVERTURNING                    |       |            |            | RESISTING          |       |      |        |
|--------------------------------|-------|------------|------------|--------------------|-------|------|--------|
|                                | Force | Arm        | Moment     |                    | Force | Arm  | Moment |
|                                | kip   | ft         | k-ft       |                    | kip   | ft   | k-ft   |
| <b>- About X-X</b>             |       |            |            | <b>- About X-X</b> |       |      |        |
| Ext. Moment Mx ...             | 0.0   | 0.0        | 0.0        | Soil Cover .....   | 12.5  | 2.50 | 31.2   |
| Ext. Shear Vz .....            | 0.0   | 1.33       | 0.0        | Footing Weight ... | 7.3   | 2.50 | 18.2   |
| Int. Moment Mx ....            | 0.0   | 0.0        | 0.0        | Ext. Column .....  | 0.0   | 2.50 | 0.0    |
| Int. Shear Vz .....            | 0.0   | 1.33       | 0.0        | Int. Column .....  | 0.0   | 2.50 | 0.0    |
| Passive Pressure               | 0.0   | 0.53       | 0.0        | Ext. Axial P ..... | 42.6  | 2.50 | 106.5  |
| Rh =                           | 0.0   | OTM =      | 0.0        | Int. Axial P ..... | 21.6  | 2.50 | 54.0   |
| <b>- About Z-Z</b>             |       |            |            | Water Buoyancy .   | -3.0  | 2.50 | -7.6   |
| Ext. Moment Mz ...             | 0.0   | 0.0        | 0.0        | Rv =               | 80.9  | RM = | 202.3  |
| Ext. Shear Vx .....            | 0.0   | 1.33       | 0.0        | <b>- About Z-Z</b> |       |      |        |
| Int. Moment Mz ....            | 0.0   | 0.0        | 0.0        | Soil Cover .....   | 12.5  | 6.05 | 75.6   |
| Int. Shear Vx .....            | 0.0   | 1.33       | 0.0        | Footing Weight ... | 7.3   | 6.05 | 43.9   |
| Passive Pressure               | 0.0   | 0.53       | 0.0        | Ext. Column .....  | 0.0   | 8.50 | 0.0    |
| Rh =                           | 0.0   | OTM =      | 0.0        | Int. Column .....  | 0.0   | 2.00 | 0.0    |
|                                |       |            |            | Ext. Axial P ..... | 42.6  | 8.50 | 362.1  |
|                                |       |            |            | Int. Axial P ..... | 21.6  | 2.00 | 43.2   |
|                                |       |            |            | Water Buoyancy .   | -3.0  | 6.05 | -18.3  |
| Arm of Vertical Resultant .... |       | <b>X-X</b> | <b>Z-Z</b> | Rv =               | 80.9  | RM = | 472.7  |
|                                |       | 2.50       | 5.84 ft    |                    |       |      |        |
| Overturning Safety Factor ..   | 99.99 | 99.99      | > 1.5 OK   |                    |       |      |        |



**FOOTING AT EXTERIOR COL.****- One-way Shear (Comb: 1.2D+1.6L+0.5S)**Under-strength  $\phi$  Factor ..... 0.75**- Side + Side**One-way Shear  $V_{ux}$  ... 24.3 27.1 kipShear Strength  $\phi V_{cx}$  .. 26.9 37.2 kipOne-way Shear  $V_{uz}$  ... 13.5 kipShear Strength  $\phi V_{cz}$  .. 27.9 kipMax. One-way Shear Ratio  $V_u/\phi V_c$  .. 0.90 OK**- Punching Shear (Comb: 1.2D+1.6L+0.5Lr)**Unbalanced Moment Factor  $\gamma_{vx}$  ... 0.47

Punching Shear due to Axial .... 66.1 psi

Punching Shear due to  $M_z$  ..... 0.0 psiPunching Shear Stress  $V_u$  ..... 66.1 psiEffective Perimeter  $b_o$  ..... 113.5 inAverage Effective Depth  $d$  ..... 12.4 inPunching Shear Strength  $\phi V_c$  .. 136.9 psiPunching Shear Ratio  $V_u/\phi V_c$  ..... 0.48 OK**- Transv. Flexure (Comb: 1.2D+1.6L+0.5S)**Under-strength  $\phi$  Factor ..... 0.90

Footing Effective Length ..... 4.11 ft

*No Top Reinf. Use Plain Concrete Strength**Use 5 #5 Bars Parallel to Z (Bot) ,  $d = 12.7$  in*

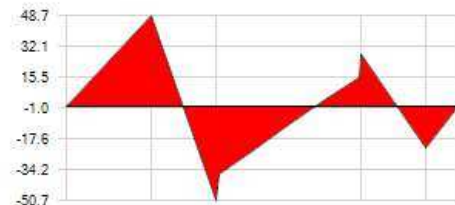
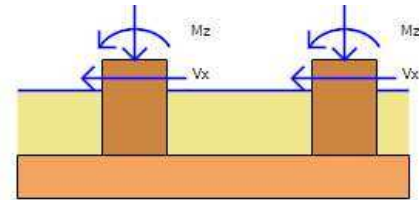
Bottom Steel Min. Area Ratio ..... 0.92 OK

**Top Bot**Bending Moment  $M_{ux}$  .. 0.0 28.0 k-ftBending Strength  $\phi M_{nx}$  28.8 85.9 k-ftMax. Bending Ratio  $M_{ux}/\phi M_{nx}$  ..... 0.33 OK

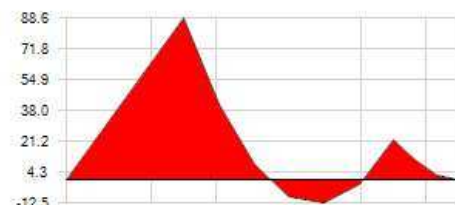
Top Z-Bars Develop. Length Ratio . N.A. OK

Bot Z-Bars Develop. Length Ratio .. 0.33 OK

Center Z-Bars S&amp;T min Ratio ..... 0.93 OK



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)

**FOOTING AT INTERIOR COL.****- One-way Shear (Comb: 1.2D+1.6L+0.5S)**

|                                             |        |        |     |
|---------------------------------------------|--------|--------|-----|
| Under-strength $\phi$ Factor .....          | 0.75   |        |     |
|                                             | - Side | + Side |     |
| One-way Shear $V_{ux}$ ...                  | 4.0    | 0.0    | kip |
| Shear Strength $\phi V_{cx}$ ..             | 26.9   | 37.2   | kip |
| One-way Shear $V_{uz}$ ...                  |        | 10.8   | kip |
| Shear Strength $\phi V_{cz}$ ..             |        | 27.7   | kip |
| Max. One-way Shear Ratio $V_u/\phi V_c$ ... | 0.39   |        | OK  |

**- Punching Shear (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |       |     |
|--------------------------------------------|-------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.49  |     |
| Punching Shear due to Axial ....           | 28.7  | psi |
| Punching Shear due to $M_z$ .....          | 0.0   | psi |
| Punching Shear Stress $V_u$ .....          | 28.7  | psi |
| Effective Perimeter $b_o$ .....            | 104.8 | in  |
| Average Effective Depth $d$ .....          | 12.4  | in  |
| Punching Shear Strength $\phi V_c$ ..      | 136.9 | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.21  | OK  |

**- Transv. Flexure (Comb: 1.2D+1.6L+0.5S)**

|                                                                     |      |    |
|---------------------------------------------------------------------|------|----|
| Under-strength $\phi$ Factor                                        | 0.90 |    |
| Footing Effective Length                                            | 4.06 | ft |
| <i>No Top Reinf. Use Plain Concrete Strength</i>                    |      |    |
| <i>Use 5 #5 Bars Parallel to Z (Bot) , <math>d = 12.7</math> in</i> |      |    |
| Bottom Steel Min. Area Ratio                                        | 0.90 | OK |

|                                               |            |            |      |
|-----------------------------------------------|------------|------------|------|
|                                               | <b>Top</b> | <b>Bot</b> |      |
| Bending Moment $M_{ux}$ ..                    | 0.0        | 22.4       | k-ft |
| Bending Strength $\phi M_{nx}$                | 28.4       | 85.9       | k-ft |
| Max. Bending Ratio $M_{ux}/\phi M_{nx}$ ..... | 0.26       |            | OK   |
| Top Z-Bars Develop. Length Ratio .            | N.A.       |            | OK   |
| Bot Z-Bars Develop. Length Ratio ..           | 0.33       |            | OK   |

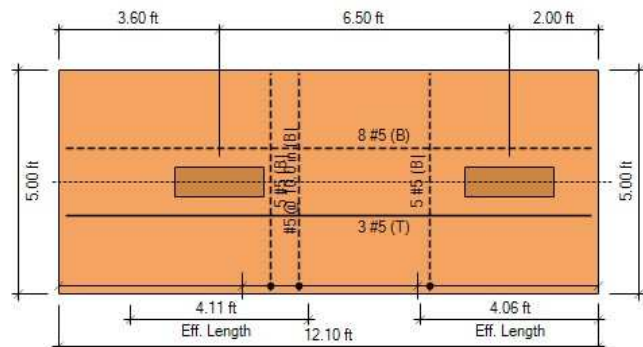
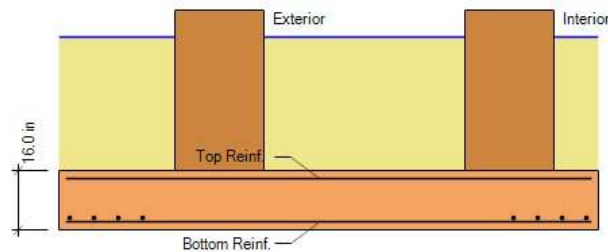
**LONGITUDINAL REINF.****- Long. Flexure (Comb: 1.4D)**

*Use 3 #5 Bars Parallel to X (Top) ,  $d = 12.9$  in*  
*Use 8 #5 Bars Parallel to X (Bot) ,  $d = 12.1$  in*

|                                               |            |            |      |
|-----------------------------------------------|------------|------------|------|
|                                               | <b>Top</b> | <b>Bot</b> |      |
| Min. Steel Area Ratio ...                     | 0.31       | 0.90       | OK   |
| Bending Moment $M_{uz}$ ..                    | 12.5       | 88.6       | k-ft |
| Bending Strength $\phi M_{nz}$                | 53.4       | 129.2      | k-ft |
| Max. Bending Ratio $M_{uz}/\phi M_{nz}$ ..... | 0.69       |            | OK   |
| Ext. Bot X-Bars Dev. Length Ratio .           | 0.15       |            | OK   |
| Int. Bot X-Bars Dev. Length Ratio ...         | 0.23       |            | OK   |

**LOAD TRANSFER (Comb: 1.2D+1.6L+0.5S)**Bearing Under-strength  $\phi$  Factor ..... 0.65

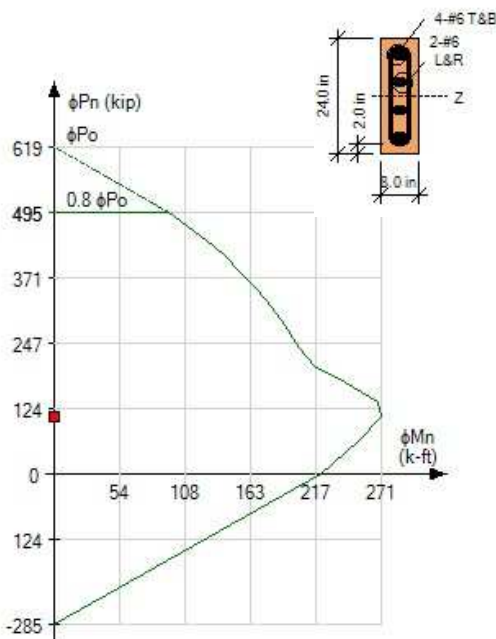
|                                  |             |             |                    |
|----------------------------------|-------------|-------------|--------------------|
|                                  | <b>Ext.</b> | <b>Int.</b> |                    |
| Compressive Stress $P_u$         | 0.6         | 0.3         | ksi                |
| Column Bearing $\phi P_n$ .....  | 3.3         | 3.3         | ksi OK             |
| Footing Bearing $\phi P_n$ ..... | 4.4         | 4.4         | ksi OK             |
| Shear Force $V_u$ .....          | 0.0         | 0.0         | kip                |
| Shear Friction $\phi V_n$ .....  | 142.6       | 142.6       | kip OK             |
| Dowel Steel Area $A_s$ .....     | 5.28        | 5.28        | in <sup>2</sup>    |
| Min. Steel Area $A_s$ min ..     | 1.92        | 1.92        | in <sup>2</sup> OK |
| Dev. Length Ratio at Col.        | 0.55        | 0.50        | OK                 |
| Dev. Length Ratio at Ftg.        | 1.27        | 1.27        | NG                 |

**UPLIFT CALCS (Comb: 0.6D+0.6W)**

|                            |       |          |
|----------------------------|-------|----------|
| Uplift Force $P$ .....     | 0.0   | kip      |
| Pedestals Selfweight ..... | 0.0   | kip      |
| Footing Selfweight .....   | 7.3   | kip      |
| Soil Cover Weight .....    | 12.5  | kip      |
| Downward Force $W$ .....   | 19.8  | kip      |
| Uplift Safety Factor ..... | 99.99 | > 1.0 OK |

**EXT. COLUMN (Comb: 1.2D+1.6L+0.5Lr)***Use 12-#6 Longitudinal Bars, Use Ties #4*

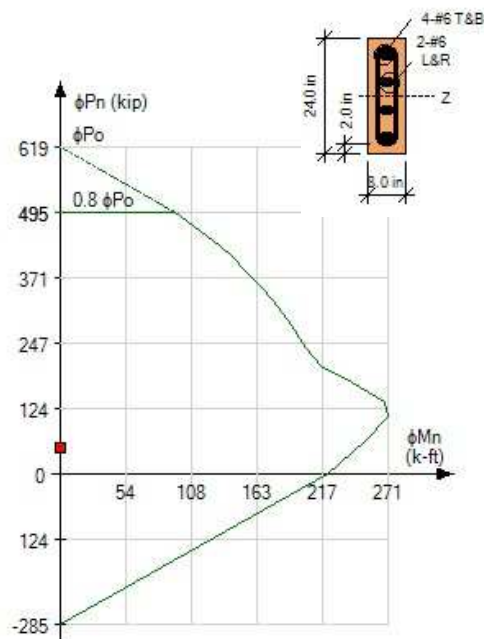
|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 109.2 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 492.2 | kip  |
| Flexural Strength $\phi M_n$ ..... | 271.4 | k-ft |
| Biaxial Strength Ratio .....       | 0.22  | OK   |



**EXT. INTERACTION DIAGRAM**  
Controlling Load Comb: 1.2D+1.6L+0.5Lr

**INT. COLUMN (Comb: 1.2D+1.6L+0.5Lr)***Use 12-#6 Longitudinal Bars, Use Ties #4*

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 49.6  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 492.2 | kip  |
| Flexural Strength $\phi M_n$ ..... | 246.2 | k-ft |
| Biaxial Strength Ratio .....       | 0.10  | OK   |



**INT. INTERACTION DIAGRAM**  
Controlling Load Comb: 1.2D+1.6L+0.5Lr

## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 9.00  | ft |    |
| Footing Width (Z-dir) .....  | 3.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 72.0  | in |    |
| Column Width (Z-dir) .....   | 8.0   | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.97  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

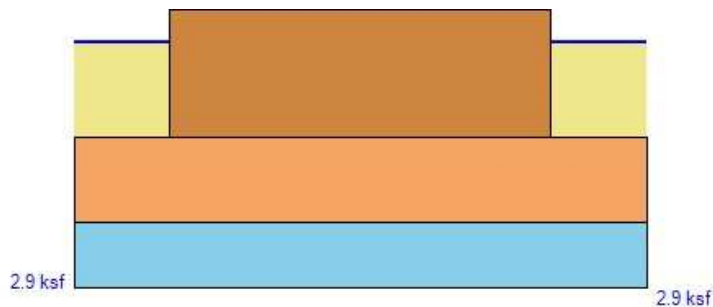
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 60.0 | 8.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 3.2   | 1.50 | 4.9    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 1.50 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 4.6   | 1.50 | 6.8    |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 36.0  | 1.50 | 54.0   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.3  | 1.50 | -2.0   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 42.4  | RM = | 63.7   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 3.2   | 4.50 | 14.6   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 4.50 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 4.6   | 4.50 | 20.5   |
|                             |       |       |        | Axial Force P ..... | 36.0  | 4.50 | 162.0  |
|                             |       |       |        | Water Buoyancy .    | -1.3  | 1.50 | -2.0   |
| Arm of Vertical Resultant = | X-X   | Z-Z   | ft     | Rv =                | 42.4  | RM = | 191.0  |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  |                     |       |      |        |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

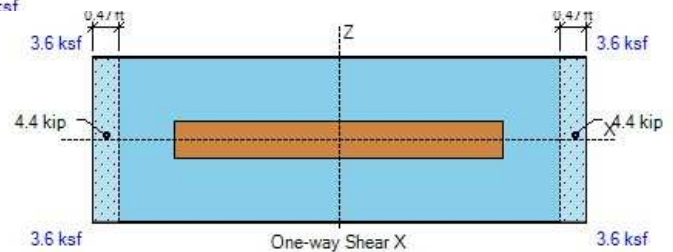
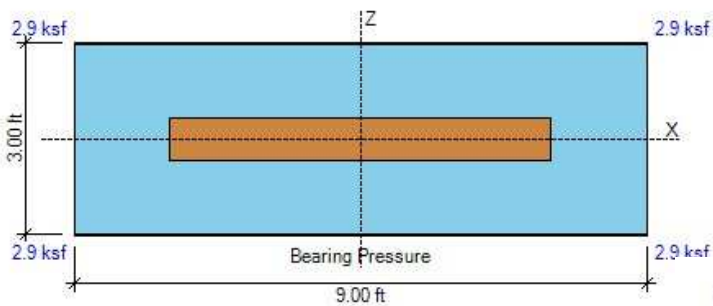
|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 19.1       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 7.0        | 20.9        |
| Horiz. Resisting Force            | 26.1       | 40.0        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

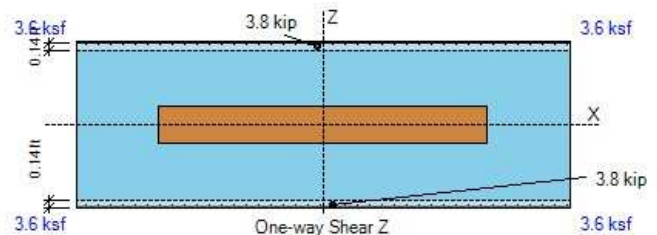
**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 3.2   | kip   |
| Soil Cover Weight .....    | 4.6   | kip   |
| Downward Force W .....     | 7.8   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK

**PUNCHING SHEAR (Comb: 1.4D)**

|                                            |             |     |
|--------------------------------------------|-------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.27        |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.55        |     |
| Punching Shear due to Axial ....           | 32.9        | psi |
| Punching Shear due to $M_x$ .....          | 0.0         | psi |
| Punching Shear due to $M_z$ .....          | 0.0         | psi |
| Punching Shear Stress $V_u$ .....          | 32.9        | psi |
| Effective Perimeter $b_o$ .....            | 124.4       | in  |
| Average Effective Depth $d$ .....          | 12.4        | in  |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |     |
| Column Aspect Ratio $\beta$ .....          | 9.00        |     |
| Punching Shear Strength $\phi V_c$ ..      | 100.4       | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.33        | OK  |





**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 4.4    | 4.4    | kip |
| One-way Shear $V_{uz}$ ...                 | 3.8    | 3.8    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 21.4   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 60.2   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.21   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | N.A. |         |
| Z-Bars Development Length Ratio ..        | N.A. |         |
| Min. Top Steel Area Ratio .....           | N.A. |         |
| Under-strength $\phi$ Factor .....        | 0.60 |         |
| Bending Strength - $\phi M_{nx}$ .....    | 63.1 | k-ft OK |
| Bending Strength - $\phi M_{nz}$ .....    | 21.0 | k-ft OK |
| Max. Bending Ratio - $M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....              | N.A. |         |

**- Bottom Bars -**

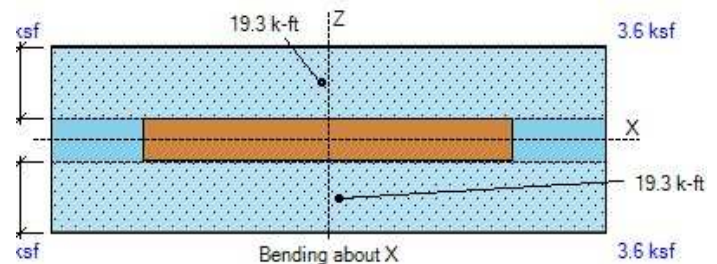
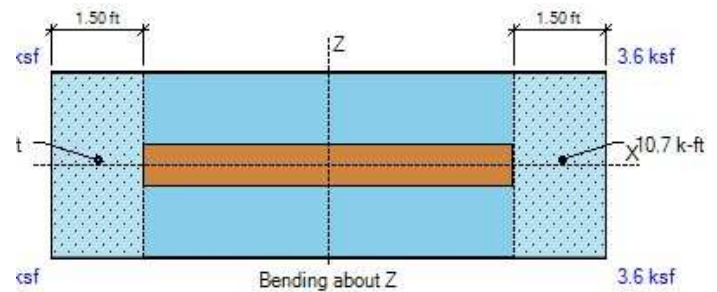
|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ... | 19.3   | 19.3   | k-ft |
| Bending Moment + $M_{uz}$ ... | 10.6   | 10.7   | k-ft |

*Use 4 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 11 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                           |       |         |
|-------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..        | 0.51  | OK      |
| Z-Bars Development Length Ratio ..        | 0.68  | OK      |
| Min. Bottom Steel Area Ratio .....        | 0.91  | OK      |
| Under-strength $\phi$ Factor .....        | 0.90  |         |
| Bending Strength + $\phi M_{nx}$ .....    | 120.9 | k-ft OK |
| Bending Strength + $\phi M_{nz}$ .....    | 68.5  | k-ft OK |
| Max. Bending Ratio + $M_u/\phi M_n$ ..... | 0.16  | OK      |
| Max. Bar Spacing Ratio .....              | 0.57  | OK      |

**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.1   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.6   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 3.7   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 5.76  | in <sup>2</sup> NG |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |



## DESIGN CODES

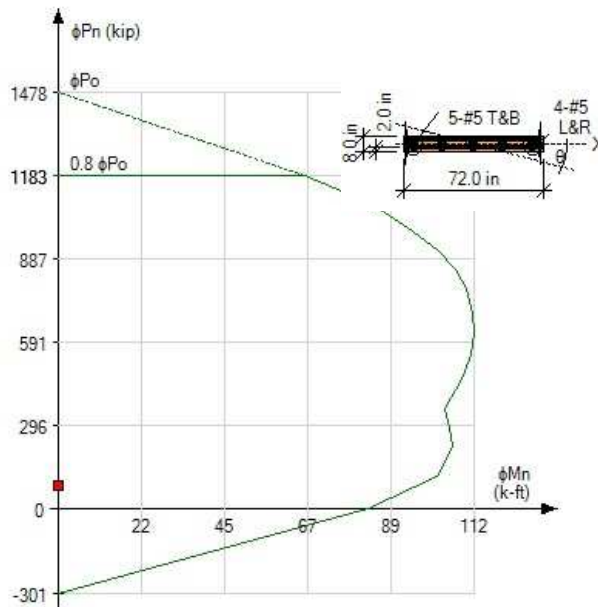
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

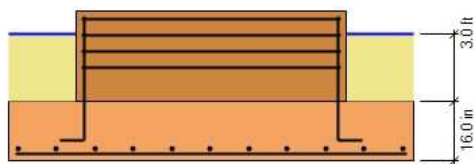
|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

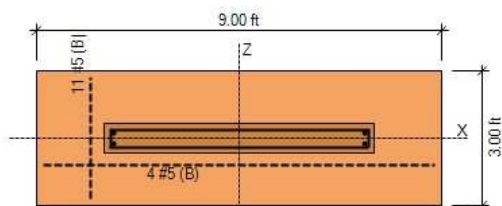
|                                    |        |      |
|------------------------------------|--------|------|
| Axial Load $P_u$ .....             | 84.8   | kip  |
| Bending Moment $M_u$ .....         | 0.0    | k-ft |
| Axial Strength $\phi P_n$ .....    | 1182.6 | kip  |
| Flexural Strength $\phi M_n$ ..... | 97.7   | k-ft |
| Biaxial Strength Ratio .....       | 0.07   | OK   |



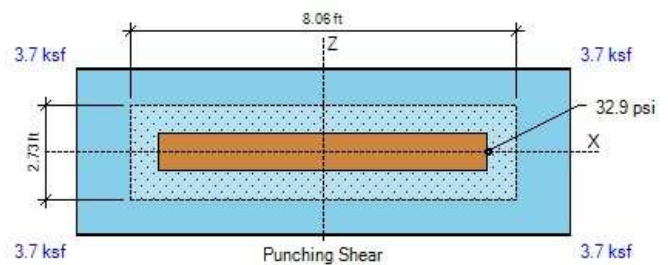
INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN



**GEOMETRY**

|                                |                 |                 |       |
|--------------------------------|-----------------|-----------------|-------|
| Column to Column Distance .... | 6.00            | ft              |       |
|                                | <u>Exterior</u> | <u>Interior</u> |       |
| Column Length (X) ....         | 16.0            | 16.0            | in    |
| Column Width (Z) .....         | 8.0             | 8.0             | in    |
| Edge Distance (X) .....        | 3.00            | 3.50            | ft OK |
| Footing Width (Z) .....        | 3.75            | 3.75            | ft    |
| Footing Thickness .....        | 16.0            | in              | OK    |
| Soil Cover .....               | 3.00            | ft              |       |
| Pedestal Height .....          | N. A.           |                 |       |

**SOIL PRESSURES (D+L)**

|                                         |                 |                 |     |
|-----------------------------------------|-----------------|-----------------|-----|
| Gross Allow. Soil Pressure .....        | 3.00            | ksf             |     |
| Overburden Pressure .....               | 0.46            | ksf             |     |
| Reaction Force .....                    | 133.7           | kip             |     |
| Eccentricity X = -0.10 ft , Z = 0.00 ft |                 |                 |     |
|                                         | <u>Exterior</u> | <u>Interior</u> |     |
| Bearing Pressure .....                  | 2.71            | 3.00            | ksf |
| Bearing Ratio .....                     | 0.90            | 1.00            | OK  |

**APPLIED LOADS**

|                        |             |             |              |             |             |                |      |
|------------------------|-------------|-------------|--------------|-------------|-------------|----------------|------|
| <u>- Exterior Col.</u> | <u>Dead</u> | <u>Live</u> | <u>RLive</u> | <u>Snow</u> | <u>Wind</u> | <u>Seismic</u> |      |
| Axial Force P .....    | 45.0        | 4.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Moment about X Mx      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Moment about Z Mz      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Shear Force Vx .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Shear Force Vz .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| <u>- Interior Col.</u> | <u>Dead</u> | <u>Live</u> | <u>RLive</u> | <u>Snow</u> | <u>Wind</u> | <u>Seismic</u> |      |
| Axial Force P .....    | 56.0        | 7.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Moment about X Mx      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Moment about Z Mz      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Shear Force Vx .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Shear Force Vz .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |

**MATERIALS**

|                          |                |                |     |
|--------------------------|----------------|----------------|-----|
|                          | <u>Columns</u> | <u>Footing</u> |     |
| Concrete f'c .....       | 4.0            | 3.0            | ksi |
| Reinf. Steel fy .....    | 60.0           | 60.0           | ksi |
| Soil Cover Density ..... | 120.0          | pcf            |     |

**SLIDING (comb: 0.6D+0.6W)**

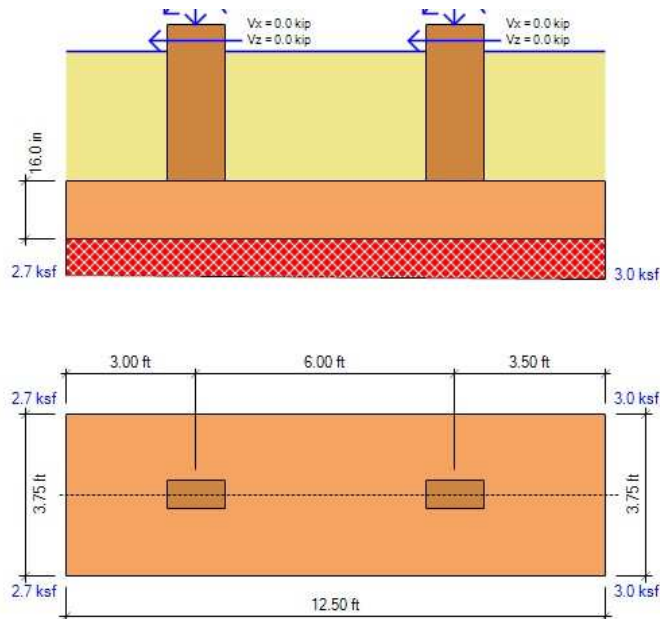
|                                   |            |                |
|-----------------------------------|------------|----------------|
| Footing-Soil Friction Coeff. .... | 0.45       |                |
| Friction Force at Base .....      | 33.1       | kip            |
| Passive Pressure Coeff. Kp ....   | 4.33       |                |
|                                   | <u>X-X</u> | <u>Z-Z</u>     |
| Passive Force @ Ftg ...           | 9.5        | 31.7 kip       |
| Horiz. Resisting Force            | 42.6       | 64.8 kip       |
| Horiz. Sliding Force .....        | 0.0        | 0.0 kip        |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 OK |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

### OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                    |       |       |        | RESISTING          |       |      |        |
|--------------------------------|-------|-------|--------|--------------------|-------|------|--------|
|                                | Force | Arm   | Moment |                    | Force | Arm  | Moment |
| - About X-X                    | kip   | ft    | k-ft   | - About X-X        | kip   | ft   | k-ft   |
| Ext. Moment Mx ...             | 0.0   | 0.0   | 0.0    | Soil Cover .....   | 9.7   | 1.88 | 18.3   |
| Ext. Shear Vz .....            | 0.0   | 1.33  | 0.0    | Footing Weight ... | 5.6   | 1.88 | 10.5   |
| Int. Moment Mx ....            | 0.0   | 0.0   | 0.0    | Ext. Column .....  | 0.0   | 1.88 | 0.0    |
| Int. Shear Vz .....            | 0.0   | 1.33  | 0.0    | Int. Column .....  | 0.0   | 1.88 | 0.0    |
| Passive Pressure               | 0.0   | 0.53  | 0.0    | Ext. Axial P ..... | 27.0  | 1.88 | 50.6   |
| Rh =                           | 0.0   | OTM = | 0.0    | Int. Axial P ..... | 33.6  | 1.88 | 63.0   |
| - About Z-Z                    |       |       |        | Water Buoyancy .   | -2.3  | 1.88 | -4.4   |
| Ext. Moment Mz ...             | 0.0   | 0.0   | 0.0    | Rv =               | 73.6  | RM = | 138.0  |
| Ext. Shear Vx .....            | 0.0   | 1.33  | 0.0    | - About Z-Z        |       |      |        |
| Int. Moment Mz ....            | 0.0   | 0.0   | 0.0    | Soil Cover .....   | 9.7   | 6.25 | 60.9   |
| Int. Shear Vx .....            | 0.0   | 1.33  | 0.0    | Footing Weight ... | 5.6   | 6.25 | 35.2   |
| Passive Pressure               | 0.0   | 0.53  | 0.0    | Ext. Column .....  | 0.0   | 9.50 | 0.0    |
| Rh =                           | 0.0   | OTM = | 0.0    | Int. Column .....  | 0.0   | 3.50 | 0.0    |
|                                |       | X-X   | Z-Z    | Ext. Axial P ..... | 27.0  | 9.50 | 256.5  |
| Arm of Vertical Resultant .... | 1.88  | 6.19  | ft     | Int. Axial P ..... | 33.6  | 3.50 | 117.6  |
| Overturning Safety Factor ..   | 99.99 | 99.99 | > 1.5  | Water Buoyancy .   | -2.3  | 6.25 | -14.6  |
|                                |       |       | OK     | Rv =               | 73.6  | RM = | 455.5  |



**FOOTING AT EXTERIOR COL.****- One-way Shear (Comb: 1.2D+1.6L+0.5S)**Under-strength  $\phi$  Factor ..... 0.75**- Side + Side**One-way Shear  $V_{ux}$  ... 13.6 10.4 kipShear Strength  $\phi V_{cx}$  .. 19.4 27.9 kipOne-way Shear  $V_{uz}$  ... 5.0 kipShear Strength  $\phi V_{cz}$  .. 23.1 kipMax. One-way Shear Ratio  $V_u/\phi V_c$  .. 0.70 OK**- Punching Shear (Comb: 1.4D)**Unbalanced Moment Factor  $\gamma_{vx}$  ... 0.44

Punching Shear due to Axial .... 42.5 psi

Punching Shear due to  $M_z$  ..... 0.0 psiPunching Shear Stress  $V_u$  ..... 42.5 psiEffective Perimeter  $b_o$  ..... 97.5 inAverage Effective Depth  $d$  ..... 12.4 inPunching Shear Strength  $\phi V_c$  .. 164.3 psiPunching Shear Ratio  $V_u/\phi V_c$  ..... 0.26 OK**- Transv. Flexure (Comb: 1.4D)**Under-strength  $\phi$  Factor ..... 0.90

Footing Effective Length ..... 3.45 ft

*No Top Reinf. Use Plain Concrete Strength**Use 4 #5 Bars Parallel to Z (Bot) ,  $d = 12.7$  in*

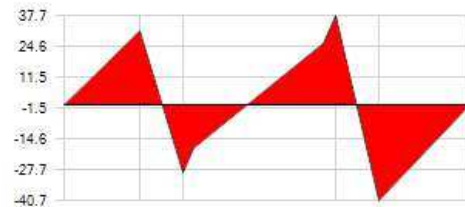
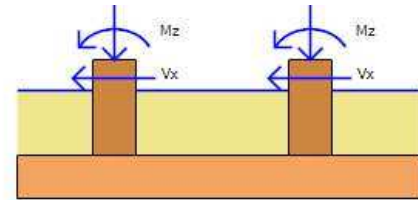
Bottom Steel Min. Area Ratio ..... 0.96 OK

**Top Bot**Bending Moment  $M_{ux}$  .. 0.0 12.1 k-ftBending Strength  $\phi M_{nx}$  24.2 68.8 k-ftMax. Bending Ratio  $M_{ux}/\phi M_{nx}$  ..... 0.18 OK

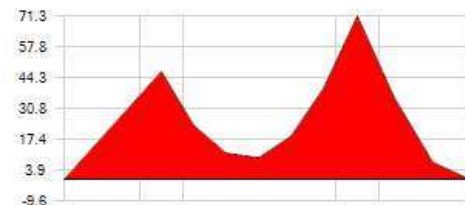
Top Z-Bars Develop. Length Ratio . N.A. OK

Bot Z-Bars Develop. Length Ratio .. 0.48 OK

Center Z-Bars S&amp;T min Ratio ..... 0.93 OK



SHEAR DIAGRAM (kip)



MOMENT DIAGRAM (k-ft)

**FOOTING AT INTERIOR COL.****- One-way Shear (Comb: 1.2D+1.6L+0.5S)**

|                                            |               |               |     |
|--------------------------------------------|---------------|---------------|-----|
| Under-strength $\phi$ Factor               | .....         | 0.75          |     |
|                                            | <b>- Side</b> | <b>+ Side</b> |     |
| One-way Shear $V_{ux}$ ..                  | 18.4          | 21.2          | kip |
| Shear Strength $\phi V_{cx}$ ..            | 19.4          | 27.9          | kip |
| One-way Shear $V_{uz}$ ..                  |               | 5.4           | kip |
| Shear Strength $\phi V_{cz}$ ..            |               | 23.1          | kip |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.95          |               | OK  |

**- Punching Shear (Comb: 1.4D)**

|                                           |       |  |     |
|-------------------------------------------|-------|--|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ .. | 0.44  |  |     |
| Punching Shear due to Axial ....          | 54.6  |  | psi |
| Punching Shear due to $M_z$ .....         | 0.0   |  | psi |
| Punching Shear Stress $V_u$ .....         | 54.6  |  | psi |
| Effective Perimeter $b_o$ .....           | 97.5  |  | in  |
| Average Effective Depth $d$ .....         | 12.4  |  | in  |
| Punching Shear Strength $\phi V_c$ ..     | 164.3 |  | psi |
| Punching Shear Ratio $V_u/\phi V_c$ ..... | 0.33  |  | OK  |

**- Transv. Flexure (Comb: 1.4D)**

|                                                                     |       |      |    |
|---------------------------------------------------------------------|-------|------|----|
| Under-strength $\phi$ Factor                                        | ..... | 0.90 |    |
| Footing Effective Length                                            | ..... | 3.45 | ft |
| <i>No Top Reinf. Use Plain Concrete Strength</i>                    |       |      |    |
| <i>Use 4 #5 Bars Parallel to Z (Bot) , <math>d = 12.7</math> in</i> |       |      |    |
| Bottom Steel Min. Area Ratio                                        | ..... | 0.96 | OK |

|                                               |            |            |      |
|-----------------------------------------------|------------|------------|------|
|                                               | <b>Top</b> | <b>Bot</b> |      |
| Bending Moment $M_{ux}$ ..                    | 0.0        | 12.6       | k-ft |
| Bending Strength $\phi M_{nx}$                | 24.2       | 68.8       | k-ft |
| Max. Bending Ratio $M_{ux}/\phi M_{nx}$ ..... | 0.18       |            | OK   |
| Top Z-Bars Develop. Length Ratio .            | N.A.       |            | OK   |
| Bot Z-Bars Develop. Length Ratio ..           | 0.48       |            | OK   |

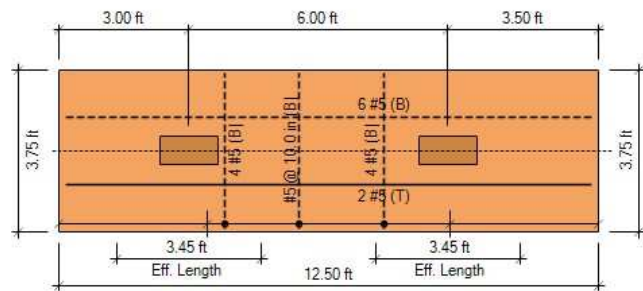
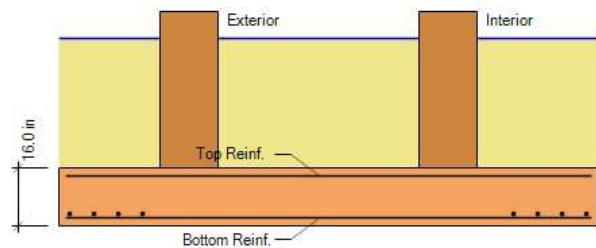
**LONGITUDINAL REINF.****- Long. Flexure (Comb: 1.2D+1.6L+0.5Lr)**

*Use 2 #5 Bars Parallel to X (Top) ,  $d = 12.9$  in*  
*Use 6 #5 Bars Parallel to X (Bot) ,  $d = 12.1$  in*

|                                               |            |            |      |
|-----------------------------------------------|------------|------------|------|
|                                               | <b>Top</b> | <b>Bot</b> |      |
| Min. Steel Area Ratio ...                     | 0.36       | 0.97       | OK   |
| Bending Moment $M_{uz}$ ..                    | 9.6        | 71.3       | k-ft |
| Bending Strength $\phi M_{nz}$                | 35.6       | 96.9       | k-ft |
| Max. Bending Ratio $M_{uz}/\phi M_{nz}$ ..... | 0.74       |            | OK   |
| Ext. Bot X-Bars Dev. Length Ratio .           | 0.19       |            | OK   |
| Int. Bot X-Bars Dev. Length Ratio ...         | 0.16       |            | OK   |

**LOAD TRANSFER (Comb: 1.2D+1.6L+0.5S)**Bearing Under-strength  $\phi$  Factor ..... 0.65

|                                  |             |             |                    |
|----------------------------------|-------------|-------------|--------------------|
|                                  | <b>Ext.</b> | <b>Int.</b> |                    |
| Compressive Stress $P_u$         | 0.5         | 0.6         | ksi                |
| Column Bearing $\phi P_n$ .....  | 3.8         | 3.8         | ksi OK             |
| Footing Bearing $\phi P_n$ ..... | 4.9         | 4.9         | ksi OK             |
| Shear Force $V_u$ .....          | 0.0         | 0.0         | kip                |
| Shear Friction $\phi V_n$ .....  | 142.6       | 142.6       | kip OK             |
| Dowel Steel Area $A_s$ .....     | 5.28        | 5.28        | in <sup>2</sup>    |
| Min. Steel Area $A_{s \min}$ ..  | 1.28        | 1.28        | in <sup>2</sup> OK |
| Dev. Length Ratio at Col.        | 0.50        | 0.51        | OK                 |
| Dev. Length Ratio at Ftg.        | 1.27        | 1.27        | NG                 |

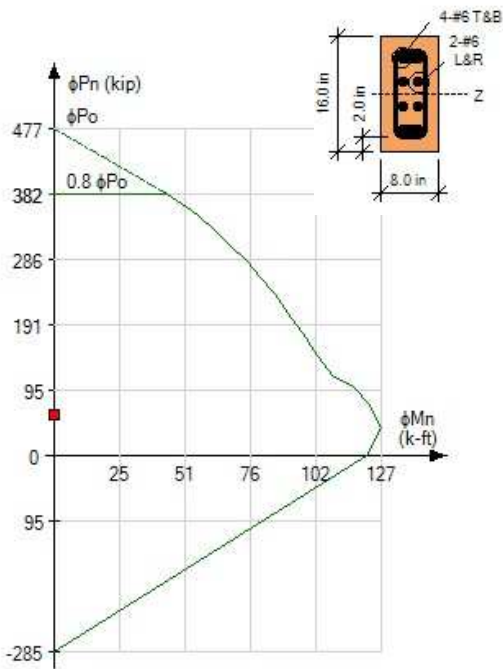
**UPLIFT CALCS (Comb: 0.6D+0.6W)**

|                            |       |          |
|----------------------------|-------|----------|
| Uplift Force $P$ .....     | 0.0   | kip      |
| Pedestals Selfweight ..... | 0.0   | kip      |
| Footing Selfweight .....   | 5.6   | kip      |
| Soil Cover Weight .....    | 9.7   | kip      |
| Downward Force $W$ .....   | 15.4  | kip      |
| Uplift Safety Factor ..... | 99.99 | > 1.0 OK |



**EXT. COLUMN (Comb: 1.2D+1.6L+0.5Lr)***Use 12-#6 Longitudinal Bars, Use Ties #4*

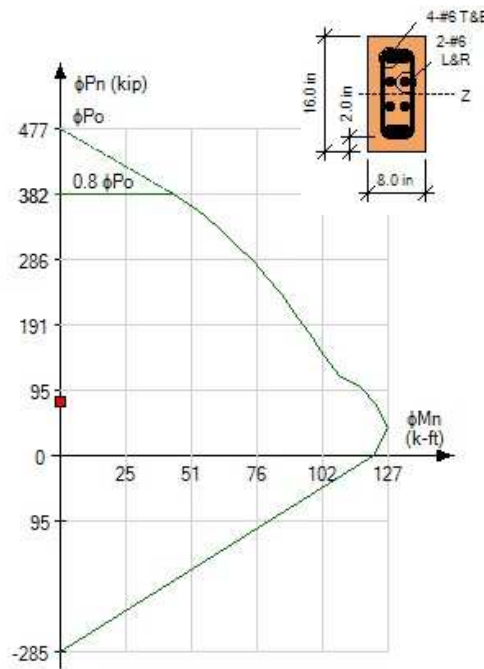
|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 60.4  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 380.5 | kip  |
| Flexural Strength $\phi M_n$ ..... | 125.6 | k-ft |
| Biaxial Strength Ratio .....       | 0.16  | OK   |



**EXT. INTERACTION DIAGRAM**  
Controlling Load Comb: 1.2D+1.6L+0.5Lr

**INT. COLUMN (Comb: 1.2D+1.6L+0.5Lr)***Use 12-#6 Longitudinal Bars, Use Ties #4*

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 78.4  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 380.5 | kip  |
| Flexural Strength $\phi M_n$ ..... | 121.0 | k-ft |
| Biaxial Strength Ratio .....       | 0.21  | OK   |



**INT. INTERACTION DIAGRAM**  
Controlling Load Comb: 1.2D+1.6L+0.5Lr

## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 4.00  | ft |    |
| Footing Width (Z-dir) .....  | 4.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 8.0   | in |    |
| Column Width (Z-dir) .....   | 24.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 3.0   | ksf |    |
| Bearing Pressure Ratio .....       | 0.99  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

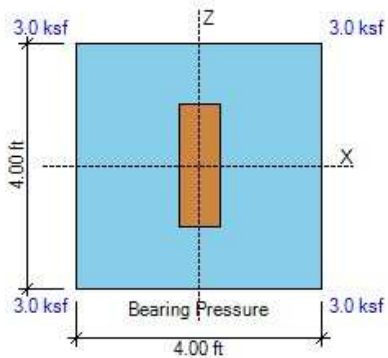
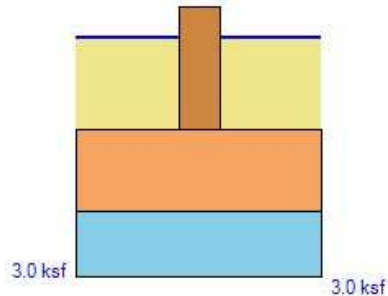
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 35.0 | 6.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 1.9   | 2.00 | 3.8    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.00 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 2.9   | 2.00 | 5.8    |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 21.0  | 2.00 | 42.0   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.8  | 2.00 | -1.6   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 25.0  | RM = | 50.1   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 1.9   | 2.00 | 3.8    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 2.00 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 2.9   | 2.00 | 5.8    |
|                             |       |       |        | Axial Force P ..... | 21.0  | 2.00 | 42.0   |
|                             |       |       |        | Water Buoyancy .    | -0.8  | 2.00 | -1.6   |
| Arm of Vertical Resultant = |       |       |        | Rv =                | 25.0  | RM = | 50.1   |
| Overturning Safety Factor = |       |       |        |                     |       |      |        |

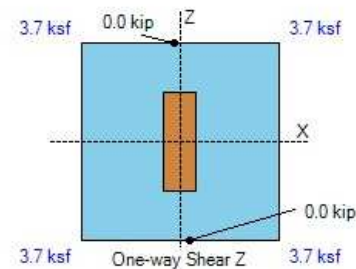
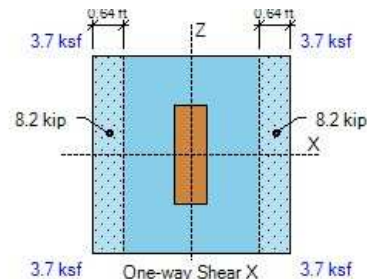
OK

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 11.3       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 9.3        | 9.3         |
| Horiz. Resisting Force            | 20.6       | 20.6        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 1.9   | kip   |
| Soil Cover Weight .....    | 2.9   | kip   |
| Downward Force W .....     | 4.8   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |           |     |
|--------------------------------------------|-----------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.49      |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.32      |     |
| Punching Shear due to Axial ....           | 27.3      | psi |
| Punching Shear due to $M_x$ .....          | 0.0       | psi |
| Punching Shear due to $M_z$ .....          | 0.0       | psi |
| Punching Shear Stress $V_u$ .....          | 27.3      | psi |
| Effective Perimeter $b_o$ .....            | 104.8     | in  |
| Average Effective Depth $d$ .....          | 12.4      | in  |
| Column Location Factor $\alpha_s$ ....     | 30 (Edge) |     |
| Column Aspect Ratio $\beta$ .....          | 3.00      |     |
| Punching Shear Strength $\phi V_c$ ..      | 136.9     | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.20      | OK  |

**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 8.2    | 8.2    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$ ..... | 27.9   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$ ..... | 26.9   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.29   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 28.0 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 28.0 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

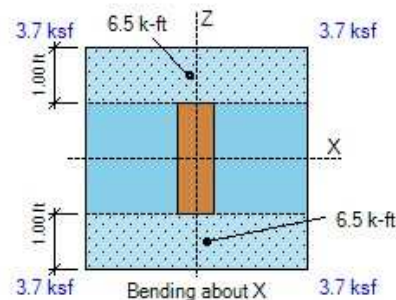
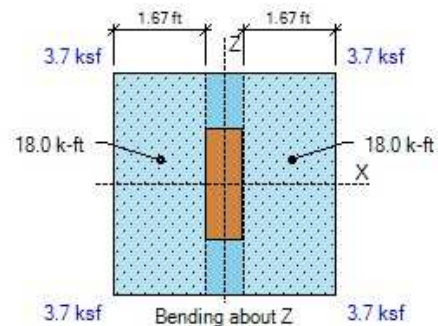
|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 6.5    | 6.5    | k-ft |
| Bending Moment $+M_{uz}$ ... | 18.0   | 18.0   | k-ft |

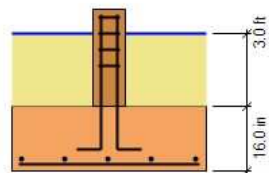
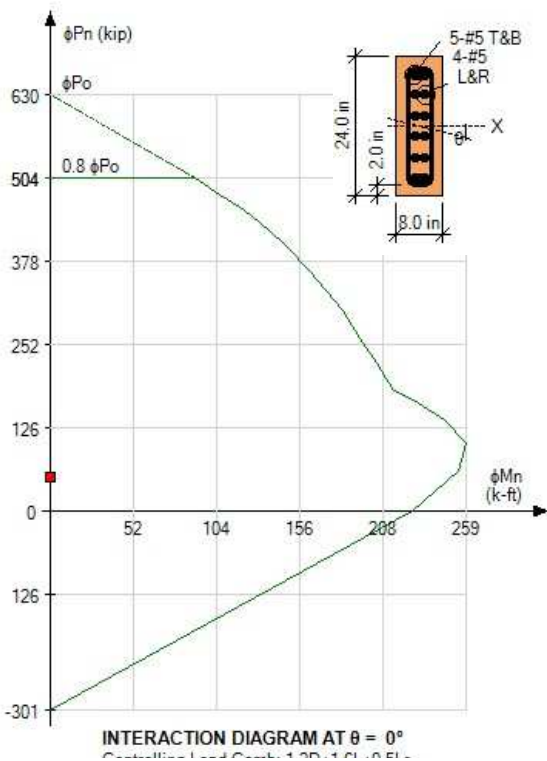
*Use 5 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 5 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | 0.45 | OK      |
| Z-Bars Development Length Ratio ..       | 0.83 | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.89 | OK      |
| Under-strength $\phi$ Factor .....       | 0.90 |         |
| Bending Strength $+\phi M_{nx}$ .....    | 81.5 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 85.8 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.21 | OK      |
| Max. Bar Spacing Ratio .....             | 0.58 | OK      |

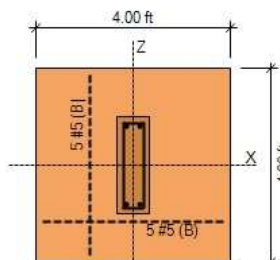
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.3   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.3   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.4   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 1.92  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |





ELEVATION



PLAN

## DESIGN CODES

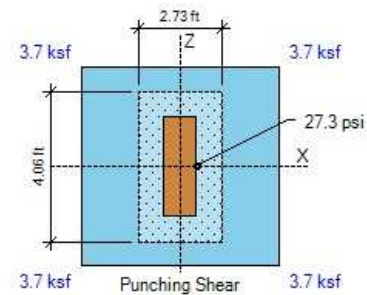
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 51.6  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 503.1 | kip  |
| Flexural Strength $\phi M_n$ ..... | 250.0 | k-ft |
| Biaxial Strength Ratio .....       | 0.10  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 10.00 | ft |    |
| Footing Width (Z-dir) .....  | 4.60  | ft |    |
| Footing Thickness .....      | 18.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 38.0  | in |    |
| Column Width (Z-dir) .....   | 12.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 3.0   | ksf |    |
| Bearing Pressure Ratio .....       | 0.99  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

## APPLIED LOADS

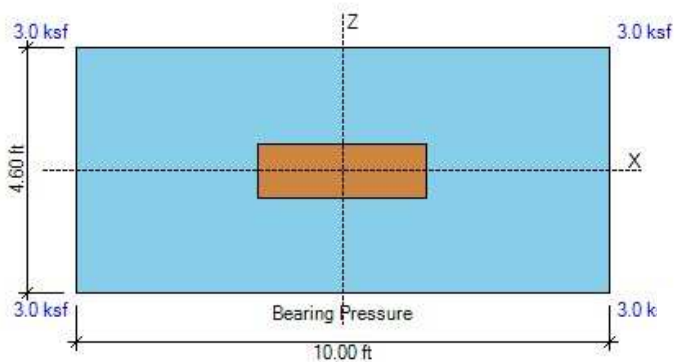
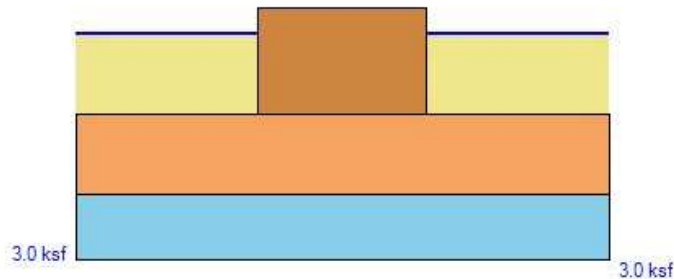
|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 93.0 | 24.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 6.2   | 2.30 | 14.3   |
| Shear Force Vz ....         | 0.0   | 1.50  | 0.0    | Column Weight ..    | 0.0   | 2.30 | 0.0    |
| Passive Pressure            | 0.0   | 0.60  | 0.0    | Soil Cover .....    | 8.5   | 2.30 | 19.5   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 55.8  | 2.30 | 128.3  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -2.6  | 2.30 | -5.9   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 67.9  | RM = | 156.2  |
| Shear Force Vx ....         | 0.0   | 1.50  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.60  | 0.0    | Footing Weight ..   | 6.2   | 5.00 | 31.1   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 5.00 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 8.5   | 5.00 | 42.4   |
|                             |       |       |        | Axial Force P ..... | 55.8  | 5.00 | 279.0  |
|                             |       |       |        | Water Buoyancy .    | -2.6  | 2.30 | -5.9   |
| Arm of Vertical Resultant = | X-X   | Z-Z   | ft     | Rv =                | 67.9  | RM = | 339.5  |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  |                     |       |      |        |

OK



**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

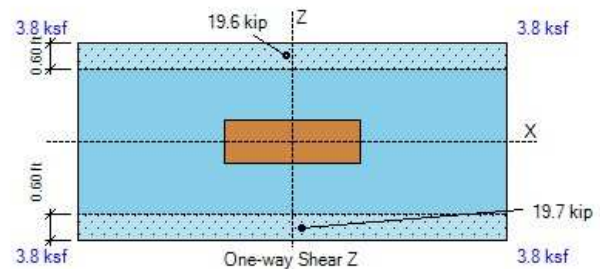
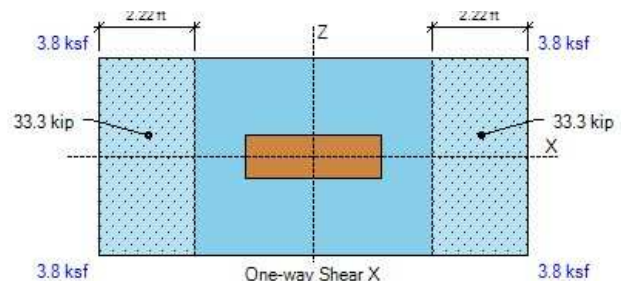
|                                            |               |
|--------------------------------------------|---------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.32          |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.48          |
| Punching Shear due to Axial ....           | 52.4 psi      |
| Punching Shear due to $M_x$ .....          | 0.0 psi       |
| Punching Shear due to $M_z$ .....          | 0.0 psi       |
| Punching Shear Stress $V_u$ .....          | 52.4 psi      |
| Effective Perimeter $b_o$ .....            | 157.5 in      |
| Average Effective Depth $d$ .....          | 14.4 in       |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |
| Column Aspect Ratio $\beta$ .....          | 3.17          |
| Punching Shear Strength $\phi V_c$ ..      | 134.0 psi     |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.39 OK       |

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |                           |
|-----------------------------------|---------------------------|
| Footing-Soil Friction Coeff. .... | 0.45                      |
| Friction Force at Base .....      | 30.6 kip                  |
| Passive Pressure Coeff. Kp ....   | 4.33                      |
|                                   | <b>X-X</b> <b>Z-Z</b>     |
| Passive Force @ Ftg ...           | 12.3      26.8 kip        |
| Horiz. Resisting Force .....      | 42.9      57.3 kip        |
| Horiz. Sliding Force .....        | 0.0      0.0 kip          |
| Sliding Safety Factor ...         | 99.99      99.99 > 1.5 OK |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |                |
|----------------------------|----------------|
| Uplift Force P .....       | 0.0 kip        |
| Pedestal Selfweight .....  | 0.0 kip        |
| Footing Selfweight .....   | 6.2 kip        |
| Soil Cover Weight .....    | 8.5 kip        |
| Downward Force W .....     | 14.7 kip       |
| Uplift Safety Factor ..... | 99.99 > 1.0 OK |



**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 33.3   | 33.3   | kip |
| One-way Shear $V_{uz}$ ...                 | 19.7   | 19.6   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 35.9   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 73.7   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.93   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing*

*Use Plain Concrete Flexural Strength at Top*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | N.A. |         |
| Z-Bars Development Length Ratio ..        | N.A. |         |
| Min. Top Steel Area Ratio .....           | N.A. |         |
| Under-strength $\phi$ Factor .....        | 0.60 |         |
| Bending Strength - $\phi M_{nx}$ .....    | 88.7 | k-ft OK |
| Bending Strength - $\phi M_{nz}$ .....    | 40.8 | k-ft OK |
| Max. Bending Ratio - $M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....              | N.A. |         |

**- Bottom Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ... | 52.9   | 53.0   | k-ft |
| Bending Moment + $M_{uz}$ ... | 87.6   | 87.7   | k-ft |

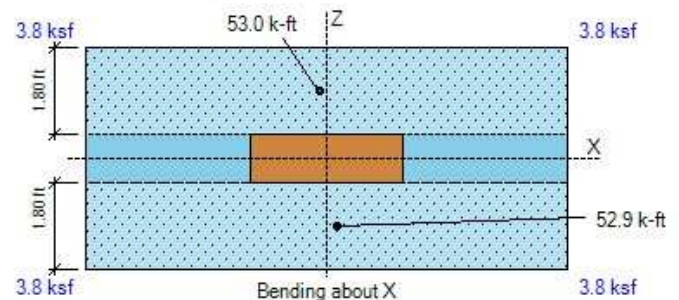
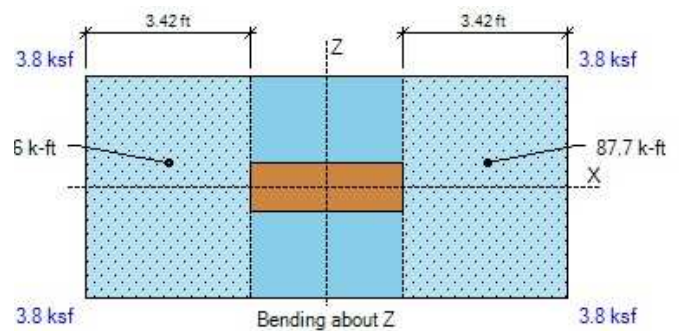
*Use 6 #5 Bars Parallel to X (Bot) ,  $d = 14.7$  in*

*Use 12 #5 Bars Parallel to Z (Bot) ,  $d = 14.1$  in*

|                                           |       |         |
|-------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..        | 0.20  | OK      |
| Z-Bars Development Length Ratio ..        | 0.41  | OK      |
| Min. Bottom Steel Area Ratio .....        | 1.05  | NG      |
| Under-strength $\phi$ Factor .....        | 0.90  |         |
| Bending Strength + $\phi M_{nx}$ .....    | 168.6 | k-ft OK |
| Bending Strength + $\phi M_{nz}$ .....    | 119.6 | k-ft OK |
| Max. Bending Ratio + $M_u/\phi M_n$ ..... | 0.73  | OK      |
| Max. Bar Spacing Ratio .....              | 0.58  | OK      |

**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.3   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.7   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 3.8   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 4.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.84  | OK                 |



## DESIGN CODES

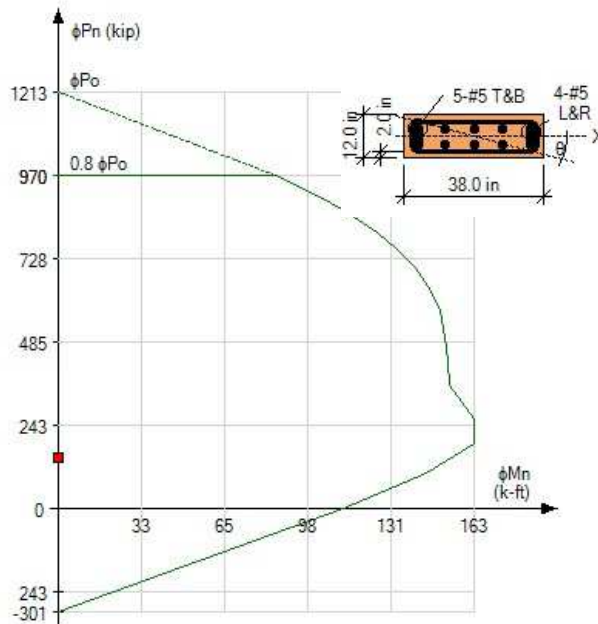
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

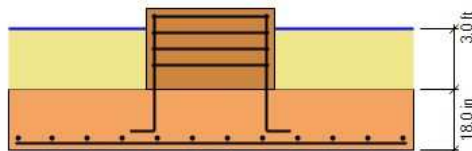
|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

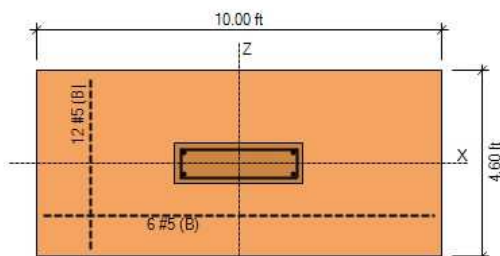
|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 150.0 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 970.4 | kip  |
| Flexural Strength $\phi M_n$ ..... | 155.8 | k-ft |
| Biaxial Strength Ratio .....       | 0.15  | OK   |



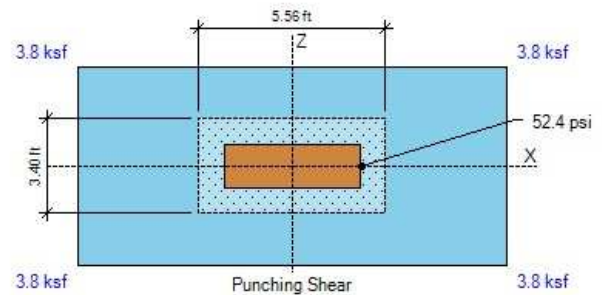
INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 5.75  | ft |    |
| Footing Width (Z-dir) .....  | 5.75  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 16.0  | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.97  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

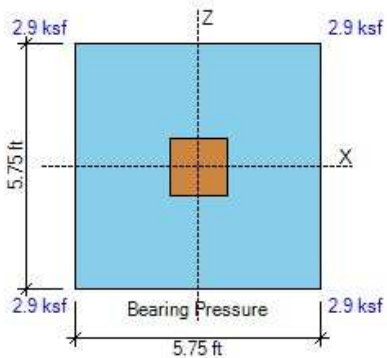
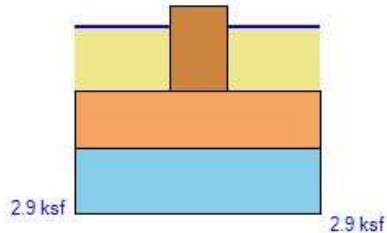
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 60.0 | 22.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 4.0   | 2.88 | 11.4   |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.88 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 6.2   | 2.88 | 17.8   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 36.0  | 2.88 | 103.5  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.7  | 2.88 | -4.7   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 44.5  | RM = | 128.0  |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 4.0   | 2.88 | 11.4   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 2.88 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 6.2   | 2.88 | 17.8   |
|                             |       |       |        | Axial Force P ..... | 36.0  | 2.88 | 103.5  |
|                             |       |       |        | Water Buoyancy .    | -1.7  | 2.88 | -4.7   |
| Arm of Vertical Resultant = | X-X   | Z-Z   | ft     | Rv =                | 44.5  | RM = | 128.0  |
| Overturing Safety Factor =  | 99.99 | 99.99 | > 1.5  |                     |       |      |        |

OK

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

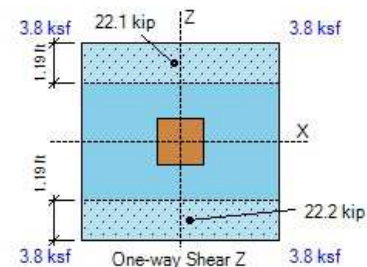
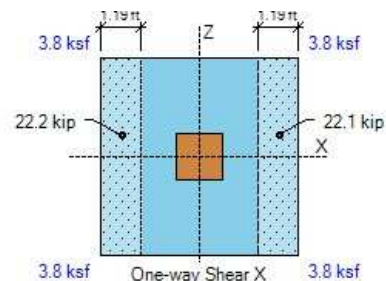
|                                            |               |
|--------------------------------------------|---------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.40          |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.40          |
| Punching Shear due to Axial ....           | 64.5 psi      |
| Punching Shear due to $M_x$ .....          | 0.0 psi       |
| Punching Shear due to $M_z$ .....          | 0.0 psi       |
| Punching Shear Stress $V_u$ .....          | 64.5 psi      |
| Effective Perimeter $b_o$ .....            | 113.0 in      |
| Average Effective Depth $d$ .....          | 12.3 in       |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |
| Column Aspect Ratio $\beta$ .....          | 1.00          |
| Punching Shear Strength $\phi V_c$ ..      | 164.3 psi     |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.39 OK       |

**SLIDING (combDlg. 0.6D+0.6W)**

|                                    |                       |
|------------------------------------|-----------------------|
| Footing-Soil Friction Coeff. ....  | 0.45                  |
| Friction Force at Base .....       | 20.0 kip              |
| Passive Pressure Coeff. $K_p$ .... | 4.33                  |
|                                    | <b>X-X</b> <b>Z-Z</b> |
| Passive Force @ Ftg ...            | 13.4 13.4 kip         |
| Horiz. Resisting Force             | 33.4 33.4 kip         |
| Horiz. Sliding Force .....         | 0.0 0.0 kip           |
| Sliding Safety Factor ...          | 99.99 99.99 > 1.5 OK  |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |                |
|----------------------------|----------------|
| Uplift Force $P$ .....     | 0.0 kip        |
| Pedestal Selfweight .....  | 0.0 kip        |
| Footing Selfweight .....   | 4.0 kip        |
| Soil Cover Weight .....    | 6.2 kip        |
| Downward Force $W$ .....   | 10.2 kip       |
| Uplift Safety Factor ..... | 99.99 > 1.0 OK |



**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 22.2   | 22.1   | kip |
| One-way Shear $V_{uz}$ ...                 | 22.2   | 22.1   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$ ..... | 39.8   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$ ..... | 38.2   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.58   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 40.3 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 40.3 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

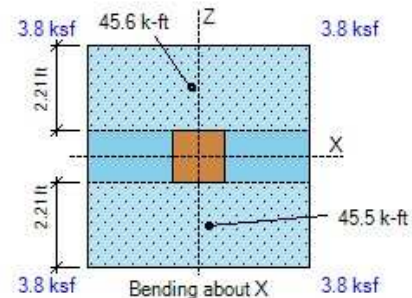
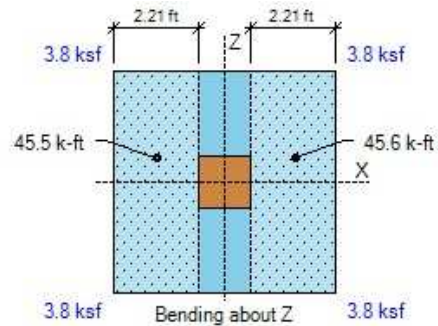
|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 45.5   | 45.6   | k-ft |
| Bending Moment $+M_{uz}$ ... | 45.5   | 45.6   | k-ft |

*Use 5 #6 Bars Parallel to X (Bot) ,  $d = 12.6$  in**Use 5 #6 Bars Parallel to Z (Bot) ,  $d = 11.9$  in*

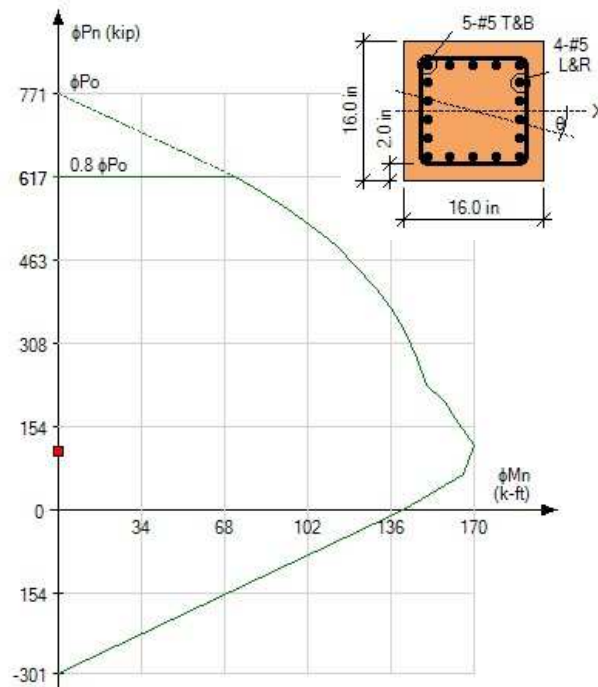
|                                          |       |         |
|------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..       | 0.43  | OK      |
| Z-Bars Development Length Ratio ..       | 0.43  | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.90  | OK      |
| Under-strength $\phi$ Factor .....       | 0.90  |         |
| Bending Strength $+\phi M_{nx}$ .....    | 113.8 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 121.3 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.40  | OK      |
| Max. Bar Spacing Ratio .....             | 0.88  | OK      |

**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

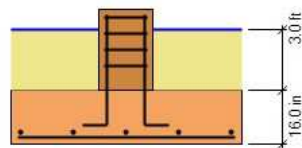
|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.4   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |



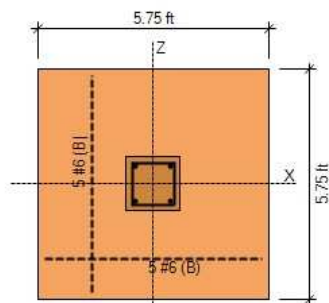




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN

## DESIGN CODES

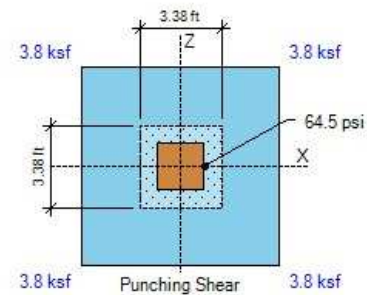
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 107.2 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 614.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 173.1 | k-ft |
| Biaxial Strength Ratio .....       | 0.17  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 5.50  | ft |    |
| Footing Width (Z-dir) .....  | 12.00 | ft |    |
| Footing Thickness .....      | 20.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 8.0   | in |    |
| Column Width (Z-dir) .....   | 66.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 3.0   | ksf |    |
| Bearing Pressure Ratio .....       | 0.99  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

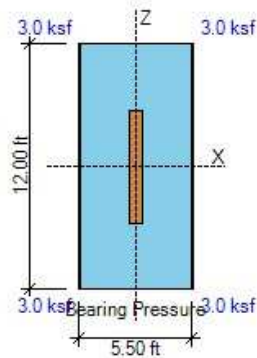
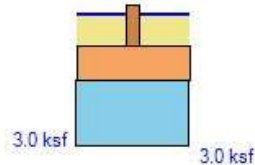
## APPLIED LOADS

|                      | Dead  | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|-------|------|-------|------|------|---------|------|
| Axial Force P .....  | 127.0 | 39.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 9.9   | 6.00 | 59.4   |
| Shear Force Vz ....         | 0.0   | 1.67  | 0.0    | Column Weight ..    | 0.0   | 6.00 | 0.0    |
| Passive Pressure            | 0.0   | 0.67  | 0.0    | Soil Cover .....    | 12.3  | 6.00 | 74.1   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 76.2  | 6.00 | 457.2  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -4.1  | 6.00 | -24.7  |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 94.3  | RM = | 565.9  |
| Shear Force Vx ....         | 0.0   | 1.67  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.67  | 0.0    | Footing Weight ..   | 9.9   | 2.75 | 27.2   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 2.75 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 12.3  | 2.75 | 33.9   |
|                             |       |       |        | Axial Force P ..... | 76.2  | 2.75 | 209.6  |
|                             |       |       |        | Water Buoyancy .    | -4.1  | 6.00 | -24.7  |
| Arm of Vertical Resultant = | X-X   | Z-Z   |        | Rv =                | 94.3  | RM = | 259.4  |
| Overturing Safety Factor =  | 6.00  | 2.75  | ft     |                     |       |      |        |
|                             | 99.99 | 99.99 | > 1.5  |                     |       |      |        |

OK

**SLIDING (combDlg. 0.6D+0.6W)**

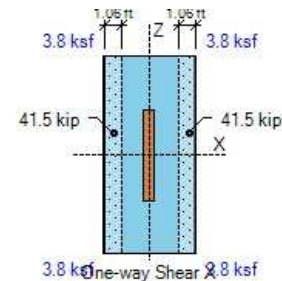
|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 42.4       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 36.5       | 16.7        |
| Horiz. Resisting Force            | 78.9       | 59.2        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

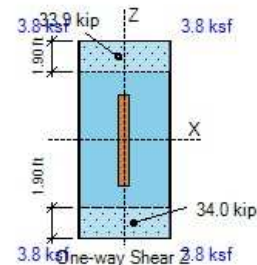
**UPLIFT (Comb: 0.6D+0.6W)**

|                            |             |     |
|----------------------------|-------------|-----|
| Uplift Force P .....       | 0.0         | kip |
| Pedestal Selfweight .....  | 0.0         | kip |
| Footing Selfweight .....   | 9.9         | kip |
| Soil Cover Weight .....    | 12.3        | kip |
| Downward Force W .....     | 22.2        | kip |
| Uplift Safety Factor ..... | 99.99 > 1.0 |     |

OK



One-way Shear



One-way Shear

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |               |     |
|--------------------------------------------|---------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.55          |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.27          |     |
| Punching Shear due to Axial ....           | 49.0          | psi |
| Punching Shear due to $M_x$ .....          | 0.0           | psi |
| Punching Shear due to $M_z$ .....          | 0.0           | psi |
| Punching Shear Stress $V_u$ .....          | 49.0          | psi |
| Effective Perimeter $b_o$ .....            | 213.0         | in  |
| Average Effective Depth $d$ .....          | 16.3          | in  |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |     |
| Column Aspect Ratio $\beta$ .....          | 8.25          |     |
| Punching Shear Strength $\phi V_c$ ..      | 102.1         | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.48          | OK  |

**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 41.5   | 41.5   | kip |
| One-way Shear $V_{uz}$ ...                 | 34.0   | 33.9   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 104.5  | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 47.8   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.71   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                          |       |         |
|------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..       | N.A.  |         |
| Z-Bars Development Length Ratio ..       | N.A.  |         |
| Min. Top Steel Area Ratio .....          | N.A.  |         |
| Under-strength $\phi$ Factor .....       | 0.60  |         |
| Bending Strength $-\phi M_{nx}$ .....    | 60.2  | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 131.5 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00  | OK      |
| Max. Bar Spacing Ratio .....             | N.A.  |         |

**- Bottom Bars -**

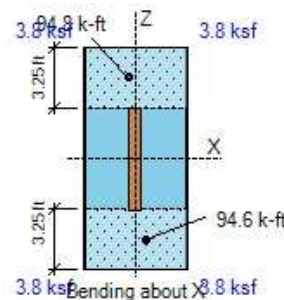
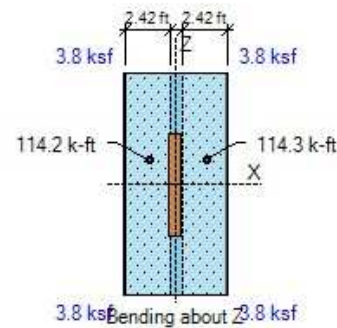
|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 94.6   | 94.8   | k-ft |
| Bending Moment $+M_{uz}$ ... | 114.2  | 114.3  | k-ft |

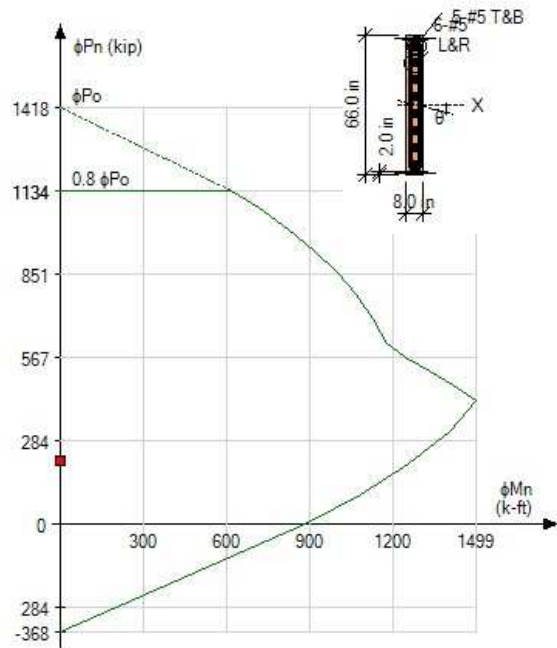
*Use 12 #6 Bars Parallel to X (Bot) ,  $d = 16.6$  in**Use 6 #6 Bars Parallel to Z (Bot) ,  $d = 15.9$  in*

|                                          |       |         |
|------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..       | 0.39  | OK      |
| Z-Bars Development Length Ratio ..       | 0.28  | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.98  | OK      |
| Under-strength $\phi$ Factor .....       | 0.90  |         |
| Bending Strength $+\phi M_{nx}$ .....    | 183.0 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 282.6 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.52  | OK      |
| Max. Bar Spacing Ratio .....             | 0.70  | OK      |

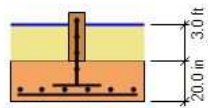
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 22 #5 x 3.00 ft hooked dowels , <math>A_s = 6.82</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.4   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.7   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 3.8   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 184.1 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 5.28  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.74  | OK                 |

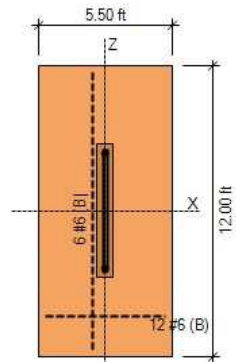




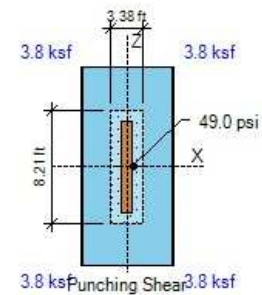
INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



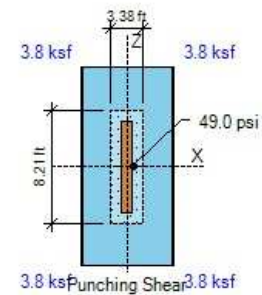
ELEVATION



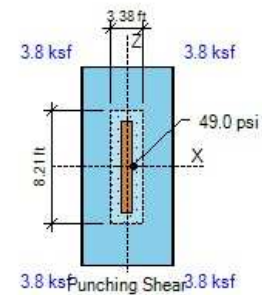
PLAN



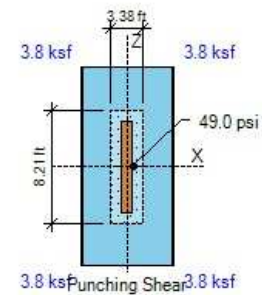
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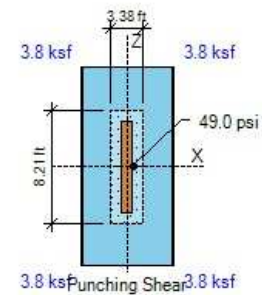
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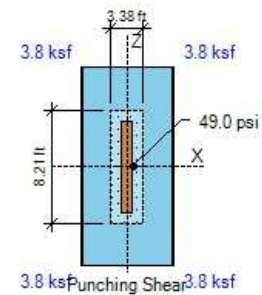
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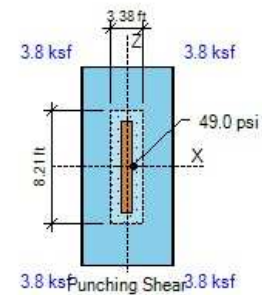
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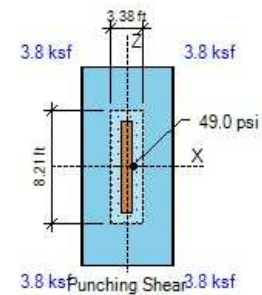
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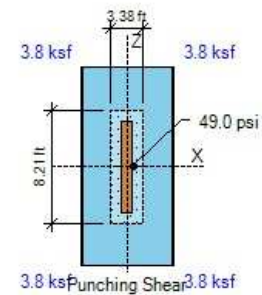
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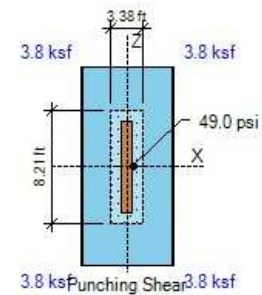
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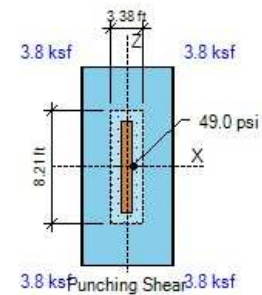
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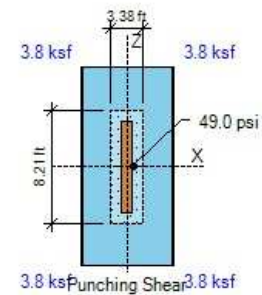
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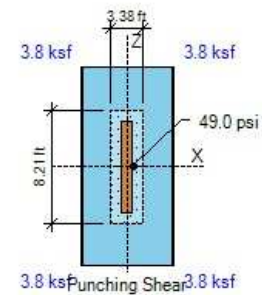
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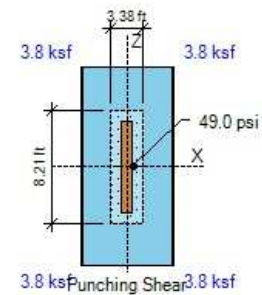
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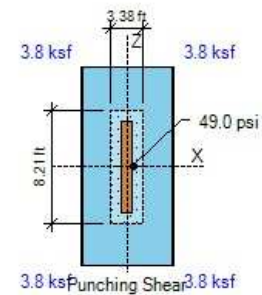
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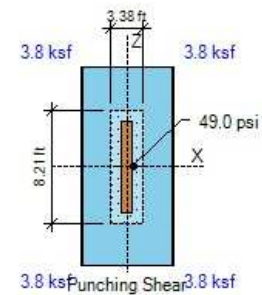
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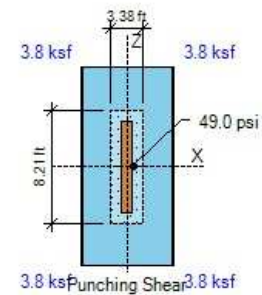
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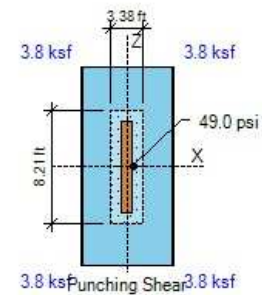
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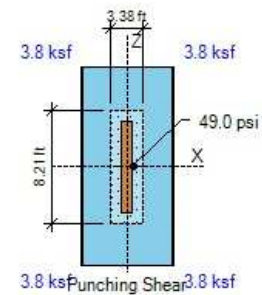
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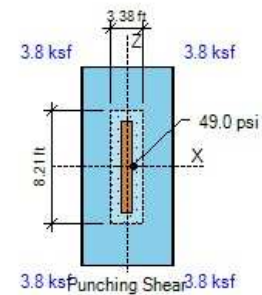
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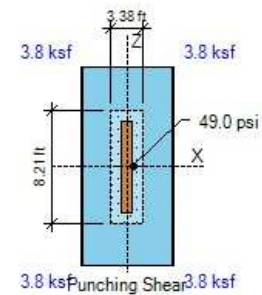
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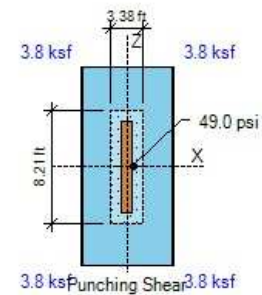
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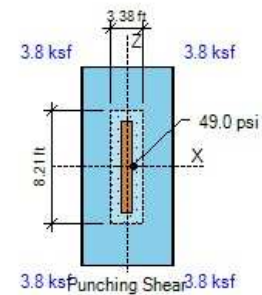
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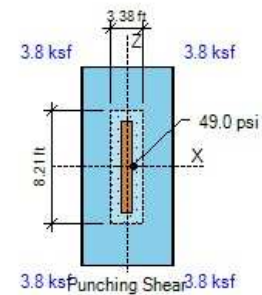
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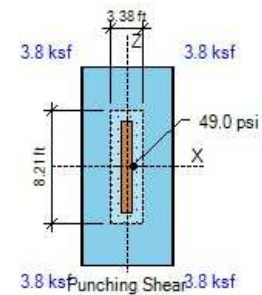
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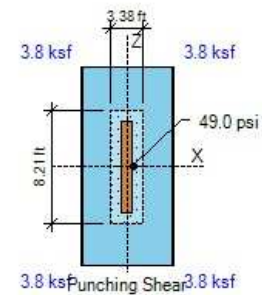
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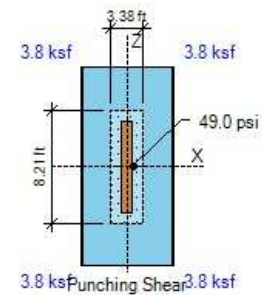
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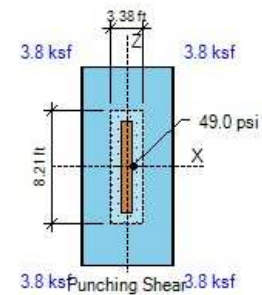
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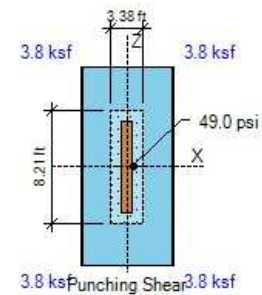
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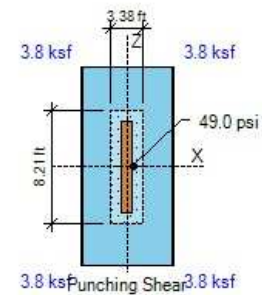
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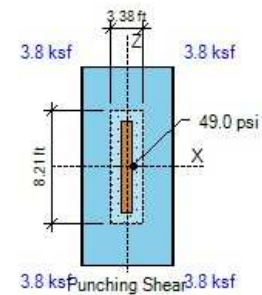
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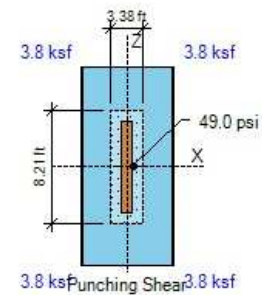
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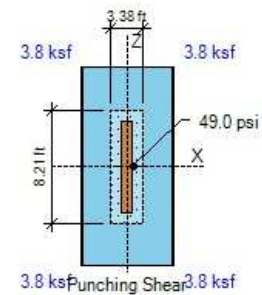
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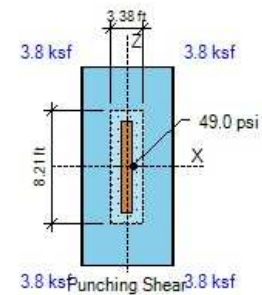
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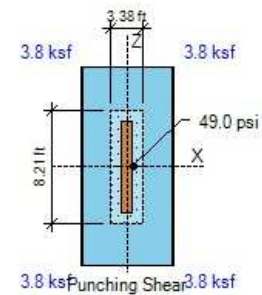
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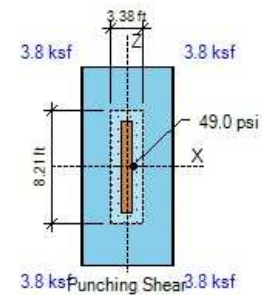
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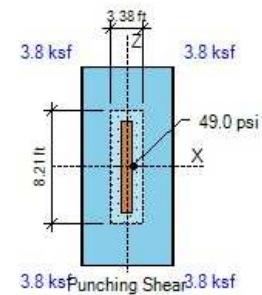
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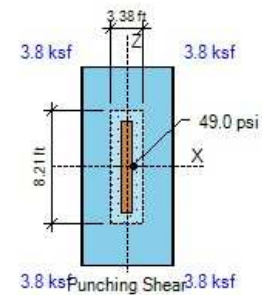
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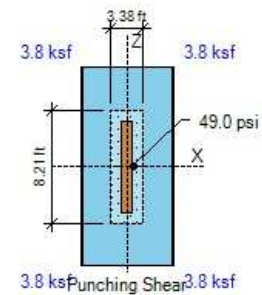
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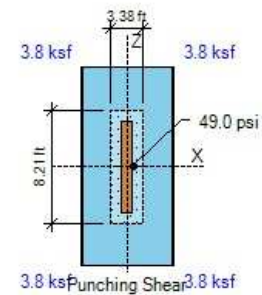
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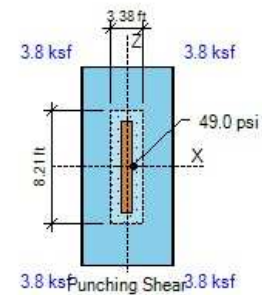
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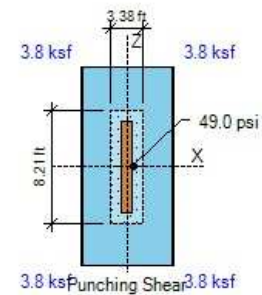
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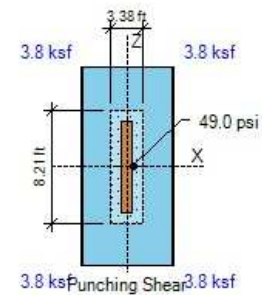
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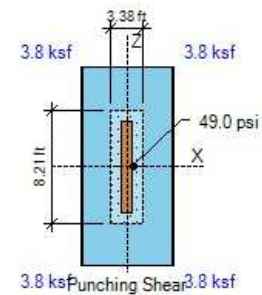
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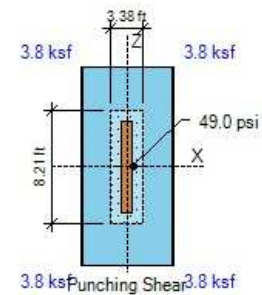
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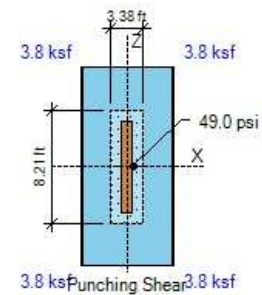
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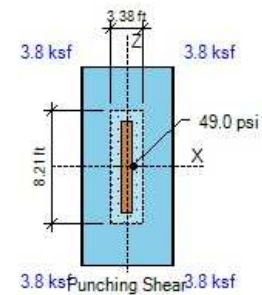
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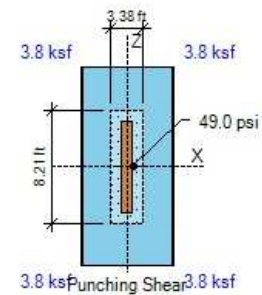
3.8 ksf Punching Shear 3.8 ksf



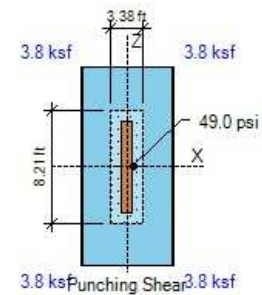
3.8 ksf Punching Shear 3.8 ksf



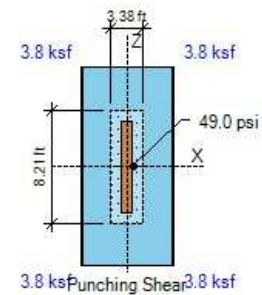
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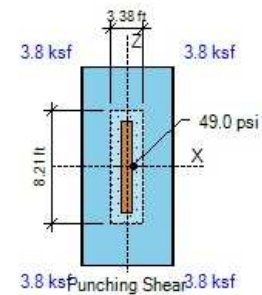
3.8 ksf Punching Shear 3.8 ksf



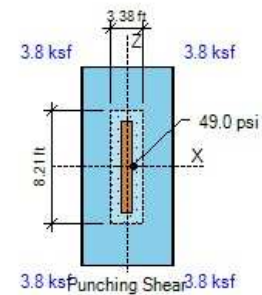
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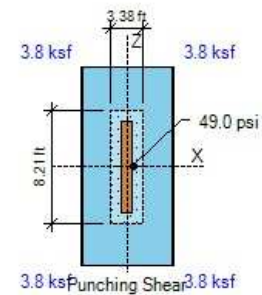
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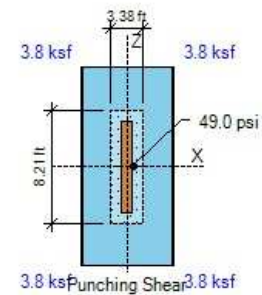
3.8 ksf Punching Shear 3.8 ksf



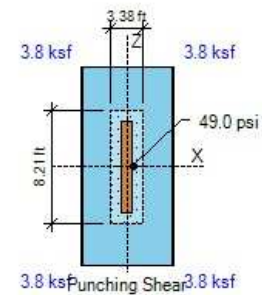
3.8 ksf Punching Shear 3.8 ksf



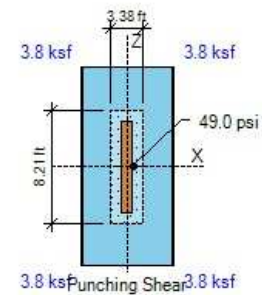
3.8 ksf Punching Shear 3.8 ksf



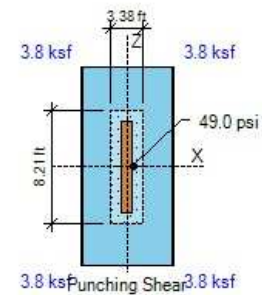
3.8 ksf Punching Shear 3.8 ksf



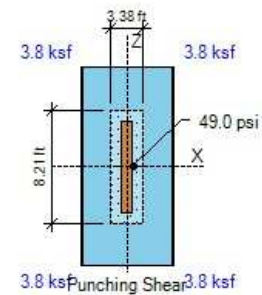
3.8 ksf Punching Shear 3.8 ksf



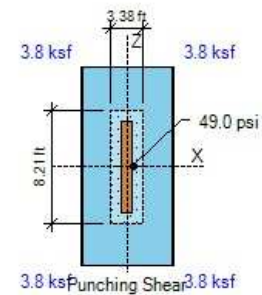
3.8 ksf Punching Shear 3.8 ksf



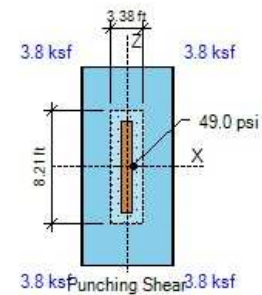
3.8 ksf Punching Shear 3.8 ksf



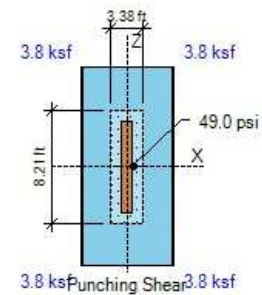
3.8 ksf Punching Shear 3.8 ksf



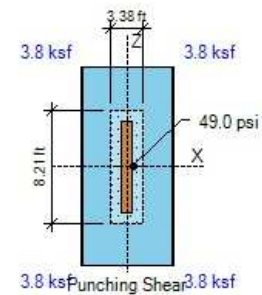
3.8 ksf Punching Shear 3.8 ksf



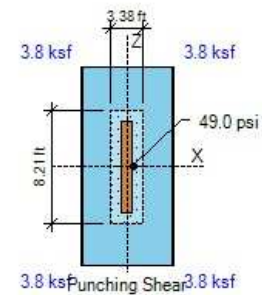
3.8 ksf Punching Shear 3.8 ksf



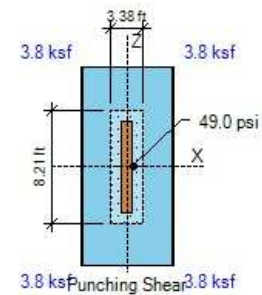
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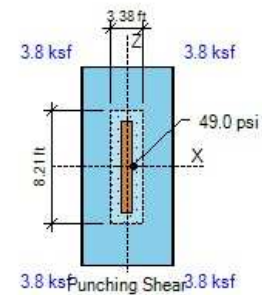
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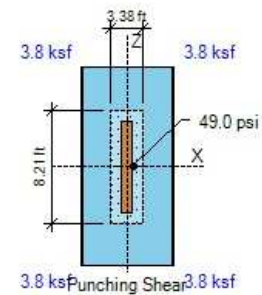
3.8 ksf Punching Shear 3.8 ksf



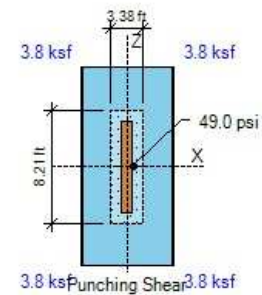
3.8 ksf Punching Shear 3.8 ksf



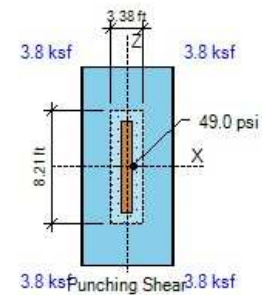
3.8 ksf Punching Shear 3.8 ksf



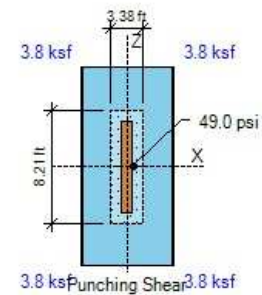
3.8 ksf Punching Shear 3.8 ksf



3.8 ksf Punching Shear 3.8 ksf



3.8 ksf Punching Shear 3.8 ksf



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 5.50  | ft |    |
| Footing Width (Z-dir) .....  | 2.67  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 42.0  | in |    |
| Column Width (Z-dir) .....   | 8.0   | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+0.75L+0.75Lr)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.8   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.8   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.8   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.8   | ksf |    |
| Bearing Pressure Ratio .....       | 0.94  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

## APPLIED LOADS

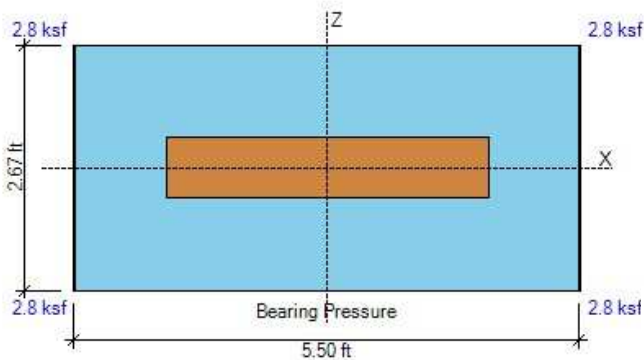
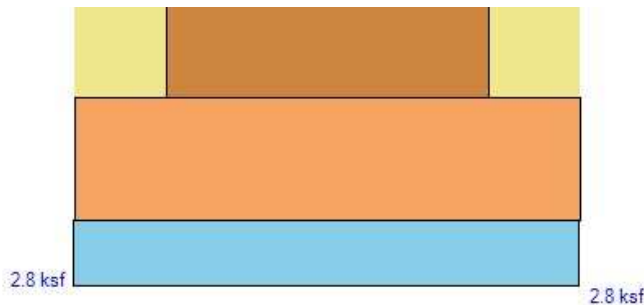
|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 25.0 | 10.0 | 4.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 1.8   | 1.34 | 2.4    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 1.34 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 2.4   | 1.34 | 3.3    |
| Rh = 0.0                    | OTM = | 0.0   |        | Axial Force P ..... | 15.0  | 1.34 | 20.0   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.7  | 1.34 | -1.0   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv = 18.5           | RM =  | 24.7 |        |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 1.8   | 2.75 | 4.8    |
| Rh = 0.0                    | OTM = | 0.0   |        | Column Weight ..    | 0.0   | 2.75 | 0.0    |
|                             | X-X   | Z-Z   |        | Soil Cover .....    | 2.4   | 2.75 | 6.7    |
| Arm of Vertical Resultant = | 1.34  | 2.75  | ft     | Axial Force P ..... | 15.0  | 2.75 | 41.3   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -0.7  | 1.34 | -1.0   |
|                             |       |       |        | Rv = 18.5           | RM =  | 50.8 |        |

OK



**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

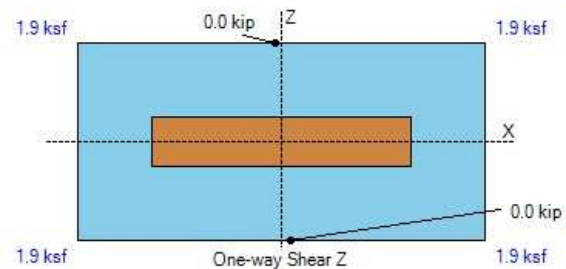
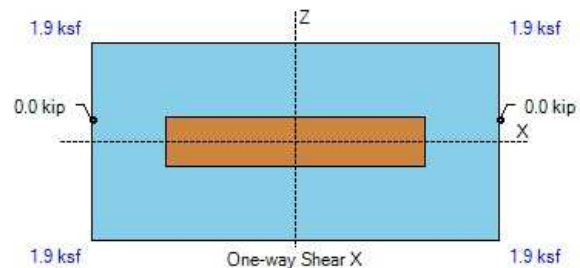
|                                            |             |
|--------------------------------------------|-------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.31        |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.50        |
| Punching Shear due to Axial ....           | 22.8 psi    |
| Punching Shear due to $M_x$ .....          | 0.0 psi     |
| Punching Shear due to $M_z$ .....          | 0.0 psi     |
| Punching Shear Stress $V_u$ .....          | 22.8 psi    |
| Effective Perimeter $b_o$ .....            | 86.4 in     |
| Average Effective Depth $d$ .....          | 12.4 in     |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |
| Column Aspect Ratio $\beta$ .....          | 5.25        |
| Punching Shear Strength $\phi V_c$ ..      | 113.5 psi   |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.20 OK     |

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |                       |
|-----------------------------------|-----------------------|
| Footing-Soil Friction Coeff. .... | 0.45                  |
| Friction Force at Base .....      | 8.3 kip               |
| Passive Pressure Coeff. Kp ....   | 4.33                  |
|                                   | <b>X-X</b> <b>Z-Z</b> |
| Passive Force @ Ftg ...           | 6.2 12.8 kip          |
| Horiz. Resisting Force            | 14.5 21.1 kip         |
| Horiz. Sliding Force .....        | 0.0 0.0 kip           |
| Sliding Safety Factor ...         | 99.99 99.99 > 1.5 OK  |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |                |
|----------------------------|----------------|
| Uplift Force P .....       | 0.0 kip        |
| Pedestal Selfweight .....  | 0.0 kip        |
| Footing Selfweight .....   | 1.8 kip        |
| Soil Cover Weight .....    | 2.4 kip        |
| Downward Force W .....     | 4.2 kip        |
| Uplift Safety Factor ..... | 99.99 > 1.0 OK |



**ONE-WAY SHEAR (Comb: 0.9D+E)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 0.0    | 0.0    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 18.0   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 37.3   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.00   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5Lr)****- Top Bars -**

|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment - $M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment - $M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | N.A. |         |
| Z-Bars Development Length Ratio ..        | N.A. |         |
| Min. Top Steel Area Ratio .....           | N.A. |         |
| Under-strength $\phi$ Factor .....        | 0.60 |         |
| Bending Strength - $\phi M_{nx}$ .....    | 38.6 | k-ft OK |
| Bending Strength - $\phi M_{nz}$ .....    | 18.7 | k-ft OK |
| Max. Bending Ratio - $M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....              | N.A. |         |

**- Bottom Bars -**

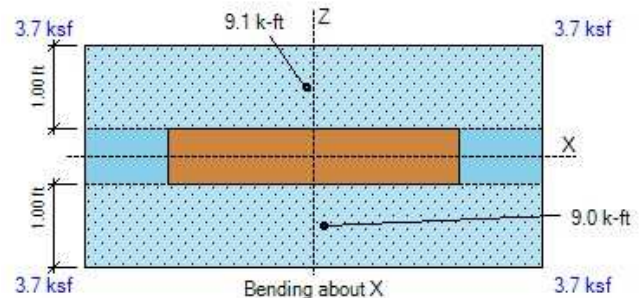
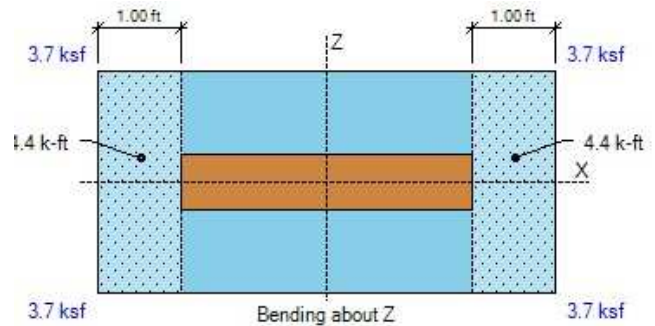
|                               | - Side | + Side |      |
|-------------------------------|--------|--------|------|
| Bending Moment + $M_{ux}$ ... | 9.0    | 9.1    | k-ft |
| Bending Moment + $M_{uz}$ ... | 4.4    | 4.4    | k-ft |

*Use 3 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 7 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                           |      |         |
|-------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..        | 0.83 | OK      |
| Z-Bars Development Length Ratio ..        | 0.83 | OK      |
| Min. Bottom Steel Area Ratio .....        | 0.99 | OK      |
| Under-strength $\phi$ Factor .....        | 0.90 |         |
| Bending Strength + $\phi M_{nx}$ .....    | 85.4 | k-ft OK |
| Bending Strength + $\phi M_{nz}$ .....    | 51.7 | k-ft OK |
| Max. Bending Ratio + $M_u/\phi M_n$ ..... | 0.11 | OK      |
| Max. Bar Spacing Ratio .....              | 0.72 | OK      |

**TRANSFER (Comb: 1.2D+1.6L+0.5Lr)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.1   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 2.9   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.0   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 3.36  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |



## DESIGN CODES

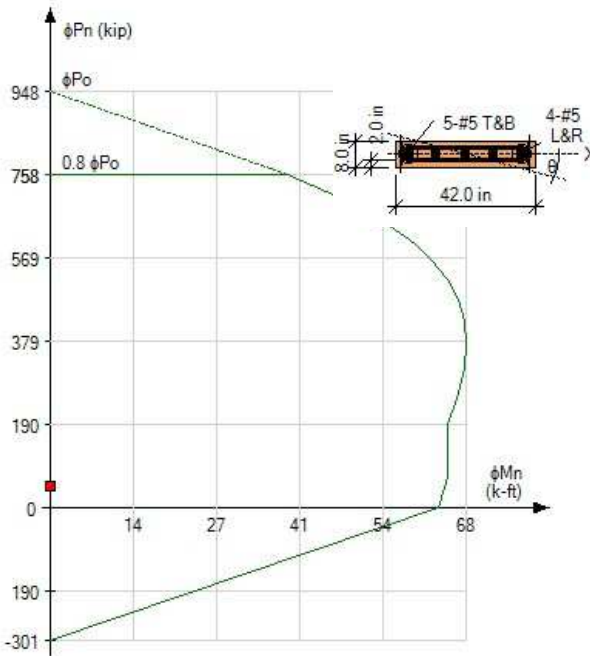
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

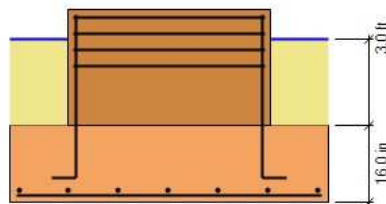
|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

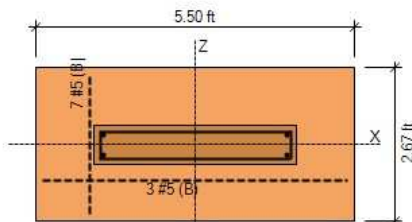
|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 48.0  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 758.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 64.1  | k-ft |
| Biaxial Strength Ratio .....       | 0.06  | OK   |



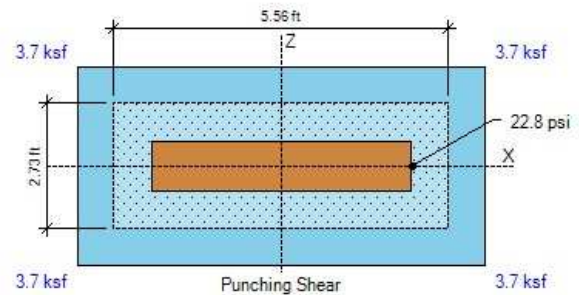
INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN



Punching Shear

## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 6.50  | ft |    |
| Footing Width (Z-dir) .....  | 2.67  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 54.0  | in |    |
| Column Width (Z-dir) .....   | 8.0   | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+0.75L+0.75Lr)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.4   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.4   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.4   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.4   | ksf |    |
| Bearing Pressure Ratio .....       | 0.81  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

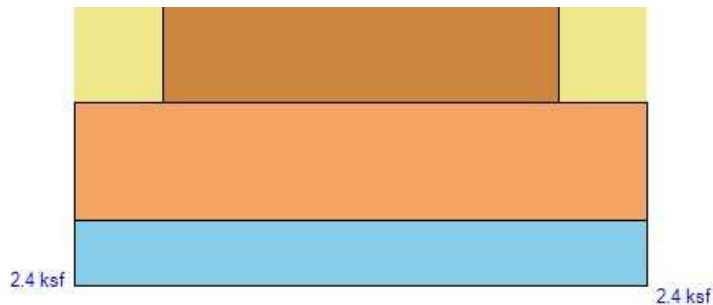
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 25.0 | 10.0 | 4.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 2.1   | 1.34 | 2.8    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 1.34 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 2.8   | 1.34 | 3.8    |
| Rh = 0.0                    | OTM = | 0.0   |        | Axial Force P ..... | 15.0  | 1.34 | 20.0   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.9  | 1.34 | -1.2   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv = 19.1           | RM =  | 25.4 |        |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 2.1   | 3.25 | 6.8    |
| Rh = 0.0                    | OTM = | 0.0   |        | Column Weight ..    | 0.0   | 3.25 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 2.8   | 3.25 | 9.2    |
|                             | X-X   | Z-Z   |        | Axial Force P ..... | 15.0  | 3.25 | 48.8   |
| Arm of Vertical Resultant = | 1.34  | 3.25  | ft     | Water Buoyancy .    | -0.9  | 1.34 | -1.2   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Rv = 19.1           | RM =  | 61.9 |        |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

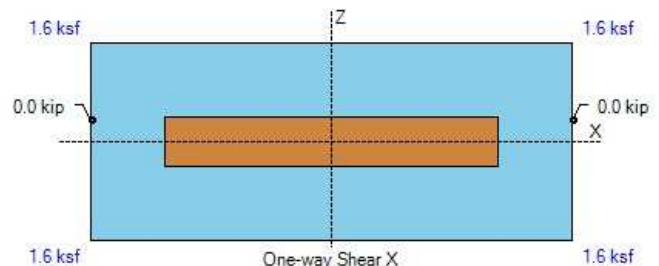
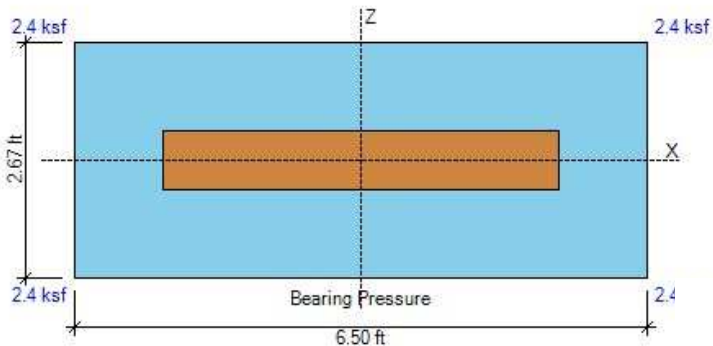
|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 8.6        | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 6.2        | 15.1        |
| Horiz. Resisting Force            | 14.8       | 23.7        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

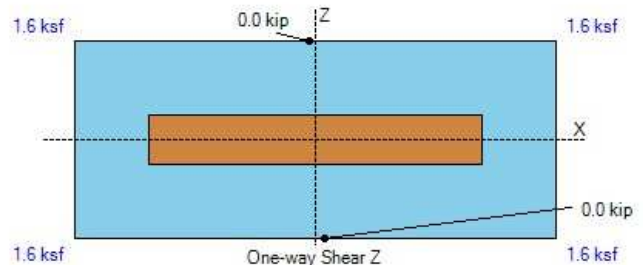
**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 2.1   | kip   |
| Soil Cover Weight .....    | 2.8   | kip   |
| Downward Force W .....     | 4.9   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK



One-way Shear X



One-way Shear Z

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |             |     |
|--------------------------------------------|-------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.29        |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.53        |     |
| Punching Shear due to Axial ....           | 19.5        | psi |
| Punching Shear due to $M_x$ .....          | 0.0         | psi |
| Punching Shear due to $M_z$ .....          | 0.0         | psi |
| Punching Shear Stress $V_u$ .....          | 19.5        | psi |
| Effective Perimeter $b_o$ .....            | 98.4        | in  |
| Average Effective Depth $d$ .....          | 12.4        | in  |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |     |
| Column Aspect Ratio $\beta$ .....          | 6.75        |     |
| Punching Shear Strength $\phi V_c$ ..      | 106.5       | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.18        | OK  |

### ONE-WAY SHEAR (Comb: 0.9D+E)

|                                            | - Side | + Side |        |
|--------------------------------------------|--------|--------|--------|
| One-way Shear $V_{ux}$ ...                 | 0.0    | 0.0    | kip    |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip    |
| Under-strength $\phi$ Factor .....         |        | 0.75   |        |
| One-way Shear Strength $\phi V_{cx}$       |        | 18.0   | kip OK |
| One-way Shear Strength $\phi V_{cz}$       |        | 43.6   | kip OK |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. |        | 0.00   | OK     |

**FLEXURE (Comb: 1.2D+1.6L+0.5Lr)**

| - Top Bars -            | - Side | + Side |      |
|-------------------------|--------|--------|------|
| Bending Moment -Mux ... | 0.0    | 0.0    | k-ft |
| Bending Moment -Muz ... | 0.0    | 0.0    | k-ft |

### No Top Reinforcement Provided at the Footing

*Use Plain Concrete Flexural Strength at Top*

|                                          |           |    |
|------------------------------------------|-----------|----|
| X-Bars Development Length Ratio ..       | N.A.      |    |
| Z-Bars Development Length Ratio ..       | N.A.      |    |
| Min. Top Steel Area Ratio .....          | N.A.      |    |
| Under-strength $\phi$ Factor .....       | 0.60      |    |
| Bending Strength $-\phi M_n$ .....       | 45.6 k-ft | OK |
| Bending Strength $-\phi M_n$ .....       | 18.7 k-ft | OK |
| Max. Bending Ratio $-\mu/\phi M_n$ ..... | 0.00      | OK |
| Max. Bar Spacing Ratio .....             | N.A.      |    |

**- Bottom Bars -**

|                         |     |     |      |
|-------------------------|-----|-----|------|
| Bending Moment +Mux ... | 9.0 | 9.1 | k-ft |
| Bending Moment +Muz ... | 3.7 | 3.7 | k-ft |

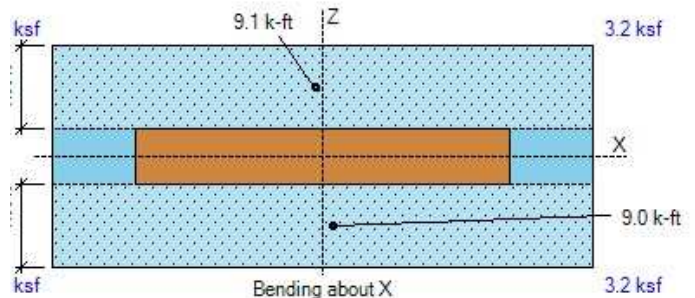
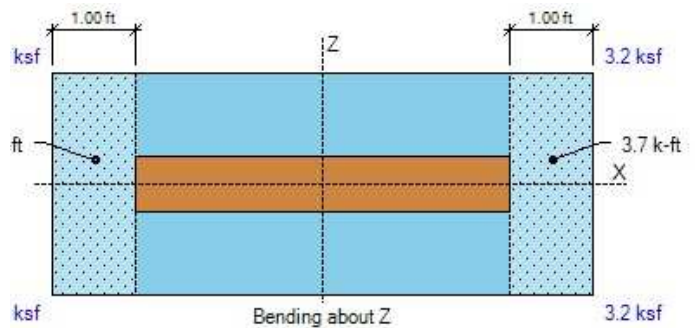
Use 3 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in

Use 8 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in

|                                         |           |    |
|-----------------------------------------|-----------|----|
| X-Bars Development Length Ratio ..      | 0.83      | OK |
| Z-Bars Development Length Ratio ..      | 0.83      | OK |
| Min. Bottom Steel Area Ratio .....      | 0.99      | OK |
| Under-strength $\phi$ Factor .....      | 0.90      |    |
| Bending Strength $+\phi M_{nx}$ .....   | 92.9 k-ft | OK |
| Bending Strength $+\phi M_{nz}$ .....   | 51.7 k-ft | OK |
| Max. Bending Ratio $+Mu/\phi M_n$ ..... | 0.10      | OK |
| Max. Bar Spacing Ratio .....            | 0.72      | OK |

**TRANSFER (Comb: 1.2D+1.6L+0.5Lr)**

|                                                                                 |       |                  |
|---------------------------------------------------------------------------------|-------|------------------|
| Bearing Under-strength $\phi$ Factor .....                                      | 0.65  |                  |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58 \text{ in}^2</math></i> |       |                  |
| Bearing Stress $P_{bu}$ .....                                                   | 0.1   | ksi              |
| Column Bearing Strength $\phi P_n$ ...                                          | 2.7   | ksi OK           |
| Footing Bearing Strength $\phi P_n$ ...                                         | 3.8   | ksi OK           |
| Shear Force Transfer $V_u$ .....                                                | 0.0   | kip              |
| Shear Friction Strength $\phi V_n$ .....                                        | 150.7 | kip OK           |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                           | 4.32  | $\text{in}^2$ OK |
| Develop. Length Ratio at Column .....                                           | 0.33  | OK               |
| Develop. Length Ratio at Footing .....                                          | 0.97  | OK               |





## DESIGN CODES

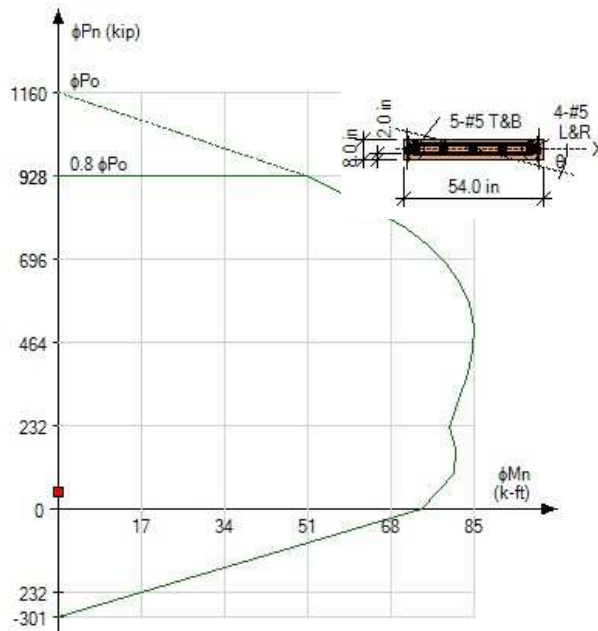
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

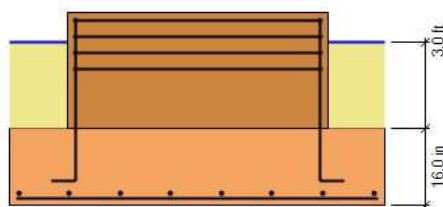
|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 48.0  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 923.5 | kip  |
| Flexural Strength $\phi M_n$ ..... | 78.8  | k-ft |
| Biaxial Strength Ratio .....       | 0.05  | OK   |



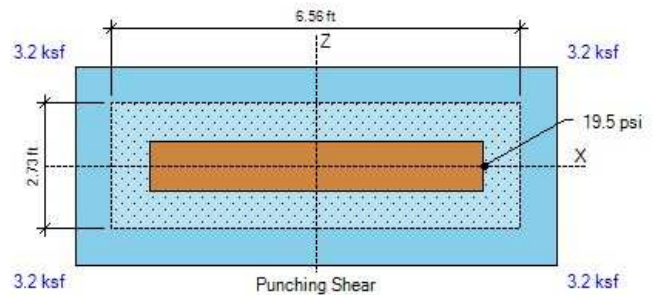
INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN



Punching Shear

## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 5.25  | ft |    |
| Footing Width (Z-dir) .....  | 5.25  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 16.0  | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.9   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.9   | ksf |    |
| Bearing Pressure Ratio .....       | 0.98  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

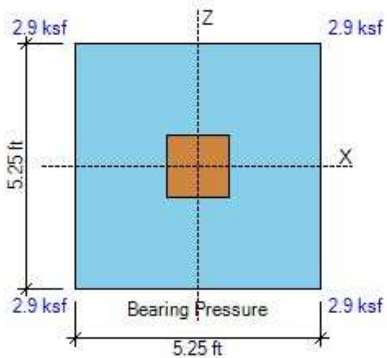
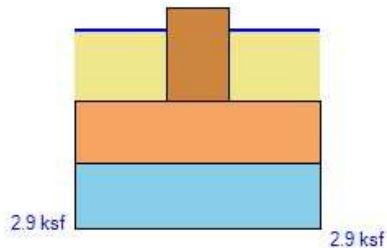
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 58.0 | 11.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 3.3   | 2.63 | 8.7    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.63 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 5.1   | 2.63 | 13.4   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 34.8  | 2.63 | 91.4   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.4  | 2.63 | -3.6   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 41.8  | RM = | 109.8  |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 3.3   | 2.63 | 8.7    |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 2.63 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 5.1   | 2.63 | 13.4   |
| Arm of Vertical Resultant = | 2.63  | 2.63  | ft     | Axial Force P ..... | 34.8  | 2.63 | 91.4   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -1.4  | 2.63 | -3.6   |
|                             |       |       |        | Rv =                | 41.8  | RM = | 109.8  |

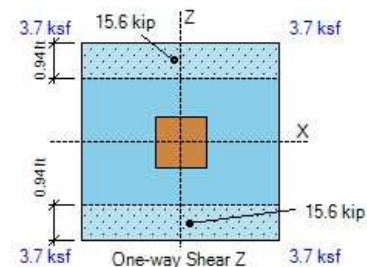
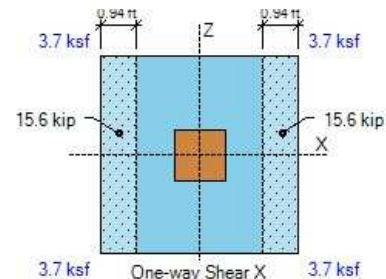
OK

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 18.8       | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 12.2       | 12.2        |
| Horiz. Resisting Force            | 31.0       | 31.0        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 3.3   | kip   |
| Soil Cover Weight .....    | 5.1   | kip   |
| Downward Force W .....     | 8.4   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |               |     |
|--------------------------------------------|---------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.40          |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.40          |     |
| Punching Shear due to Axial ....           | 50.3          | psi |
| Punching Shear due to $M_x$ .....          | 0.0           | psi |
| Punching Shear due to $M_z$ .....          | 0.0           | psi |
| Punching Shear Stress $V_u$ .....          | 50.3          | psi |
| Effective Perimeter $b_o$ .....            | 113.0         | in  |
| Average Effective Depth $d$ .....          | 12.3          | in  |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |     |
| Column Aspect Ratio $\beta$ .....          | 1.00          |     |
| Punching Shear Strength $\phi V_c$ ..      | 164.3         | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.31          | OK  |

**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 15.6   | 15.6   | kip |
| One-way Shear $V_{uz}$ ...                 | 15.6   | 15.6   | kip |
| Under-strength $\phi$ Factor .....         |        | 0.75   |     |
| One-way Shear Strength $\phi V_{cx}$       | 37.4   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 35.9   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.43   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5S)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing*

*Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 36.8 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 36.8 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 31.9   | 31.9   | k-ft |
| Bending Moment $+M_{uz}$ ... | 31.9   | 31.9   | k-ft |

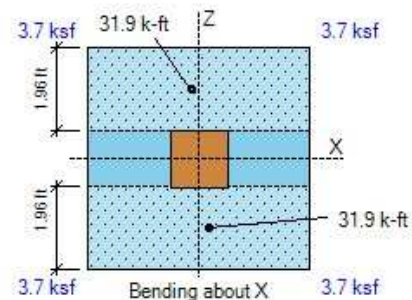
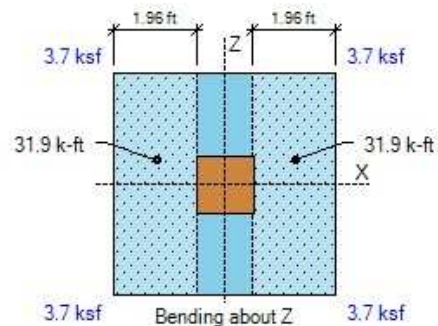
*Use 5 #6 Bars Parallel to X (Bot) ,  $d = 12.6$  in*

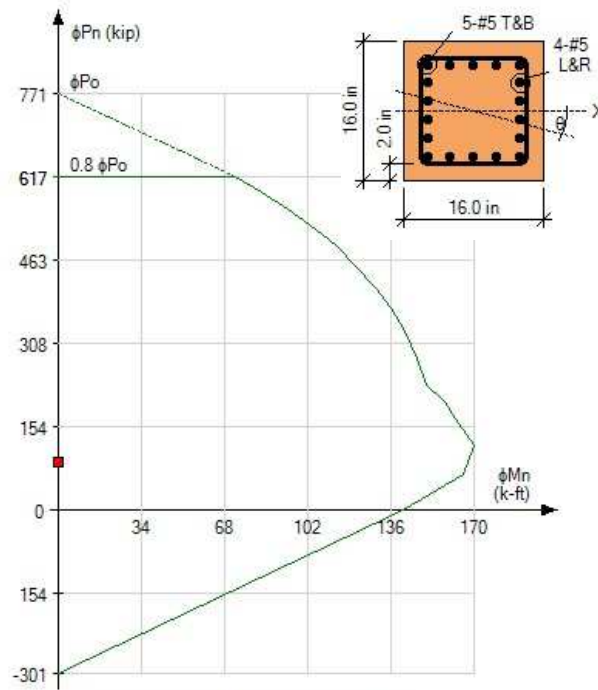
*Use 5 #6 Bars Parallel to Z (Bot) ,  $d = 11.9$  in*

|                                          |       |         |
|------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..       | 0.49  | OK      |
| Z-Bars Development Length Ratio ..       | 0.49  | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.82  | OK      |
| Under-strength $\phi$ Factor .....       | 0.90  |         |
| Bending Strength $+\phi M_{nx}$ .....    | 113.5 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 120.9 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.28  | OK      |
| Max. Bar Spacing Ratio .....             | 0.79  | OK      |

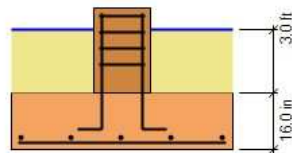
**TRANSFER (Comb: 1.2D+1.6L+0.5S)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.3   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

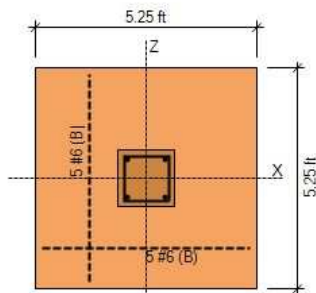




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN

## DESIGN CODES

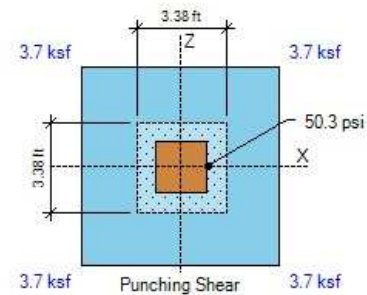
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 87.2  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 614.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 170.8 | k-ft |
| Biaxial Strength Ratio .....       | 0.14  | OK   |



**GEOMETRY**

|                                |                 |                 |       |
|--------------------------------|-----------------|-----------------|-------|
| Column to Column Distance .... | 6.50            | ft              |       |
|                                | <u>Exterior</u> | <u>Interior</u> |       |
| Column Length (X) ....         | 18.0            | 18.0            | in    |
| Column Width (Z) .....         | 8.0             | 8.0             | in    |
| Edge Distance (X) ....         | 1.50            | 4.00            | ft OK |
| Footing Width (Z) .....        | 4.50            | 4.50            | ft    |
| Footing Thickness .....        | 20.0            | in              | OK    |
| Soil Cover .....               | 3.00            | ft              |       |
| Pedestal Height .....          | N. A.           |                 |       |

**SOIL PRESSURES (D+L)**

|                                         |                 |                 |     |
|-----------------------------------------|-----------------|-----------------|-----|
| Gross Allow. Soil Pressure .....        | 3.00            | ksf             |     |
| Overburden Pressure .....               | 0.49            | ksf             |     |
| Reaction Force .....                    | 154.6           | kip             |     |
| Eccentricity X = -0.02 ft , Z = 0.00 ft |                 |                 |     |
|                                         | <u>Exterior</u> | <u>Interior</u> |     |
| Bearing Pressure .....                  | 2.84            | 2.89            | ksf |
| Bearing Ratio .....                     | 0.95            | 0.96            | OK  |

**APPLIED LOADS**

|                        |             |             |              |             |             |                |      |
|------------------------|-------------|-------------|--------------|-------------|-------------|----------------|------|
| <u>- Exterior Col.</u> | <u>Dead</u> | <u>Live</u> | <u>RLive</u> | <u>Snow</u> | <u>Wind</u> | <u>Seismic</u> |      |
| Axial Force P .....    | 24.0        | 15.0        | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Moment about X Mx      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Moment about Z Mz      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Shear Force Vx .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Shear Force Vz .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| <u>- Interior Col.</u> | <u>Dead</u> | <u>Live</u> | <u>RLive</u> | <u>Snow</u> | <u>Wind</u> | <u>Seismic</u> |      |
| Axial Force P .....    | 76.0        | 13.0        | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Moment about X Mx      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Moment about Z Mz      | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | k-ft |
| Shear Force Vx .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |
| Shear Force Vz .....   | 0.0         | 0.0         | 0.0          | 0.0         | 0.0         | 0.0            | kip  |

**MATERIALS**

|                          |                |                |     |
|--------------------------|----------------|----------------|-----|
|                          | <u>Columns</u> | <u>Footing</u> |     |
| Concrete f'c .....       | 4.0            | 3.0            | ksi |
| Reinf. Steel fy .....    | 60.0           | 60.0           | ksi |
| Soil Cover Density ..... | 120.0          | pcf            |     |

**SLIDING (comb: 0.6D+0.6W)**

|                                   |            |                |
|-----------------------------------|------------|----------------|
| Footing-Soil Friction Coeff. .... | 0.45       |                |
| Friction Force at Base .....      | 34.2       | kip            |
| Passive Pressure Coeff. Kp ....   | 4.33       |                |
|                                   | <u>X-X</u> | <u>Z-Z</u>     |
| Passive Force @ Ftg ...           | 14.9       | 39.8 kip       |
| Horiz. Resisting Force            | 49.1       | 74.0 kip       |
| Horiz. Sliding Force .....        | 0.0        | 0.0 kip        |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 OK |

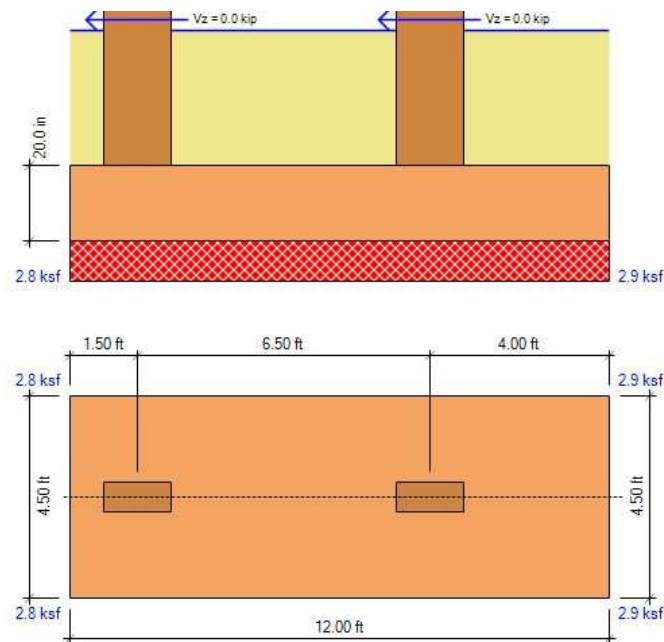
**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |



**OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)**

| OVERTURNING                    |       |            |            | RESISTING          |       |       |        |
|--------------------------------|-------|------------|------------|--------------------|-------|-------|--------|
|                                | Force | Arm        | Moment     |                    | Force | Arm   | Moment |
|                                | kip   | ft         | k-ft       |                    | kip   | ft    | k-ft   |
| <b>- About X-X</b>             |       |            |            | <b>- About X-X</b> |       |       |        |
| Ext. Moment Mx ...             | 0.0   | 0.0        | 0.0        | Soil Cover .....   | 11.2  | 2.25  | 25.3   |
| Ext. Shear Vz .....            | 0.0   | 1.67       | 0.0        | Footing Weight ... | 8.1   | 2.25  | 18.2   |
| Int. Moment Mx ....            | 0.0   | 0.0        | 0.0        | Ext. Column .....  | 0.0   | 2.25  | 0.0    |
| Int. Shear Vz .....            | 0.0   | 1.67       | 0.0        | Int. Column .....  | 0.0   | 2.25  | 0.0    |
| Passive Pressure               | 0.0   | 0.67       | 0.0        | Ext. Axial P ..... | 14.4  | 2.25  | 32.4   |
| Rh =                           | 0.0   | OTM =      | 0.0        | Int. Axial P ..... | 45.6  | 2.25  | 102.6  |
| <b>- About Z-Z</b>             |       |            |            | Water Buoyancy .   | -3.4  | 2.25  | -7.6   |
| Ext. Moment Mz ...             | 0.0   | 0.0        | 0.0        | Rv =               | 76.0  | RM =  | 170.9  |
| Ext. Shear Vx .....            | 0.0   | 1.67       | 0.0        | <b>- About Z-Z</b> |       |       |        |
| Int. Moment Mz ....            | 0.0   | 0.0        | 0.0        | Soil Cover .....   | 11.2  | 6.00  | 67.4   |
| Int. Shear Vx .....            | 0.0   | 1.67       | 0.0        | Footing Weight ... | 8.1   | 6.00  | 48.6   |
| Passive Pressure               | 0.0   | 0.67       | 0.0        | Ext. Column .....  | 0.0   | 10.50 | 0.0    |
| Rh =                           | 0.0   | OTM =      | 0.0        | Int. Column .....  | 0.0   | 4.00  | 0.0    |
|                                |       | <b>X-X</b> | <b>Z-Z</b> | Ext. Axial P ..... | 14.4  | 10.50 | 151.2  |
| Arm of Vertical Resultant .... |       | 2.25       | 5.65 ft    | Int. Axial P ..... | 45.6  | 4.00  | 182.4  |
| Overturning Safety Factor ..   | 99.99 | 99.99      | > 1.5 OK   | Water Buoyancy .   | -3.4  | 6.00  | -20.2  |
|                                |       |            |            | Rv =               | 76.0  | RM =  | 429.4  |



**FOOTING AT EXTERIOR COL.****- One-way Shear (Comb: 1.2D+1.6L+0.5S)**Under-strength  $\phi$  Factor ..... 0.75**- Side + Side**One-way Shear  $V_{ux}$  ... 0.0 1.7 kipShear Strength  $\phi V_{cx}$  .. 30.2 40.0 kipOne-way Shear  $V_{uz}$  ... 6.3 kipShear Strength  $\phi V_{cz}$  .. 33.0 kipMax. One-way Shear Ratio  $V_u/\phi V_c$  .. 0.19 OK**- Punching Shear (Comb: 1.2D+1.6L+0.5Lr)**Unbalanced Moment Factor  $\gamma_{vx}$  ... 0.44

Punching Shear due to Axial .... 21.8 psi

Punching Shear due to  $M_z$  ..... 0.0 psiPunching Shear Stress  $V_u$  ..... 21.8 psiEffective Perimeter  $b_o$  ..... 94.8 inAverage Effective Depth  $d$  ..... 16.4 inPunching Shear Strength  $\phi V_c$  .. 155.2 psiPunching Shear Ratio  $V_u/\phi V_c$  ..... 0.14 OK**- Transv. Flexure (Comb: 1.2D+1.6L+0.5S)**Under-strength  $\phi$  Factor ..... 0.90

Footing Effective Length ..... 3.64 ft

*No Top Reinf. Use Plain Concrete Strength**Use 6 #5 Bars Parallel to Z (Bot) ,  $d = 16.7$  in*

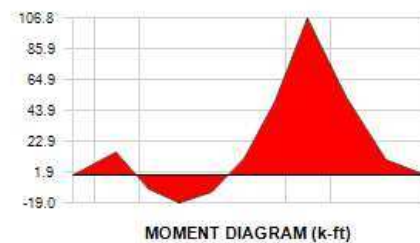
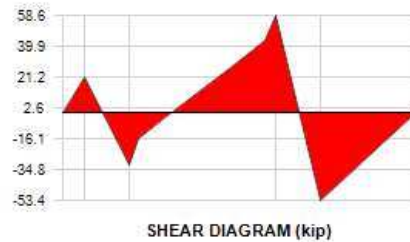
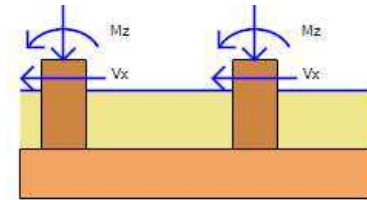
Bottom Steel Min. Area Ratio ..... 0.85 OK

**Top Bot**Bending Moment  $M_{ux}$  .. 0.0 20.8 k-ftBending Strength  $\phi M_{nx}$  39.9 135.5 k-ftMax. Bending Ratio  $M_{ux}/\phi M_{nx}$  ..... 0.15 OK

Top Z-Bars Develop. Length Ratio . N.A. OK

Bot Z-Bars Develop. Length Ratio .. 0.37 OK

Center Z-Bars S&amp;T min Ratio ..... 0.93 OK



**FOOTING AT INTERIOR COL.****- One-way Shear (Comb: 1.2D+1.6L+0.5S)**

|                                            |               |               |     |
|--------------------------------------------|---------------|---------------|-----|
| Under-strength $\phi$ Factor               | .....         | 0.75          |     |
|                                            | <b>- Side</b> | <b>+ Side</b> |     |
| One-way Shear $V_{ux}$ ...                 | 29.7          | 25.0          | kip |
| Shear Strength $\phi V_{cx}$ ..            | 30.2          | 40.0          | kip |
| One-way Shear $V_{uz}$ ...                 |               | 7.1           | kip |
| Shear Strength $\phi V_{cz}$ ..            |               | 36.8          | kip |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.98          |               | OK  |

**- Punching Shear (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |       |  |     |
|--------------------------------------------|-------|--|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.44  |  |     |
| Punching Shear due to Axial ....           | 49.4  |  | psi |
| Punching Shear due to $M_z$ .....          | 0.0   |  | psi |
| Punching Shear Stress $V_u$ .....          | 49.4  |  | psi |
| Effective Perimeter $b_o$ .....            | 117.5 |  | in  |
| Average Effective Depth $d$ .....          | 16.4  |  | in  |
| Punching Shear Strength $\phi V_c$ ..      | 155.2 |  | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.32  |  | OK  |

**- Transv. Flexure (Comb: 1.2D+1.6L+0.5S)**

|                                                                     |       |      |    |
|---------------------------------------------------------------------|-------|------|----|
| Under-strength $\phi$ Factor                                        | ..... | 0.90 |    |
| Footing Effective Length                                            | ..... | 4.28 | ft |
| <i>No Top Reinf. Use Plain Concrete Strength</i>                    |       |      |    |
| <i>Use 6 #5 Bars Parallel to Z (Bot) , <math>d = 16.7</math> in</i> |       |      |    |
| Bottom Steel Min. Area Ratio                                        | ..... | 0.99 | OK |

|                                               |            |            |      |
|-----------------------------------------------|------------|------------|------|
|                                               | <b>Top</b> | <b>Bot</b> |      |
| Bending Moment $M_{ux}$ ..                    | 0.0        | 23.5       | k-ft |
| Bending Strength $\phi M_{nx}$                | 46.9       | 136.1      | k-ft |
| Max. Bending Ratio $M_{ux}/\phi M_{nx}$ ..... | 0.17       |            | OK   |
| Top Z-Bars Develop. Length Ratio .            | N.A.       |            | OK   |
| Bot Z-Bars Develop. Length Ratio ..           | 0.37       |            | OK   |

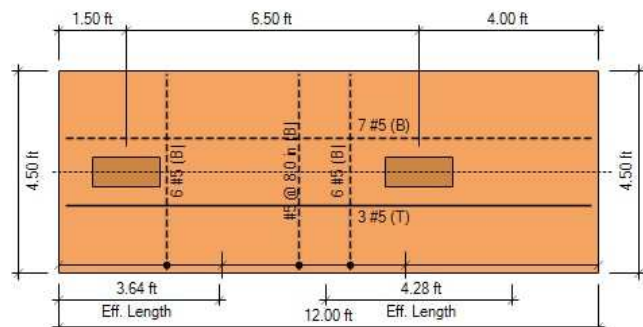
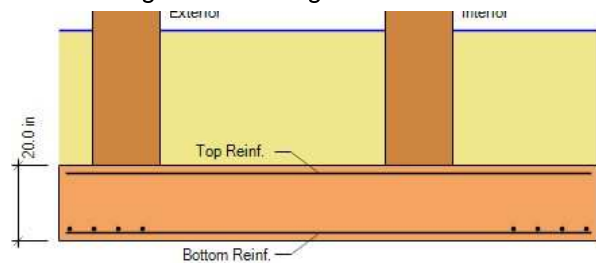
**LONGITUDINAL REINF.****- Long. Flexure (Comb: 1.2D+1.6L+0.5Lr)**

*Use 3 #5 Bars Parallel to X (Top) ,  $d = 16.9$  in*  
*Use 7 #5 Bars Parallel to X (Bot) ,  $d = 16.1$  in*

|                                               |            |            |      |
|-----------------------------------------------|------------|------------|------|
|                                               | <b>Top</b> | <b>Bot</b> |      |
| Min. Steel Area Ratio ...                     | 0.36       | 0.93       | OK   |
| Bending Moment $M_{uz}$ ..                    | 19.0       | 106.8      | k-ft |
| Bending Strength $\phi M_{nz}$                | 70.0       | 152.2      | k-ft |
| Max. Bending Ratio $M_{uz}/\phi M_{nz}$ ..... | 0.70       |            | OK   |
| Ext. Bot X-Bars Dev. Length Ratio .           | 0.31       |            | OK   |
| Int. Bot X-Bars Dev. Length Ratio ...         | 0.14       |            | OK   |

**LOAD TRANSFER (Comb: 1.2D+1.6L+0.5S)**Bearing Under-strength  $\phi$  Factor ..... 0.65

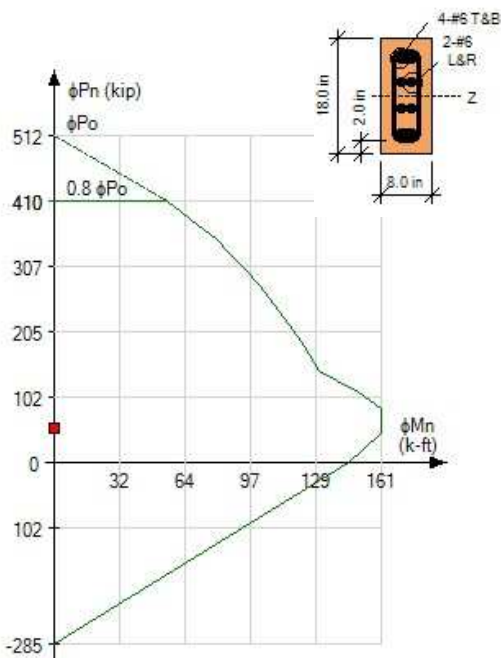
|                                  |             |             |                    |
|----------------------------------|-------------|-------------|--------------------|
|                                  | <b>Ext.</b> | <b>Int.</b> |                    |
| Compressive Stress $P_u$         | 0.4         | 0.8         | ksi                |
| Column Bearing $\phi P_n$ .....  | 3.6         | 3.6         | ksi OK             |
| Footing Bearing $\phi P_n$ ..... | 4.7         | 4.7         | ksi OK             |
| Shear Force $V_u$ .....          | 0.0         | 0.0         | kip                |
| Shear Friction $\phi V_n$ .....  | 142.6       | 142.6       | kip OK             |
| Dowel Steel Area $A_s$ .....     | 5.28        | 5.28        | in <sup>2</sup>    |
| Min. Steel Area $A_s$ min ..     | 1.44        | 1.44        | in <sup>2</sup> OK |
| Dev. Length Ratio at Col.        | 0.50        | 0.68        | OK                 |
| Dev. Length Ratio at Ftg.        | 0.97        | 0.97        | OK                 |

**UPLIFT CALCS (Comb: 0.6D+0.6W)**

|                            |       |          |
|----------------------------|-------|----------|
| Uplift Force $P$ .....     | 0.0   | kip      |
| Pedestals Selfweight ..... | 0.0   | kip      |
| Footing Selfweight .....   | 8.1   | kip      |
| Soil Cover Weight .....    | 11.2  | kip      |
| Downward Force $W$ .....   | 19.3  | kip      |
| Uplift Safety Factor ..... | 99.99 | > 1.0 OK |

**EXT. COLUMN (Comb: 1.2D+1.6L+0.5Lr)***Use 12-#6 Longitudinal Bars, Use Ties #4*

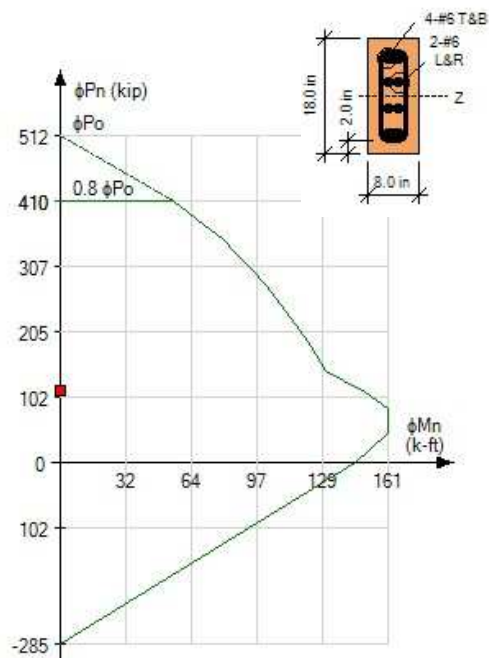
|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 52.8  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 408.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 163.1 | k-ft |
| Biaxial Strength Ratio .....       | 0.13  | OK   |



**EXT. INTERACTION DIAGRAM**  
Controlling Load Comb: 1.2D+1.6L+0.5Lr

**INT. COLUMN (Comb: 1.2D+1.6L+0.5Lr)***Use 12-#6 Longitudinal Bars, Use Ties #4*

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 112.0 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 408.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 146.9 | k-ft |
| Biaxial Strength Ratio .....       | 0.27  | OK   |



**INT. INTERACTION DIAGRAM**  
Controlling Load Comb: 1.2D+1.6L+0.5Lr

## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 6.60  | ft |    |
| Footing Width (Z-dir) .....  | 6.60  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 16.0  | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+L)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 3.0   | ksf |    |
| Bearing Pressure Ratio .....       | 0.99  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

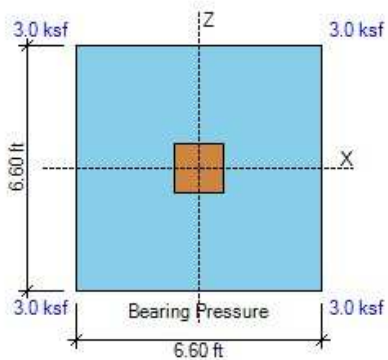
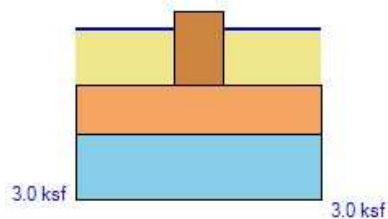
## APPLIED LOADS

|                      | Dead  | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|-------|------|-------|------|------|---------|------|
| Axial Force P .....  | 100.0 | 10.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 5.2   | 3.30 | 17.2   |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 3.30 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 8.3   | 3.30 | 27.3   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 60.0  | 3.30 | 198.0  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -2.2  | 3.30 | -7.2   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 71.3  | RM = | 235.4  |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 5.2   | 3.30 | 17.2   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 3.30 | 0.0    |
|                             |       |       |        | Soil Cover .....    | 8.3   | 3.30 | 27.3   |
|                             |       |       |        | Axial Force P ..... | 60.0  | 3.30 | 198.0  |
|                             |       |       |        | Water Buoyancy .    | -2.2  | 3.30 | -7.2   |
| Arm of Vertical Resultant = |       |       |        | Rv =                | 71.3  | RM = | 235.4  |
| Overturning Safety Factor = |       |       |        |                     |       |      |        |

OK

**PUNCHING SHEAR (Comb: 1.4D)**

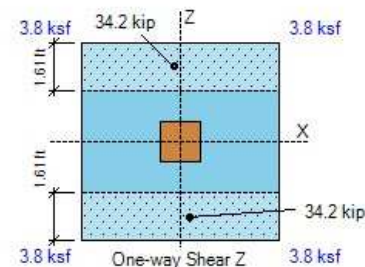
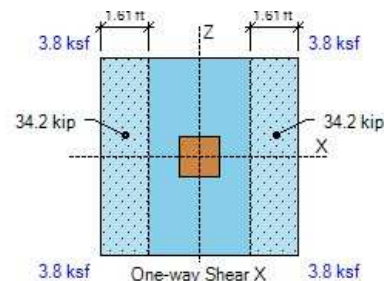
|                                            |               |
|--------------------------------------------|---------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.40          |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.40          |
| Punching Shear due to Axial ....           | 88.3 psi      |
| Punching Shear due to $M_x$ .....          | 0.0 psi       |
| Punching Shear due to $M_z$ .....          | 0.0 psi       |
| Punching Shear Stress $V_u$ .....          | 88.3 psi      |
| Effective Perimeter $b_o$ .....            | 113.0 in      |
| Average Effective Depth $d$ .....          | 12.3 in       |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |
| Column Aspect Ratio $\beta$ .....          | 1.00          |
| Punching Shear Strength $\phi V_c$ ..      | 164.3 psi     |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.54 OK       |

**SLIDING (combDlg. 0.6D+0.6W)**

|                                    |                       |
|------------------------------------|-----------------------|
| Footing-Soil Friction Coeff. ....  | 0.45                  |
| Friction Force at Base .....       | 32.1 kip              |
| Passive Pressure Coeff. $K_p$ .... | 4.33                  |
|                                    | <b>X-X</b> <b>Z-Z</b> |
| Passive Force @ Ftg ...            | 15.4 15.4 kip         |
| Horiz. Resisting Force             | 47.4 47.4 kip         |
| Horiz. Sliding Force .....         | 0.0 0.0 kip           |
| Sliding Safety Factor ...          | 99.99 99.99 > 1.5 OK  |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |                |
|----------------------------|----------------|
| Uplift Force $P$ .....     | 0.0 kip        |
| Pedestal Selfweight .....  | 0.0 kip        |
| Footing Selfweight .....   | 5.2 kip        |
| Soil Cover Weight .....    | 8.3 kip        |
| Downward Force $W$ .....   | 13.5 kip       |
| Uplift Safety Factor ..... | 99.99 > 1.0 OK |





**ONE-WAY SHEAR (Comb: 1.4D)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 34.2   | 34.2   | kip |
| One-way Shear $V_{uz}$ ...                 | 34.2   | 34.2   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 46.3   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 44.5   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.77   |        | OK  |

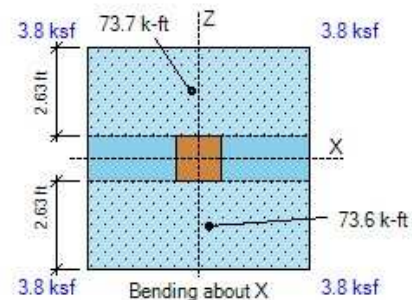
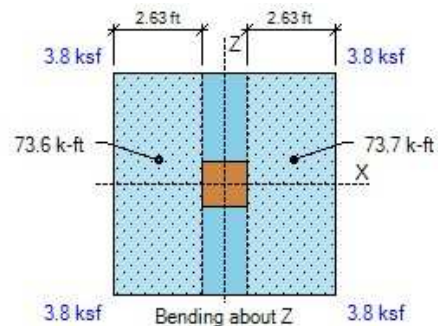
**FLEXURE (Comb: 1.4D)**

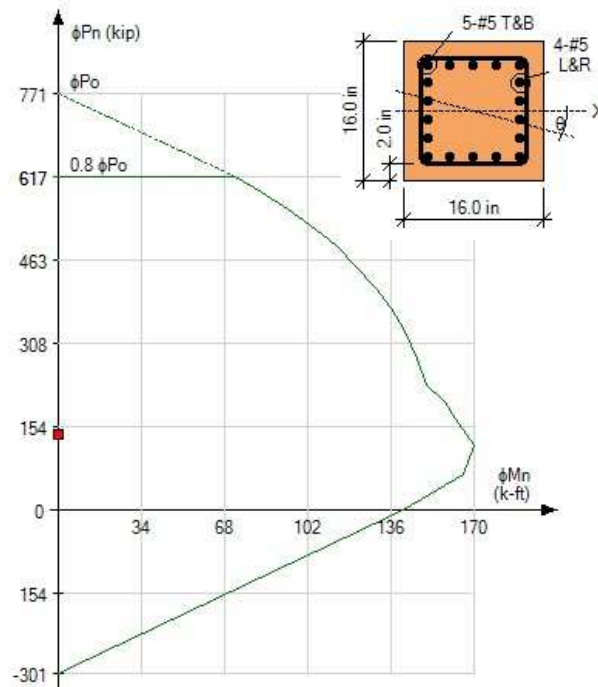
| - Top Bars -                                        | - Side | + Side |      |
|-----------------------------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ...                        | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ...                        | 0.0    | 0.0    | k-ft |
| <i>No Top Reinforcement Provided at the Footing</i> |        |        |      |
| <i>Use Plain Concrete Flexural Strength at Top</i>  |        |        |      |
| X-Bars Development Length Ratio ..                  | N.A.   |        |      |
| Z-Bars Development Length Ratio ..                  | N.A.   |        |      |
| Min. Top Steel Area Ratio .....                     | N.A.   |        |      |
| Under-strength $\phi$ Factor .....                  | 0.60   |        |      |
| Bending Strength $-\phi M_{nx}$ .....               | 46.3   | k-ft   | OK   |
| Bending Strength $-\phi M_{nz}$ .....               | 46.3   | k-ft   | OK   |
| Max. Bending Ratio $-M_u/\phi M_n$ .....            | 0.00   |        | OK   |
| Max. Bar Spacing Ratio .....                        | N.A.   |        |      |

| - Bottom Bars -                                                     | - Side | + Side |      |
|---------------------------------------------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ...                                        | 73.6   | 73.7   | k-ft |
| Bending Moment $+M_{uz}$ ...                                        | 73.6   | 73.7   | k-ft |
| <i>Use 6 #6 Bars Parallel to X (Bot) , <math>d = 12.6</math> in</i> |        |        |      |
| <i>Use 6 #6 Bars Parallel to Z (Bot) , <math>d = 11.9</math> in</i> |        |        |      |
| X-Bars Development Length Ratio ..                                  | 0.36   |        | OK   |
| Z-Bars Development Length Ratio ..                                  | 0.36   |        | OK   |
| Min. Bottom Steel Area Ratio .....                                  | 0.86   |        | OK   |
| Under-strength $\phi$ Factor .....                                  | 0.90   |        |      |
| Bending Strength $+\phi M_{nx}$ .....                               | 136.4  | k-ft   | OK   |
| Bending Strength $+\phi M_{nz}$ .....                               | 145.3  | k-ft   | OK   |
| Max. Bending Ratio $+M_u/\phi M_n$ .....                            | 0.54   |        | OK   |
| Max. Bar Spacing Ratio .....                                        | 0.81   |        | OK   |

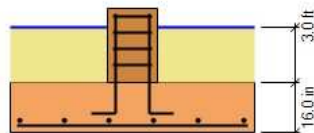
**TRANSFER (Comb: 1.4D)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.5   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

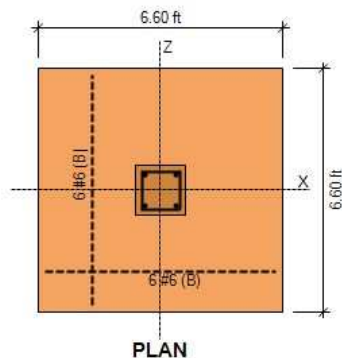




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.4D



ELEVATION



PLAN

### DESIGN CODES

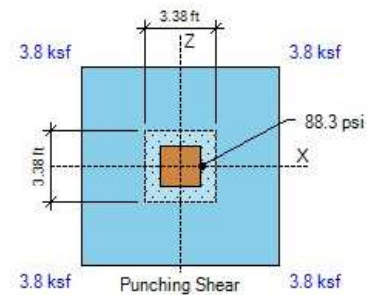
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

### MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

### COLUMN (Comb: 1.4D)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 140.0 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 614.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 169.9 | k-ft |
| Biaxial Strength Ratio .....       | 0.23  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 7.00  | ft |    |
| Footing Width (Z-dir) .....  | 7.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 16.0  | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+0.75L+0.75Lr)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 2 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 3 ....     | 3.0   | ksf |    |
| Soil Pressure at Corner 4 ....     | 3.0   | ksf |    |
| Bearing Pressure Ratio .....       | 0.99  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

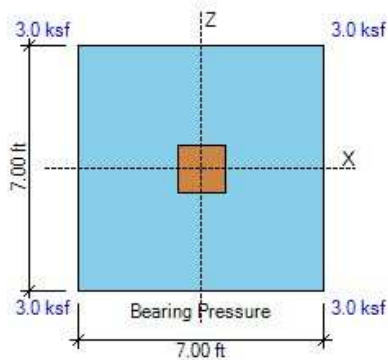
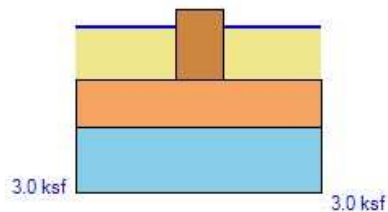
## APPLIED LOADS

|                      | Dead  | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|-------|------|-------|------|------|---------|------|
| Axial Force P .....  | 106.0 | 10.0 | 15.0  | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 5.9   | 3.50 | 20.6   |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 3.50 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 9.4   | 3.50 | 32.7   |
| Rh =                        | 0.0   | OTM = | 0.0    | Axial Force P ..... | 63.6  | 3.50 | 222.6  |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -2.4  | 3.50 | -8.6   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv =                | 76.4  | RM = | 267.3  |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 5.9   | 3.50 | 20.6   |
| Rh =                        | 0.0   | OTM = | 0.0    | Column Weight ..    | 0.0   | 3.50 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 9.4   | 3.50 | 32.7   |
| Arm of Vertical Resultant = | 3.50  | 3.50  | ft     | Axial Force P ..... | 63.6  | 3.50 | 222.6  |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -2.4  | 3.50 | -8.6   |
|                             |       |       |        | Rv =                | 76.4  | RM = | 267.3  |

OK

**PUNCHING SHEAR (Comb: 1.2D+0.5L+1.6Lr)**

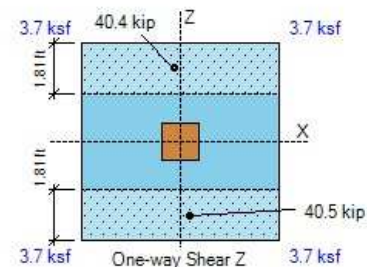
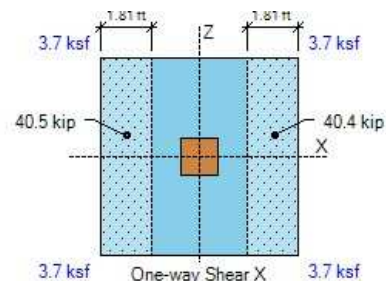
|                                            |               |
|--------------------------------------------|---------------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.40          |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.40          |
| Punching Shear due to Axial ....           | 100.1 psi     |
| Punching Shear due to $M_x$ .....          | 0.0 psi       |
| Punching Shear due to $M_z$ .....          | 0.0 psi       |
| Punching Shear Stress $V_u$ .....          | 100.1 psi     |
| Effective Perimeter $b_o$ .....            | 113.0 in      |
| Average Effective Depth $d$ .....          | 12.3 in       |
| Column Location Factor $\alpha_s$ ....     | 40 (Interior) |
| Column Aspect Ratio $\beta$ .....          | 1.00          |
| Punching Shear Strength $\phi V_c$ ..      | 164.3 psi     |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.61 OK       |

**SLIDING (combDlg. 0.6D+0.6W)**

|                                   |                       |
|-----------------------------------|-----------------------|
| Footing-Soil Friction Coeff. .... | 0.45                  |
| Friction Force at Base .....      | 34.4 kip              |
| Passive Pressure Coeff. Kp ....   | 4.33                  |
|                                   | <b>X-X</b> <b>Z-Z</b> |
| Passive Force @ Ftg ...           | 16.3 16.3 kip         |
| Horiz. Resisting Force            | 50.7 50.7 kip         |
| Horiz. Sliding Force .....        | 0.0 0.0 kip           |
| Sliding Safety Factor ...         | 99.99 99.99 > 1.5 OK  |

**UPLIFT (Comb: 0.6D+0.6W)**

|                            |                |
|----------------------------|----------------|
| Uplift Force P .....       | 0.0 kip        |
| Pedestal Selfweight .....  | 0.0 kip        |
| Footing Selfweight .....   | 5.9 kip        |
| Soil Cover Weight .....    | 9.4 kip        |
| Downward Force W .....     | 15.2 kip       |
| Uplift Safety Factor ..... | 99.99 > 1.0 OK |



**ONE-WAY SHEAR (Comb: 1.2D+0.5L+1.6Lr)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 40.5   | 40.4   | kip |
| One-way Shear $V_{uz}$ ...                 | 40.5   | 40.4   | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 48.2   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 46.3   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.88   |        | OK  |

**FLEXURE (Comb: 1.2D+0.5L+1.6Lr)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing*

*Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 49.1 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 49.1 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 89.7   | 89.7   | k-ft |
| Bending Moment $+M_{uz}$ ... | 89.7   | 89.7   | k-ft |

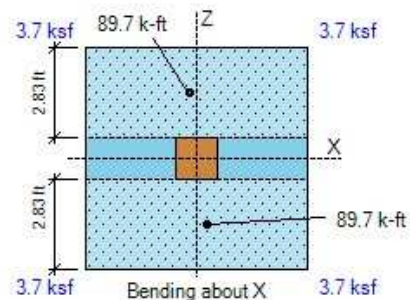
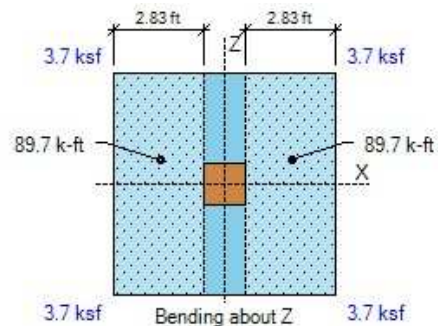
*Use 6 #6 Bars Parallel to X (Bot) ,  $d = 12.6$  in*

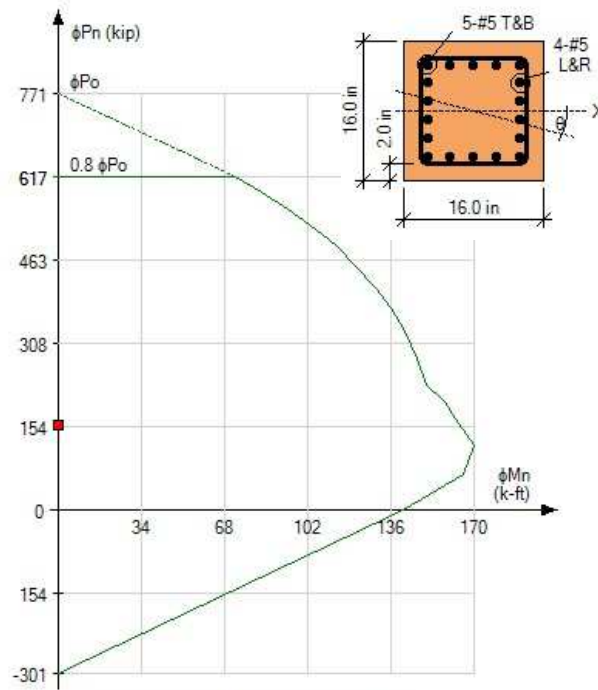
*Use 6 #6 Bars Parallel to Z (Bot) ,  $d = 11.9$  in*

|                                          |       |         |
|------------------------------------------|-------|---------|
| X-Bars Development Length Ratio ..       | 0.33  | OK      |
| Z-Bars Development Length Ratio ..       | 0.33  | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.92  | OK      |
| Under-strength $\phi$ Factor .....       | 0.90  |         |
| Bending Strength $+\phi M_{nx}$ .....    | 136.7 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 145.6 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.66  | OK      |
| Max. Bar Spacing Ratio .....             | 0.87  | OK      |

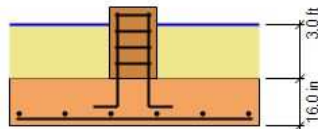
**TRANSFER (Comb: 1.2D+0.5L+1.6Lr)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.6   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

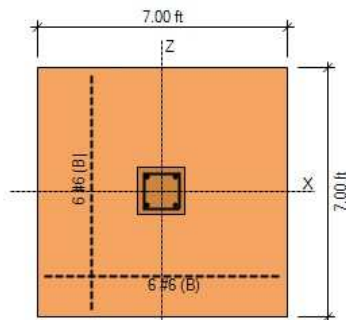




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+0.5L+1.6Lr



ELEVATION



PLAN

## DESIGN CODES

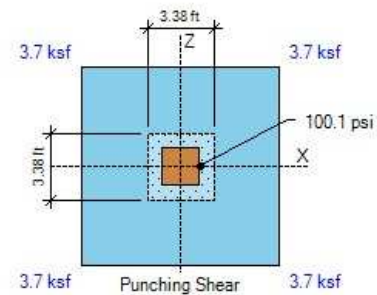
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+0.5L+1.6Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 156.2 | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 614.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 166.9 | k-ft |
| Biaxial Strength Ratio .....       | 0.25  | OK   |





## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 4.00  | ft |    |
| Footing Width (Z-dir) .....  | 4.00  | ft |    |
| Footing Thickness .....      | 16.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 16.0  | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+0.75L+0.75Lr)

|                                    |       |     |    |
|------------------------------------|-------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0   | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.6   | ksf |    |
| Soil Pressure at Corner 2 ....     | 2.6   | ksf |    |
| Soil Pressure at Corner 3 ....     | 2.6   | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.6   | ksf |    |
| Bearing Pressure Ratio .....       | 0.88  |     | OK |
| Ftg. Area in Contact with Soil ..  | 100.0 | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00  |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.00  |     | OK |

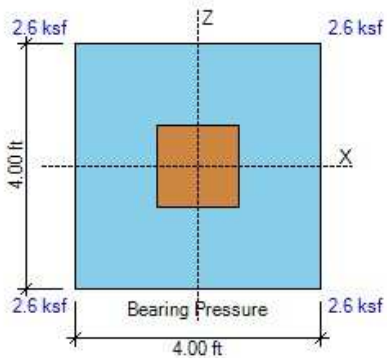
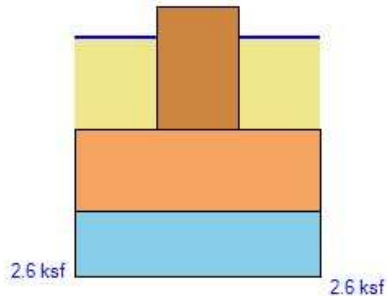
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 25.0 | 10.0 | 4.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
|                             | kip   | ft    | k-ft   |                     | kip   | ft   | k-ft   |
| - About X-X                 |       |       |        | - About X-X         |       |      |        |
| Moment Mx .....             | ---   | ---   | 0.0    | Footing Weight ..   | 1.9   | 2.00 | 3.8    |
| Shear Force Vz ....         | 0.0   | 1.33  | 0.0    | Column Weight ..    | 0.0   | 2.00 | 0.0    |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Soil Cover .....    | 2.8   | 2.00 | 5.6    |
| Rh = 0.0                    |       | OTM = | 0.0    | Axial Force P ..... | 15.0  | 2.00 | 30.0   |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -0.8  | 2.00 | -1.6   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv = 18.9           |       | RM = | 37.9   |
| Shear Force Vx ....         | 0.0   | 1.33  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.53  | 0.0    | Footing Weight ..   | 1.9   | 2.00 | 3.8    |
| Rh = 0.0                    |       | OTM = | 0.0    | Column Weight ..    | 0.0   | 2.00 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 2.8   | 2.00 | 5.6    |
| Arm of Vertical Resultant = | 2.00  | 2.00  | ft     | Axial Force P ..... | 15.0  | 2.00 | 30.0   |
| Overturning Safety Factor = | 99.99 | 99.99 | > 1.5  | Water Buoyancy .    | -0.8  | 2.00 | -1.6   |
|                             |       |       |        | Rv = 18.9           |       | RM = | 37.9   |

OK

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 8.5        | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 9.3        | 9.3         |
| Horiz. Resisting Force            | 17.8       | 17.8        |
| Horiz. Sliding Force .....        | 0.0        | 0.0         |
| Sliding Safety Factor ...         | 99.99      | 99.99 > 1.5 |

OK

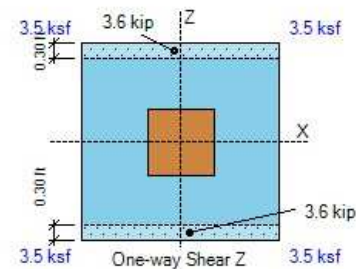
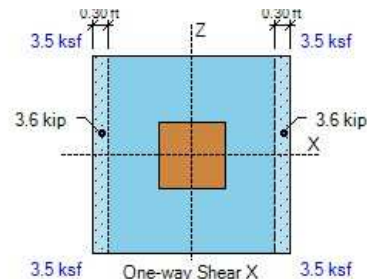
**UPLIFT (Comb: 0.6D+0.6W)**

|                            |       |       |
|----------------------------|-------|-------|
| Uplift Force P .....       | 0.0   | kip   |
| Pedestal Selfweight .....  | 0.0   | kip   |
| Footing Selfweight .....   | 1.9   | kip   |
| Soil Cover Weight .....    | 2.8   | kip   |
| Downward Force W .....     | 4.7   | kip   |
| Uplift Safety Factor ..... | 99.99 | > 1.0 |

OK

**PUNCHING SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            |             |     |
|--------------------------------------------|-------------|-----|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.40        |     |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.40        |     |
| Punching Shear due to Axial ....           | 35.4        | psi |
| Punching Shear due to $M_x$ .....          | 0.0         | psi |
| Punching Shear due to $M_z$ .....          | 0.0         | psi |
| Punching Shear Stress $V_u$ .....          | 35.4        | psi |
| Effective Perimeter $b_o$ .....            | 76.4        | in  |
| Average Effective Depth $d$ .....          | 12.4        | in  |
| Column Location Factor $\alpha_s$ ....     | 20 (Corner) |     |
| Column Aspect Ratio $\beta$ .....          | 1.00        |     |
| Punching Shear Strength $\phi V_c$ ..      | 164.3       | psi |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.22        | OK  |



**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5Lr)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 3.6    | 3.6    | kip |
| One-way Shear $V_{uz}$ ...                 | 3.6    | 3.6    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$ ..... | 27.9   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$ ..... | 26.9   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.13   |        | OK  |

**FLEXURE (Comb: 1.2D+1.6L+0.5Lr)****- Top Bars -**

|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ... | 0.0    | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ... | 0.0    | 0.0    | k-ft |

*No Top Reinforcement Provided at the Footing**Use Plain Concrete Flexural Strength at Top*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | N.A. |         |
| Z-Bars Development Length Ratio ..       | N.A. |         |
| Min. Top Steel Area Ratio .....          | N.A. |         |
| Under-strength $\phi$ Factor .....       | 0.60 |         |
| Bending Strength $-\phi M_{nx}$ .....    | 28.0 | k-ft OK |
| Bending Strength $-\phi M_{nz}$ .....    | 28.0 | k-ft OK |
| Max. Bending Ratio $-M_u/\phi M_n$ ..... | 0.00 | OK      |
| Max. Bar Spacing Ratio .....             | N.A. |         |

**- Bottom Bars -**

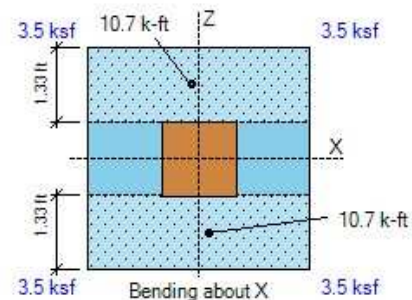
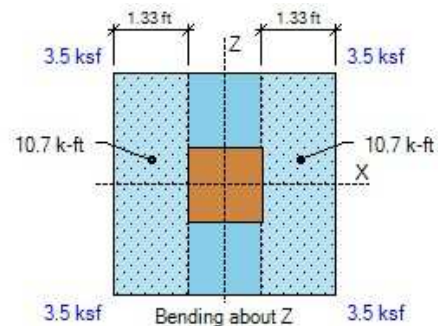
|                              | - Side | + Side |      |
|------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ... | 10.7   | 10.7   | k-ft |
| Bending Moment $+M_{uz}$ ... | 10.7   | 10.7   | k-ft |

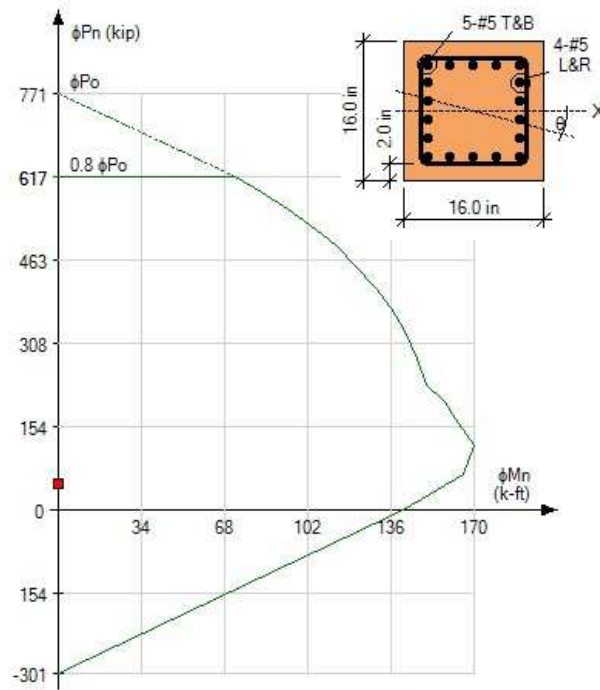
*Use 5 #5 Bars Parallel to X (Bot) ,  $d = 12.7$  in**Use 5 #5 Bars Parallel to Z (Bot) ,  $d = 12.1$  in*

|                                          |      |         |
|------------------------------------------|------|---------|
| X-Bars Development Length Ratio ..       | 0.58 | OK      |
| Z-Bars Development Length Ratio ..       | 0.58 | OK      |
| Min. Bottom Steel Area Ratio .....       | 0.89 | OK      |
| Under-strength $\phi$ Factor .....       | 0.90 |         |
| Bending Strength $+\phi M_{nx}$ .....    | 81.5 | k-ft OK |
| Bending Strength $+\phi M_{nz}$ .....    | 85.8 | k-ft OK |
| Max. Bending Ratio $+M_u/\phi M_n$ ..... | 0.13 | OK      |
| Max. Bar Spacing Ratio .....             | 0.58 | OK      |

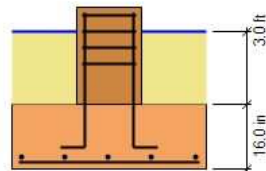
**TRANSFER (Comb: 1.2D+1.6L+0.5Lr)**

|                                                                                   |       |                    |
|-----------------------------------------------------------------------------------|-------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                        | 0.65  |                    |
| <i>Use 18 #5 x 3.00 ft hooked dowels , <math>A_s = 5.58</math> in<sup>2</sup></i> |       |                    |
| Bearing Stress $P_{bu}$ .....                                                     | 0.2   | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                            | 3.1   | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                           | 4.2   | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                  | 0.0   | kip                |
| Shear Friction Strength $\phi V_n$ .....                                          | 150.7 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                             | 2.56  | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                             | 0.33  | OK                 |
| Develop. Length Ratio at Footing .....                                            | 0.97  | OK                 |

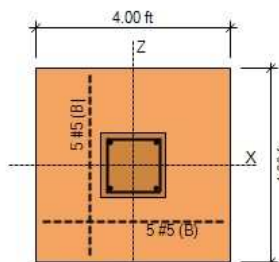




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+1.6L+0.5Lr



ELEVATION



PLAN

## DESIGN CODES

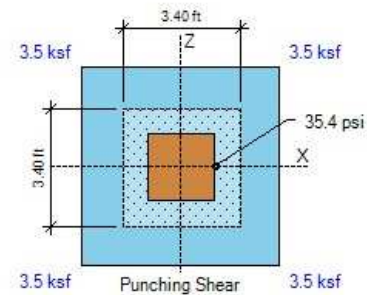
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 4.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+1.6L+0.5Lr)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 48.0  | kip  |
| Bending Moment $M_u$ .....         | 0.0   | k-ft |
| Axial Strength $\phi P_n$ .....    | 614.3 | kip  |
| Flexural Strength $\phi M_n$ ..... | 156.8 | k-ft |
| Biaxial Strength Ratio .....       | 0.08  | OK   |



## GEOMETRY

|                              |       |    |    |
|------------------------------|-------|----|----|
| Footing Length (X-dir) ..... | 4.50  | ft |    |
| Footing Width (Z-dir) .....  | 4.66  | ft |    |
| Footing Thickness .....      | 24.0  | in | OK |
| Soil Cover .....             | 3.00  | ft |    |
| Column Length (X-dir) .....  | 6.0   | in |    |
| Column Width (Z-dir) .....   | 16.0  | in |    |
| Offset (X-dir) .....         | 0.00  | in | OK |
| Offset (Z-dir) .....         | 0.00  | in | OK |
| Pedestal Height .....        | N. A. |    |    |

## SOIL PRESSURES (D+0.75L+0.75Lr+0.45W)

|                                    |      |     |    |
|------------------------------------|------|-----|----|
| Gross Allow. Soil Pressure ..      | 3.0  | ksf |    |
| Soil Pressure at Corner 1 ....     | 2.2  | ksf |    |
| Soil Pressure at Corner 2 ....     | 0.0  | ksf |    |
| Soil Pressure at Corner 3 ....     | 0.0  | ksf |    |
| Soil Pressure at Corner 4 ....     | 2.2  | ksf |    |
| Bearing Pressure Ratio .....       | 0.73 |     | OK |
| Ftg. Area in Contact with Soil ..  | 0.0  | %   |    |
| X-eccentricity / Ftg. Length ..... | 0.00 |     | OK |
| Z-eccentricity / Ftg. Width .....  | 0.27 |     | OK |

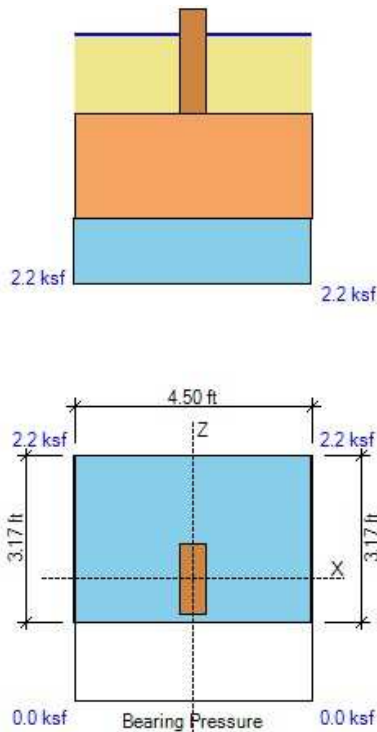
## APPLIED LOADS

|                      | Dead | Live | RLive | Snow | Wind | Seismic |      |
|----------------------|------|------|-------|------|------|---------|------|
| Axial Force P .....  | 4.4  | 1.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Moment about X Mx .. | 13.0 | 3.0  | 0.0   | 0.0  | 8.0  | 0.0     | k-ft |
| Moment about Z Mz .. | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Shear Force Vx ..... | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Shear Force Vz ..... | 0.0  | 0.0  | 0.0   | 0.0  | 1.0  | 0.0     | kip  |

## OVERTURNING CALCULATIONS (Comb: 0.6D+0.6W)

| OVERTURNING                 |       |       |        | RESISTING           |       |      |        |
|-----------------------------|-------|-------|--------|---------------------|-------|------|--------|
|                             | Force | Arm   | Moment |                     | Force | Arm  | Moment |
| - About X-X                 | kip   | ft    | k-ft   | - About X-X         | kip   | ft   | k-ft   |
| Moment Mx .....             | ---   | ---   | 12.6   | Footing Weight ..   | 3.8   | 2.33 | 8.8    |
| Shear Force Vz ....         | 0.6   | 2.00  | 1.2    | Column Weight ..    | 0.0   | 2.33 | 0.0    |
| Passive Pressure            | 0.0   | 0.80  | 0.0    | Soil Cover .....    | 4.0   | 2.33 | 9.4    |
| Rh = 0.6                    |       | OTM = | 13.8   | Axial Force P ..... | 2.6   | 2.33 | 6.2    |
| - About Z-Z                 |       |       |        | Water Buoyancy .    | -1.6  | 2.33 | -3.7   |
| Moment Mz .....             | ---   | ---   | 0.0    | Rv = 8.9            |       | RM = | 20.7   |
| Shear Force Vx ....         | 0.0   | 2.00  | 0.0    | - About Z-Z         |       |      |        |
| Passive Pressure            | 0.0   | 0.80  | 0.0    | Footing Weight ..   | 3.8   | 2.25 | 8.5    |
| Rh = 0.0                    |       | OTM = | 0.0    | Column Weight ..    | 0.0   | 2.25 | 0.0    |
|                             |       | X-X   | Z-Z    | Soil Cover .....    | 4.0   | 2.25 | 9.0    |
| Arm of Vertical Resultant = | 0.77  | 2.25  | ft     | Axial Force P ..... | 2.6   | 2.25 | 5.9    |
| Overturning Safety Factor = | 1.50  | 99.99 | < 1.5  | Water Buoyancy .    | -1.6  | 2.33 | -3.7   |
|                             |       |       |        | Rv = 8.9            |       | RM = | 19.9   |

NG

**SLIDING (combDIg. 0.6D+0.6W)**

|                                   |            |             |
|-----------------------------------|------------|-------------|
| Footing-Soil Friction Coeff. .... | 0.45       |             |
| Friction Force at Base .....      | 4.0        | kip         |
| Passive Pressure Coeff. Kp ....   | 4.33       |             |
|                                   | <b>X-X</b> | <b>Z-Z</b>  |
| Passive Force @ Ftg ...           | 17.7       | 17.1        |
| Horiz. Resisting Force            | 21.7       | 21.1        |
| Horiz. Sliding Force .....        | 0.0        | 0.6         |
| Sliding Safety Factor ...         | 99.99      | 35.19 > 1.5 |

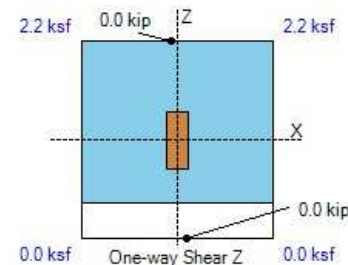
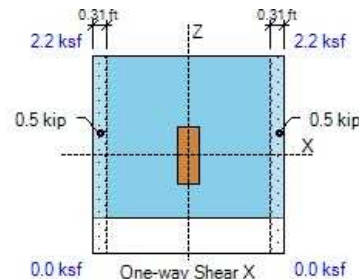
**UPLIFT (Comb: 0.6D+0.6W)**

|                            |             |     |
|----------------------------|-------------|-----|
| Uplift Force P .....       | 0.0         | kip |
| Pedestal Selfweight .....  | 0.0         | kip |
| Footing Selfweight .....   | 3.8         | kip |
| Soil Cover Weight .....    | 4.0         | kip |
| Downward Force W .....     | 7.8         | kip |
| Uplift Safety Factor ..... | 99.99 > 1.0 | OK  |

**PUNCHING SHEAR (Comb: 1.2D+0.5L+0.5Lr+W)**

|                                            |           |
|--------------------------------------------|-----------|
| Unbalanced Moment Factor $\gamma_{vx}$ ... | 0.47      |
| Unbalanced Moment Factor $\gamma_{vz}$ ... | 0.33      |
| Punching Shear due to Axial ....           | 2.8       |
| Punching Shear due to $M_x$ .....          | 4.5       |
| Punching Shear due to $M_z$ .....          | 0.0       |
| Punching Shear Stress $V_u$ .....          | 7.3       |
| Effective Perimeter $b_o$ .....            | 118.4     |
| Average Effective Depth $d$ .....          | 20.3      |
| Column Location Factor $\alpha_s$ ....     | 30 (Edge) |
| Column Aspect Ratio $\beta$ .....          | 2.67      |
| Punching Shear Strength $\phi V_c$ ..      | 143.8     |
| Punching Shear Ratio $V_u/\phi V_c$ .....  | 0.05      |

OK





**ONE-WAY SHEAR (Comb: 1.2D+1.6L+0.5S)**

|                                            | - Side | + Side |     |
|--------------------------------------------|--------|--------|-----|
| One-way Shear $V_{ux}$ ...                 | 0.5    | 0.5    | kip |
| One-way Shear $V_{uz}$ ...                 | 0.0    | 0.0    | kip |
| Under-strength $\phi$ Factor .....         | 0.75   |        |     |
| One-way Shear Strength $\phi V_{cx}$       | 51.0   | kip    | OK  |
| One-way Shear Strength $\phi V_{cz}$       | 48.6   | kip    | OK  |
| Max. One-way Shear Ratio $V_u/\phi V_c$ .. | 0.01   |        | OK  |

**FLEXURE (Comb: 1.2D+0.5L+0.5S+W)****- Top Bars -**

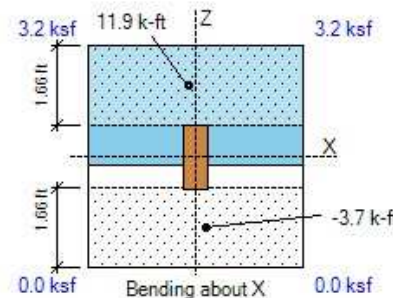
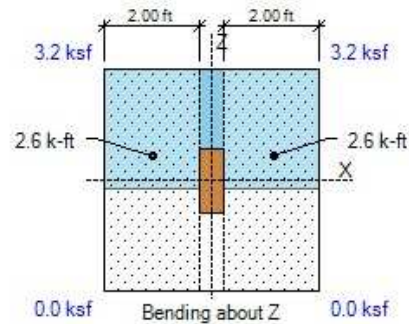
|                                                                     | - Side | + Side |      |
|---------------------------------------------------------------------|--------|--------|------|
| Bending Moment $-M_{ux}$ ...                                        | -3.7   | 0.0    | k-ft |
| Bending Moment $-M_{uz}$ ...                                        | 0.0    | 0.0    | k-ft |
| <i>Use 6 #6 Bars Parallel to X (Top) , <math>d = 21.6</math> in</i> |        |        |      |
| <i>Use 6 #6 Bars Parallel to Z (Top) , <math>d = 20.9</math> in</i> |        |        |      |
| X-Bars Development Length Ratio ..                                  | 0.56   |        | OK   |
| Z-Bars Development Length Ratio ..                                  | 0.69   |        | OK   |
| Min. Top Steel Area Ratio .....                                     | 0.92   |        | OK   |
| Under-strength $\phi$ Factor .....                                  | 0.90   |        |      |
| Bending Strength $-\phi M_{nx}$ .....                               | 241.1  | k-ft   | OK   |
| Bending Strength $-\phi M_{nz}$ .....                               | 250.3  | k-ft   | OK   |
| Max. Bending Ratio $-M_u/\phi M_n$ .....                            | 0.02   |        | OK   |
| Max. Bar Spacing Ratio .....                                        | 0.58   |        | OK   |

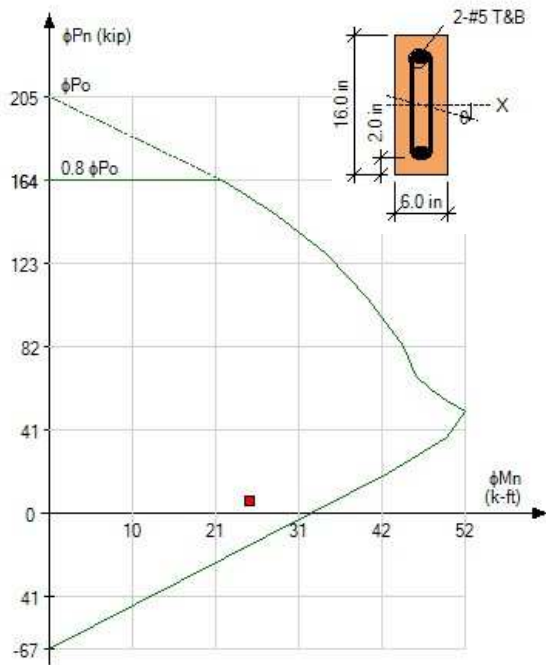
**- Bottom Bars -**

|                                                                     | - Side | + Side |      |
|---------------------------------------------------------------------|--------|--------|------|
| Bending Moment $+M_{ux}$ ...                                        | 0.0    | 11.9   | k-ft |
| Bending Moment $+M_{uz}$ ...                                        | 2.6    | 2.6    | k-ft |
| <i>Use 6 #6 Bars Parallel to X (Bot) , <math>d = 20.6</math> in</i> |        |        |      |
| <i>Use 6 #6 Bars Parallel to Z (Bot) , <math>d = 19.9</math> in</i> |        |        |      |
| X-Bars Development Length Ratio ..                                  | 0.48   |        | OK   |
| Z-Bars Development Length Ratio ..                                  | 0.59   |        | OK   |
| Min. Bottom Steel Area Ratio .....                                  | 0.92   |        | OK   |
| Under-strength $\phi$ Factor .....                                  | 0.90   |        |      |
| Bending Strength $+\phi M_{nx}$ .....                               | 229.3  | k-ft   | OK   |
| Bending Strength $+\phi M_{nz}$ .....                               | 234.4  | k-ft   | OK   |
| Max. Bending Ratio $+M_u/\phi M_n$ .....                            | 0.05   |        | OK   |
| Max. Bar Spacing Ratio .....                                        | 0.55   |        | OK   |

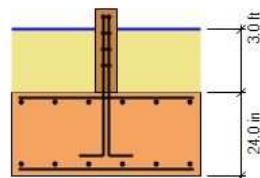
**TRANSFER (Comb: 1.2D+0.5L+0.5S+W)**

|                                                                                  |      |                    |
|----------------------------------------------------------------------------------|------|--------------------|
| Bearing Under-strength $\phi$ Factor .....                                       | 0.65 |                    |
| <i>Use 4 #5 x 3.00 ft hooked dowels , <math>A_s = 1.24</math> in<sup>2</sup></i> |      |                    |
| Bearing Stress $P_{bu}$ .....                                                    | 1.2  | ksi                |
| Column Bearing Strength $\phi P_n$ ...                                           | 2.2  | ksi OK             |
| Footing Bearing Strength $\phi P_n$ ...                                          | 3.8  | ksi OK             |
| Shear Force Transfer $V_u$ .....                                                 | 1.0  | kip                |
| Shear Friction Strength $\phi V_n$ .....                                         | 33.5 | kip OK             |
| Min. Steel Area $A_s = 0.005 A_1$ ...                                            | 0.96 | in <sup>2</sup> OK |
| Develop. Length Ratio at Column .....                                            | 0.72 | OK                 |
| Develop. Length Ratio at Footing .....                                           | 0.60 | OK                 |

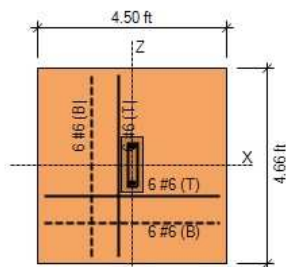




INTERACTION DIAGRAM AT  $\theta = 0^\circ$   
Controlling Load Comb: 1.2D+0.5L+0.5Lr+W



ELEVATION



PLAN

## DESIGN CODES

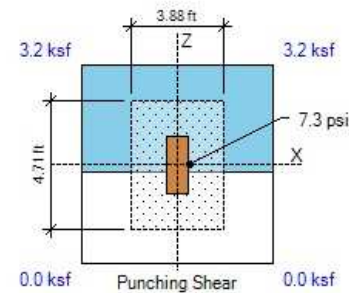
|                         |              |
|-------------------------|--------------|
| Concrete Design .....   | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

## MATERIALS

|                               |       |     |
|-------------------------------|-------|-----|
| Column Concrete $f'_c$ .....  | 3.0   | ksi |
| Column Dowels $f_y$ .....     | 60.0  | ksi |
| Column Ties $f_y$ .....       | 60.0  | ksi |
| Footing Concrete $f'_c$ ..... | 3.0   | ksi |
| Footing Rebars $f_y$ .....    | 60.0  | ksi |
| Soil Cover Density .....      | 110.0 | pcf |

## COLUMN (Comb: 1.2D+0.5L+0.5Lr+W)

|                                    |       |      |
|------------------------------------|-------|------|
| Axial Load $P_u$ .....             | 5.8   | kip  |
| Bending Moment $M_u$ .....         | 25.1  | k-ft |
| Axial Strength $\phi P_n$ .....    | 163.4 | kip  |
| Flexural Strength $\phi M_n$ ..... | 36.3  | k-ft |
| Biaxial Strength Ratio .....       | 0.69  | OK   |



## GEOMETRY

|                                   |            |
|-----------------------------------|------------|
| Column Designation .....          | HSS4X4X1/2 |
| Steel Yield Strength $F_y$ .....  | 50.0 ksi   |
| Modulus of Elasticity $E_s$ ..... | 29000 ksi  |
| Member Length $L$ .....           | 2.00 ft    |
| Effective Length Kx-factor .....  | 1.00       |
| Effective Length Ky-factor .....  | 1.00       |
| Unbraced Length $L_b$ .....       | N.A. ft    |

## PROPERTIES

|             |                      |            |                       |
|-------------|----------------------|------------|-----------------------|
| Weight      | 22 lb/ft             | $S_x$ ...  | 6.0 in <sup>3</sup>   |
| Area .      | 6.0 in <sup>2</sup>  | $Z_x$ ...  | 7.7 in <sup>3</sup>   |
| Depth       | 4.0 in               | $r_x$ .... | 1.41 in               |
| Width       | 4.00 in              | $I_y$ .... | 11.9 in <sup>4</sup>  |
| $t_{nom}$ . | 0.50 in              | $S_y$ ...  | 6.0 in <sup>3</sup>   |
| $t_{des}$ . | 0.47 in              | $Z_y$ ...  | 7.7 in <sup>3</sup>   |
| $I_x$ ..... | 11.9 in <sup>4</sup> | $r_y$ .... | 1.41 in               |
|             |                      | $J$ ....   | 21.00 in <sup>4</sup> |

## UNFACTORED LOADS (Elastic Second-Order Analysis)

|                       | Dead  | Live | RLive | Snow | Wind | Seismic |      |
|-----------------------|-------|------|-------|------|------|---------|------|
| Axial Force $P$ ..... | 100.0 | 20.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| $M_x$ at Bottom ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| $M_x$ at Top .....    | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| $M_y$ at Bottom ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| $M_y$ at Top .....    | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |

## COLUMN STRENGTH

| Comb | $P_r$<br>(kip) | $P_c$<br>(kip) | $P_r/P_c$<br>Ratio | $M_{rx}$<br>(k-ft) | $M_{cx}$<br>(k-ft) | $M_{rx}/M_{cx}$<br>Ratio | $M_{ry}$<br>(k-ft) | $M_{cy}$<br>(k-ft) | $M_{ry}/M_{cy}$<br>Ratio | H1-1a<br>Ratio | H1-1b<br>Ratio |    |
|------|----------------|----------------|--------------------|--------------------|--------------------|--------------------------|--------------------|--------------------|--------------------------|----------------|----------------|----|
| ①    | 140.0          | 265.2          | 0.53               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.53           | N.A.           | OK |
| ②    | 152.0          | 265.2          | 0.57               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.57           | N.A.           | OK |
| ③    | 152.0          | 265.2          | 0.57               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.57           | N.A.           | OK |
| ④    | 130.0          | 265.2          | 0.49               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.49           | N.A.           | OK |
| ⑤    | 130.0          | 265.2          | 0.49               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.49           | N.A.           | OK |
| ⑥    | 120.0          | 265.2          | 0.45               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.45           | N.A.           | OK |
| ⑦    | 120.0          | 265.2          | 0.45               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.45           | N.A.           | OK |
| ⑧    | 130.0          | 265.2          | 0.49               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.49           | N.A.           | OK |
| ⑨    | 130.0          | 265.2          | 0.49               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.49           | N.A.           | OK |
| ⑩    | 130.0          | 265.2          | 0.49               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.49           | N.A.           | OK |
| ⑪    | 90.0           | 265.2          | 0.34               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.34           | N.A.           | OK |
| ⑫    | 90.0           | 265.2          | 0.34               | 0.0                | 28.9               | 0.00                     | 0.0                | 28.9               | 0.00                     | 0.34           | N.A.           | OK |

## COMPRESSION

|                                       |      |    |
|---------------------------------------|------|----|
| Slenderness Ratio $K_x L / r_x$ ..... | 17.0 |    |
| Slenderness Ratio $K_y L / r_y$ ..... | 17.0 |    |
| Max. Slenderness Ratio .....          | 17.0 | OK |

| Limit States                      | Nominal $P_n$ |     |
|-----------------------------------|---------------|-----|
| Flexural Buckling                 | 294.7         | kip |
| Torsional Buckling                | N.A.          | kip |
| Flexural-Torsional Buckling       | N.A.          | kip |
| Nominal Strength $P_n$ .....      | 294.7         | kip |
| Resistance Factor $\phi$ .....    | 0.90          |     |
| Design Strength $\phi P_n$ .....  | 265.2         | kip |
| $P / \phi P_n$ Design Ratio ..... | 0.57          | OK  |

## BENDING ABOUT Y-Y

| Limit States                      | Nominal $M_n$ |      |
|-----------------------------------|---------------|------|
| Yielding                          | 32.1          | k-ft |
| Lateral-Torsional Buckling        | N.A.          | k-ft |
| Flange Local Buckling             | N.A.          | k-ft |
| Web Local Buckling                | N.A.          | k-ft |
| Nominal Strength $M_n$ .....      | 32.1          | k-ft |
| Resistance Factor $\phi$ .....    | 0.90          |      |
| Design Strength $\phi M_n$ .....  | 28.9          | k-ft |
| $M / \phi M_n$ Design Ratio ..... | 0.00          | OK   |

## LOCAL BUCKLING

|                            |             |
|----------------------------|-------------|
| Flanges in Flexure .....   | Compact     |
| Walls in Compression ..... | Non-slender |
| Webs in Flexure .....      | Compact     |

## BENDING ABOUT X-X

|                                    |      |      |
|------------------------------------|------|------|
| Moment at 1/4 point of $L_b$ ..... | N.A. | k-ft |
| Moment at 1/2 point of $L_b$ ..... | N.A. | k-ft |
| Moment at 3/4 point of $L_b$ ..... | N.A. | k-ft |
| L. T. Buckling $C_b$ -factor ..... | N.A. |      |

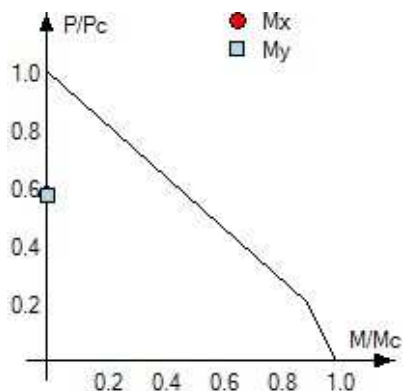
| Limit States                      | Nominal $M_n$ |      |
|-----------------------------------|---------------|------|
| Yielding                          | 32.1          | k-ft |
| Lateral-Torsional Buckling        | N.A.          | k-ft |
| Flange Local Buckling             | N.A.          | k-ft |
| Web Local Buckling                | N.A.          | k-ft |
| Nominal Strength $M_n$ .....      | 32.1          | k-ft |
| Resistance Factor $\phi$ .....    | 0.90          |      |
| Design Strength $\phi M_n$ .....  | 28.9          | k-ft |
| $M / \phi M_n$ Design Ratio ..... | 0.00          | OK   |

## COMBINED FORCES

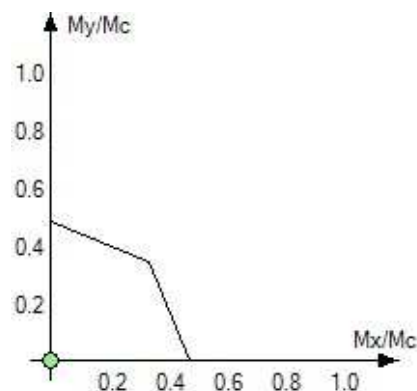
|                             |      |    |
|-----------------------------|------|----|
| Combined Forces Ratio ..... | 0.57 | OK |
|-----------------------------|------|----|

## DESIGN CODES

|                         |              |
|-------------------------|--------------|
| Steel Design .....      | AISC 360-16  |
| Load Combinations ..... | ASCE 7-10/16 |



INTERACTION DIAGRAM



BIAXIAL BENDING DIAGRAM

## GEOMETRY

|                                   |            |
|-----------------------------------|------------|
| Column Designation .....          | HSS8X4X1/2 |
| Steel Yield Strength $F_y$ .....  | 42.0 ksi   |
| Modulus of Elasticity $E_s$ ..... | 29000 ksi  |
| Member Length $L$ .....           | 12.00 ft   |
| Effective Length Kx-factor .....  | 1.00       |
| Effective Length Ky-factor .....  | 1.00       |
| Unbraced Length $L_b$ .....       | N.A. ft    |

## PROPERTIES

|          |                      |         |                       |
|----------|----------------------|---------|-----------------------|
| Weight   | 35 lb/ft             | Sx ...  | 17.9 in <sup>3</sup>  |
| Area .   | 9.7 in <sup>2</sup>  | Zx ...  | 23.5 in <sup>3</sup>  |
| Depth    | 8.0 in               | rx .... | 2.71 in               |
| Width    | 4.00 in              | ly .... | 23.6 in <sup>4</sup>  |
| t nom .  | 0.50 in              | Sy ...  | 11.8 in <sup>3</sup>  |
| t des .  | 0.47 in              | Zy ...  | 14.3 in <sup>3</sup>  |
| Ix ..... | 71.8 in <sup>4</sup> | ry .... | 1.56 in               |
|          |                      | J ....  | 61.10 in <sup>4</sup> |

## UNFACTORED LOADS (Elastic Second-Order Analysis)

|                       | Dead  | Live | RLive | Snow | Wind | Seismic |      |
|-----------------------|-------|------|-------|------|------|---------|------|
| Axial Force $P$ ..... | 100.0 | 0.0  | 10.0  | 0.0  | 0.0  | 0.0     | kip  |
| $M_x$ at Bottom ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| $M_x$ at Top .....    | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| $M_y$ at Bottom ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| $M_y$ at Top .....    | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |

## COLUMN STRENGTH

| Comb | Pr<br>(kip) | Pc<br>(kip) | Pr/Pc<br>Ratio | Mrx<br>(k-ft) | Mcx<br>(k-ft) | Mrx/Mcx<br>Ratio | Mry<br>(k-ft) | Mcy<br>(k-ft) | Mry/Mcy<br>Ratio | H1-1a<br>Ratio | H1-1b<br>Ratio |    |
|------|-------------|-------------|----------------|---------------|---------------|------------------|---------------|---------------|------------------|----------------|----------------|----|
| ①    | 100.0       | 145.1       | 0.69           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.69           | N.A.           | OK |
| ②    | 110.0       | 145.1       | 0.76           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.76           | N.A.           | OK |
| ③    | 100.0       | 145.1       | 0.69           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.69           | N.A.           | OK |
| ④    | 107.5       | 145.1       | 0.74           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.74           | N.A.           | OK |
| ⑤    | 100.0       | 145.1       | 0.69           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.69           | N.A.           | OK |
| ⑥    | 100.0       | 145.1       | 0.69           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.69           | N.A.           | OK |
| ⑦    | 100.0       | 145.1       | 0.69           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.69           | N.A.           | OK |
| ⑧    | 107.5       | 145.1       | 0.74           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.74           | N.A.           | OK |
| ⑨    | 100.0       | 145.1       | 0.69           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.69           | N.A.           | OK |
| ⑩    | 100.0       | 145.1       | 0.69           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.69           | N.A.           | OK |
| ⑪    | 60.0        | 145.1       | 0.41           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.41           | N.A.           | OK |
| ⑫    | 60.0        | 145.1       | 0.41           | 0.0           | 49.3          | 0.00             | 0.0           | 30.0          | 0.00             | 0.41           | N.A.           | OK |

## COMPRESSION

|                                       |      |    |
|---------------------------------------|------|----|
| Slenderness Ratio $K_x L / r_x$ ..... | 53.1 |    |
| Slenderness Ratio $K_y L / r_y$ ..... | 92.3 |    |
| Max. Slenderness Ratio .....          | 92.3 | OK |

| Limit States                          | Nominal $P_n$ |     |
|---------------------------------------|---------------|-----|
| Flexural Buckling                     | 242.4         | kip |
| Torsional Buckling                    | N.A.          | kip |
| Flexural-Torsional Buckling           | N.A.          | kip |
| Nominal Strength $P_n$ .....          | 242.4         | kip |
| Safety Factor $\Omega$ .....          | 1.67          |     |
| Allowable Strength $P_n/\Omega$ ..... | 145.1         | kip |
| $P / P_n/\Omega$ Design Ratio .....   | 0.76          | OK  |

## BENDING ABOUT Y-Y

| Limit States                          | Nominal $M_n$ |      |
|---------------------------------------|---------------|------|
| Yielding                              | 50.1          | k-ft |
| Lateral-Torsional Buckling            | N.A.          | k-ft |
| Flange Local Buckling                 | N.A.          | k-ft |
| Web Local Buckling                    | N.A.          | k-ft |
| Nominal Strength $M_n$ .....          | 50.1          | k-ft |
| Safety Factor $\Omega$ .....          | 1.67          |      |
| Allowable Strength $M_n/\Omega$ ..... | 30.0          | k-ft |
| $M / M_n/\Omega$ Design Ratio .....   | 0.00          | OK   |

## LOCAL BUCKLING

|                            |             |
|----------------------------|-------------|
| Flanges in Flexure .....   | Compact     |
| Walls in Compression ..... | Non-slender |
| Webs in Flexure .....      | Compact     |

## BENDING ABOUT X-X

|                                    |      |      |
|------------------------------------|------|------|
| Moment at 1/4 point of $L_b$ ..... | N.A. | k-ft |
| Moment at 1/2 point of $L_b$ ..... | N.A. | k-ft |
| Moment at 3/4 point of $L_b$ ..... | N.A. | k-ft |
| L. T. Buckling $C_b$ -factor ..... | N.A. |      |

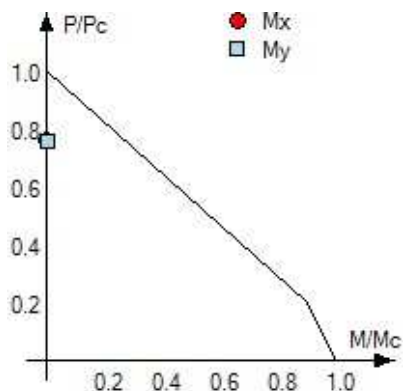
| Limit States                          | Nominal $M_n$ |      |
|---------------------------------------|---------------|------|
| Yielding                              | 82.3          | k-ft |
| Lateral-Torsional Buckling            | N.A.          | k-ft |
| Flange Local Buckling                 | N.A.          | k-ft |
| Web Local Buckling                    | N.A.          | k-ft |
| Nominal Strength $M_n$ .....          | 82.3          | k-ft |
| Safety Factor $\Omega$ .....          | 1.67          |      |
| Allowable Strength $M_n/\Omega$ ..... | 49.3          | k-ft |
| $M / M_n/\Omega$ Design Ratio .....   | 0.00          | OK   |

## COMBINED FORCES

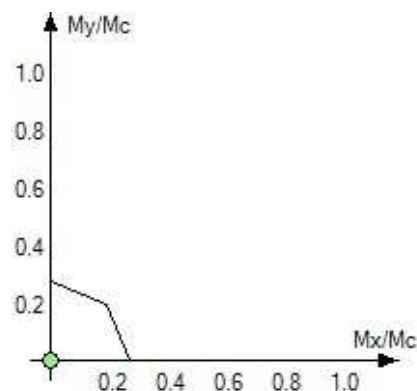
|                             |      |    |
|-----------------------------|------|----|
| Combined Forces Ratio ..... | 0.76 | OK |
|-----------------------------|------|----|

## DESIGN CODES

|                         |              |
|-------------------------|--------------|
| Steel Design .....      | AISC 360-16  |
| Load Combinations ..... | ASCE 7-10/16 |



INTERACTION DIAGRAM



BIAXIAL BENDING DIAGRAM



**GEOMETRY**

|                          |              |               |     |       |
|--------------------------|--------------|---------------|-----|-------|
| Column Section .....     | HSS8X4X1/2   |               |     |       |
|                          | <b>Width</b> | <b>Length</b> |     |       |
| Column .....             | 4.0          | 8.0           | in  |       |
| Plate .....              | 10.0         | 10.0          | in  | OK    |
| Concrete Wp1             | 8.0          | Lp1           | 8.0 | in OK |
| Support Wp2              | 8.0          | Lp2           | 8.0 | in OK |
| Rod Edge .....           | 2.0          | 2.0           | in  | OK    |
| Thickness of Grout ..... | 2.0          | in            |     |       |

**MATERIALS**

|                                                                        |      |     |
|------------------------------------------------------------------------|------|-----|
| Plate Steel Strength $F_y$ .....                                       | 36.0 | ksi |
| Pier Concrete Strength $f'_c$ ..                                       | 3.0  | ksi |
| <i>Plate Allowed to Work in Plastic Range (<math>M_n = M_p</math>)</i> |      |     |

**DESIGN CODES**

|                         |              |
|-------------------------|--------------|
| Steel Design .....      | AISC 360-16  |
| Anchorage Design .....  | ACI 318-19   |
| Load Combinations ..... | ASCE 7-10/16 |

**APPLIED LOADS**

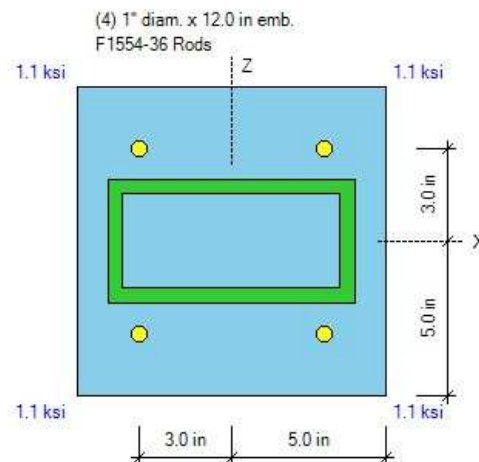
|                             | Dead  | Live | RLive | Snow | Wind | Seismic |      |
|-----------------------------|-------|------|-------|------|------|---------|------|
| Vertical Load $P$ .....     | 100.0 | 10.0 | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Bending Moment $M_x$ ...    | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Bending Moment $M_z$ ...    | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | k-ft |
| Horizontal Load $V_x$ ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |
| Horizontal Load $V_z$ ..... | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0     | kip  |

**PLATE WITH MOMENTS**

|                                        |      |         |    |
|----------------------------------------|------|---------|----|
| Bearing Strength $F_{pn}/\Omega$ ..... | 1.6  | ksi     |    |
| <b>- Comb. D+L</b>                     |      |         |    |
| Max. Bearing Stress $f_p$ .....        | 1.1  | ksi     | OK |
| X-Moment due to Bearing .....          | 5.3  | k-in/in | ←  |
| Z-Moment due to Bearing .....          | 0.8  | k-in/in |    |
| X-Moment per Rod Tension ..            | 0.0  | k-in/in |    |
| Z-Moment per Rod Tension ..            | 0.0  | k-in/in |    |
| Plate Thickness Req'd. $t_p$ .....     | 0.99 | in      |    |
| Use Plate Thickness $t_p$ .....        | 1.25 | in      | OK |

**AXIALLY LOADED PLATE**

|                                          |      |         |    |
|------------------------------------------|------|---------|----|
| <b>- Comb. D+L</b>                       |      |         |    |
| Uniform Bearing Stress $f_p$ ....        | 1.1  | ksi     | OK |
| X-Critical Section $m$ .....             | 1.2  | in      |    |
| Z-Critical Section $n$ .....             | 3.1  | in      |    |
| Int. Critical Section $\lambda n'$ ..... | N.A  |         |    |
| Moment due to Bearing .....              | 5.3  | k-in/in |    |
| Moment due to Rod Tension ..             | 0.0  | k-in/in |    |
| Plate Thickness Req'd. $t_p$ .....       | 0.99 | in      |    |

**PLAN**

**ANCHORAGE DESIGN**

Rod Material Specification ..... F1554-36

(4) Rods ,  $f_y = 36.0$  ksi,  $f_u = 58.0$  ksi

Anchor Rod Size .. 1" diam. x 12.0 in emb.

Concrete Is Cracked at Service Load Level

**Tension Analysis (kip)**- Comb. D+L

Total Tension Force N ..... 0.0 kip

Tension Force per Rod  $N_i$  .... 0.0 kip

Anchor Reinf: Use 2 Bars #5 per Rod

| Failure Mode              | $\Omega$ | $N_n$ | $N / N_n/\Omega$ |
|---------------------------|----------|-------|------------------|
| Steel Strength $N_{sa}$   | 2.00     | 35.1  | 0.00             |
| Rebars Strength $N_{rg}$  | 2.00     | 0.0   | 0.00             |
| Conc. Breakout $N_{cbg}$  | 2.00     | N.A.  | N.A.             |
| Pullout Strength $N_{pn}$ | 2.00     | 36.0  | 0.00             |
| Side Blowout $N_{sb}$     | 2.00     | 0.0   | 0.00             |

N /  $N_n/\Omega$  Tension Design Ratio .... 0.00 OK**DESIGN CODES**

Steel Design ..... AISC 360-16

Anchorage Design ..... ACI 318-19

Load Combinations ..... ASCE 7-10/16

**Shear Analysis (kip)**- Comb. D+L

Shear Taken by Anchor Rods only

Total Shear Force V ..... 0.0 kip

Shear Force per Rod  $V_i$  ..... 0.0 kip

Only Front Rods Are Effective

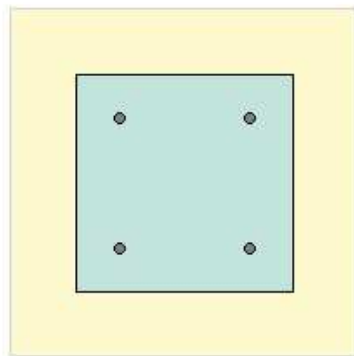
Anchor Reinf: Use Hairpins #4 per Rod

| Failure Mode                              | $\Omega$ | $V_n$ | $V / V_n/\Omega$ |
|-------------------------------------------|----------|-------|------------------|
| Steel Strength $V_{sa}$                   | 2.31     | 16.9  | 0.00             |
| Rebars Strength $V_{rg}$                  | 2.00     | 48.0  | 0.00             |
| Conc. Breakout $V_{cbg}$                  | 2.00     | N.A.  | N.A.             |
| Conc. Pryout $V_{cp}$                     | 2.00     | 0.0   | 0.00             |
| V / $V_n/\Omega$ Shear Design Ratio ..... |          | 0.00  | OK               |

**Tension-Shear Interaction**- Comb. D+L

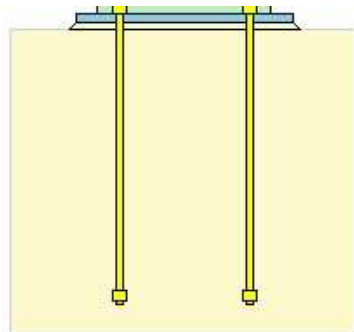
Combined Stress Ratio ..... 0.00 OK

**DESIGN IS DUCTILE**

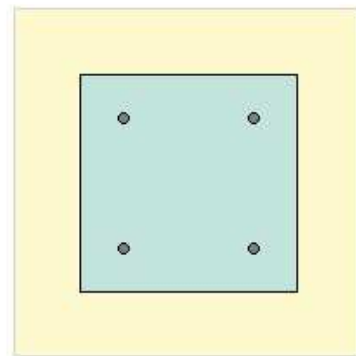


Area Anc = 0 (No anchors in tension)

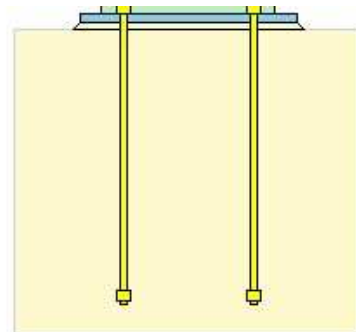
**PLAN**



Tension Breakout



● Indicates shear rods  
Area Avc = 0 (No anchors in shear)



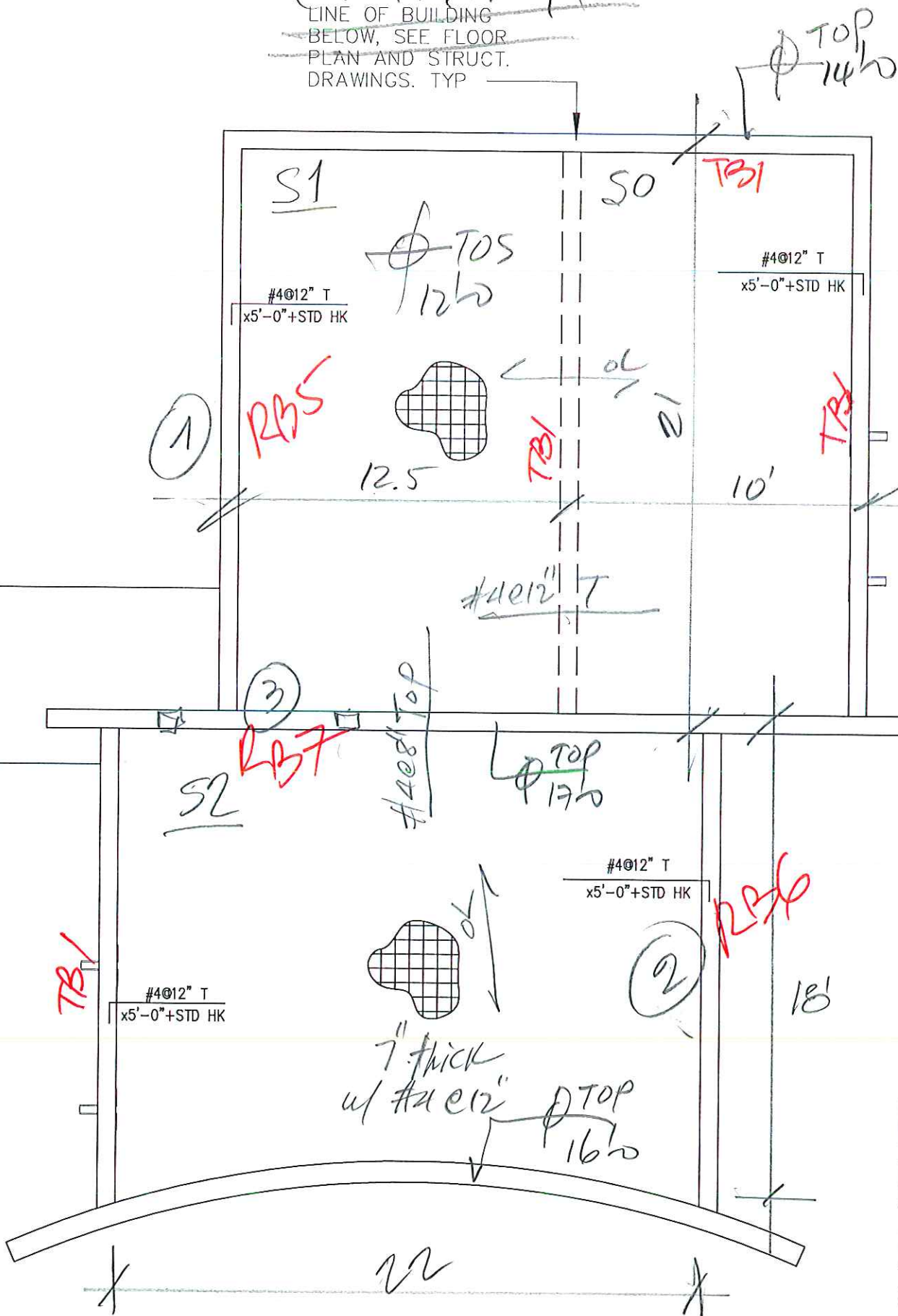
Shear Breakout



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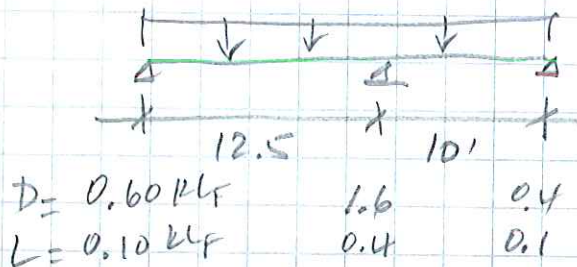
## *Cabana Design*

LINE OF BUILDING  
BELOW, SEE FLOOR  
PLAN AND STRUCT.  
DRAWINGS. TYP —



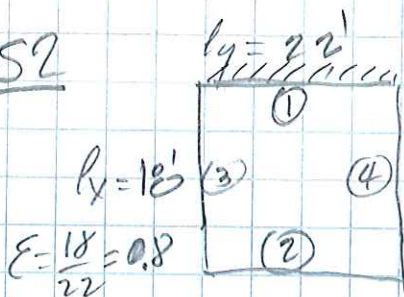
## CABANA SLABS

S1



7" THK  
 ADL 20 psf  
 LL 30 psf  
 (See comp print out)

S2



$$h = \frac{1.1 l_n}{36 + 5 \beta} = \frac{1.1 \times 22}{36 + 5 \frac{22}{18}} = 0.57'$$

7" THK

DL = 100 psf  
 ADL = 20 psf  
 LL = 30 psf

UTL = 200 psf

$$M_x^e = -0.1008 \times 200 \times 18^2 = -6.53 \text{ k/F}$$

$$M_x = 0.0428 \times 20 \times 18^2 = 2.77 \text{ k/F}$$

$$M_y = 0.0187 \times 20 \times 18^2 = 1.21 \text{ k/F}$$

$$A_s = \frac{6.53}{4 \times 5.5} = 0.30 \text{ in}^2/\text{F}$$

#5 @ 12" T  
 OR #4 @ 8" T

Reactions:

$$R_{1D} = 0.449 \times 120 \times 18 = 0.97 \text{ klf}$$

$$R_{1L} = 0.449 \times 30 \times 18 = 0.24 \text{ klf}$$

$$R_{2D} = 0.259 \times 120 \times 18 = 0.56 \text{ klf}$$

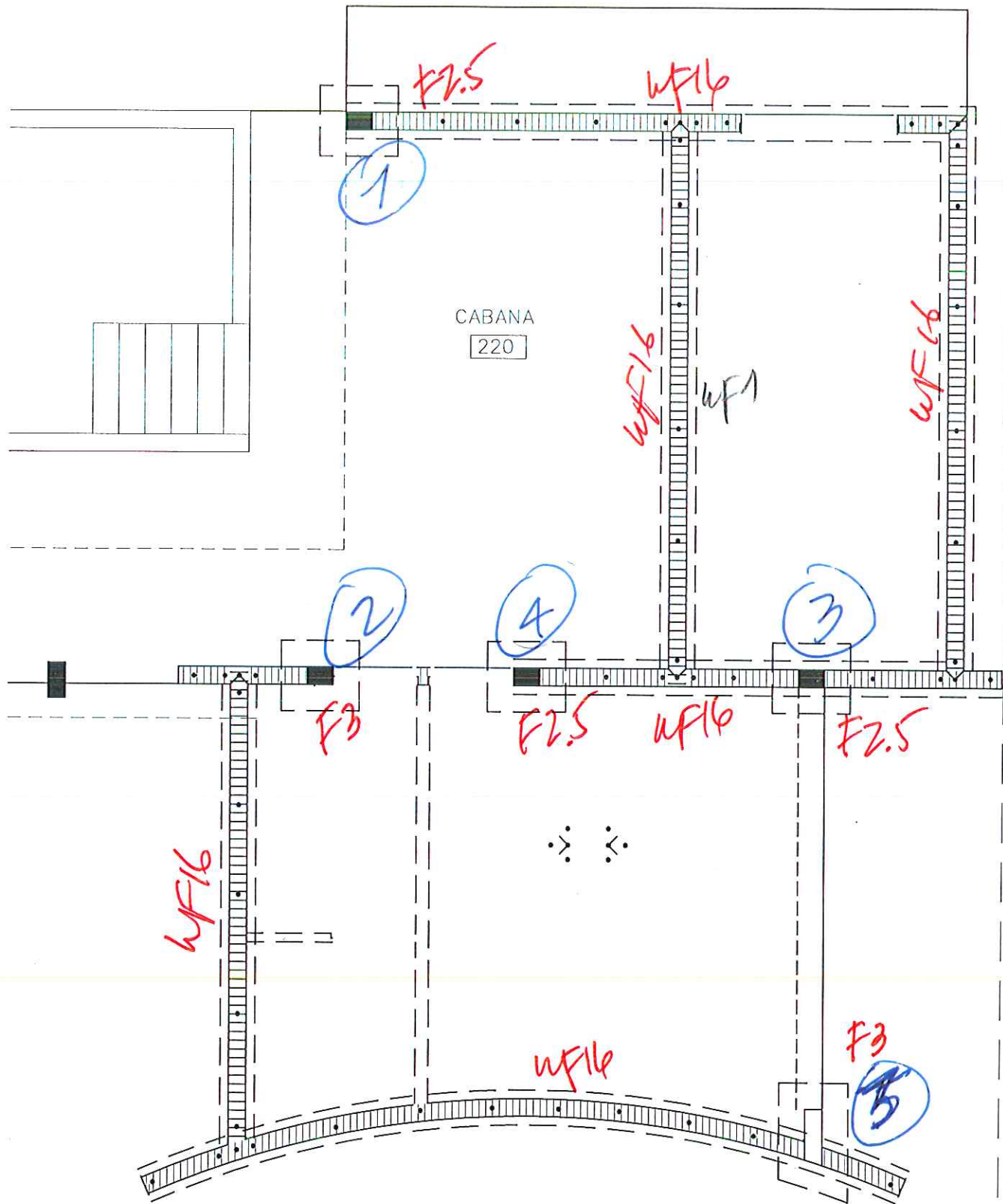
$$R_{2L} = 0.259 \times 30 \times 18 = 0.140 \text{ klf}$$

$$R_{3D} = 0.146 \times 120 \times 22 = 0.39 \text{ klf}$$

$$R_{3L} = 0.146 \times 30 \times 22 = 0.10 \text{ klf}$$

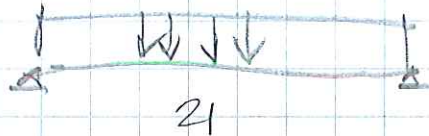
→ #4 @ 12" C  
 $M_L = 4.6 \text{ k/F}$





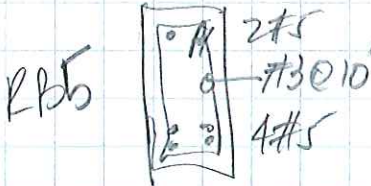
## Palana Beams

① 8"x24"



$$D = 0.62 + 0.18 = 0.8 \text{ KLF}$$

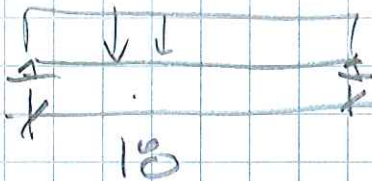
$$L = 0.25 \text{ KLF}$$



$$D = 11 \text{ K}$$

$$L = 3 \text{ K}$$

② 8"x24"



$$D = 0.600 \text{ KLF}$$

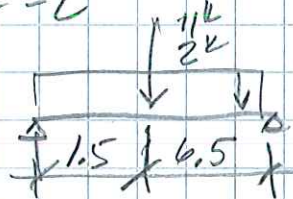
$$L = 0.100 \text{ KLF}$$



$$D = 7 \text{ K}$$

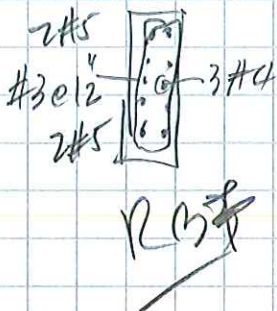
$$L = 2 \text{ K}$$

③ 8"x48"



$$D = 1 + 0.4 = 1.4 \text{ KLF}$$

$$L = 0.30 \text{ KLF}$$



$$D = 17 \text{ K}$$

$$L = 3 \text{ K}$$

$$10 \text{ K}$$

$$2 \text{ K}$$

## Cabana Footings

①  $P_d = 11^k$   $P_L = 3^k$   $P = 3^k$  self  $2^k$   $13^k$   $\#2.5 = 2' \times 2' \times 16"$  w/5#4 EW

②  $P_d = 20^k$   $P_L = 3^k$   $F3 = 3' \times 3' \times 16"$

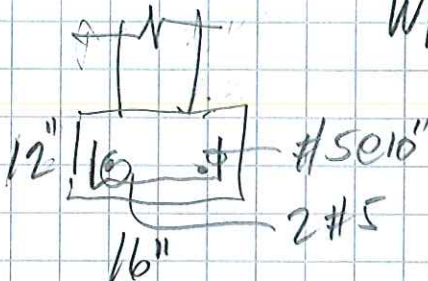
③  $P_d = 10^k$   $P_L = 2^k \rightarrow F2.5$

④  $P_d = 12^k$   $P_L = 2^k \rightarrow F2.5$

Wall FTS: Center Wall  
WF1

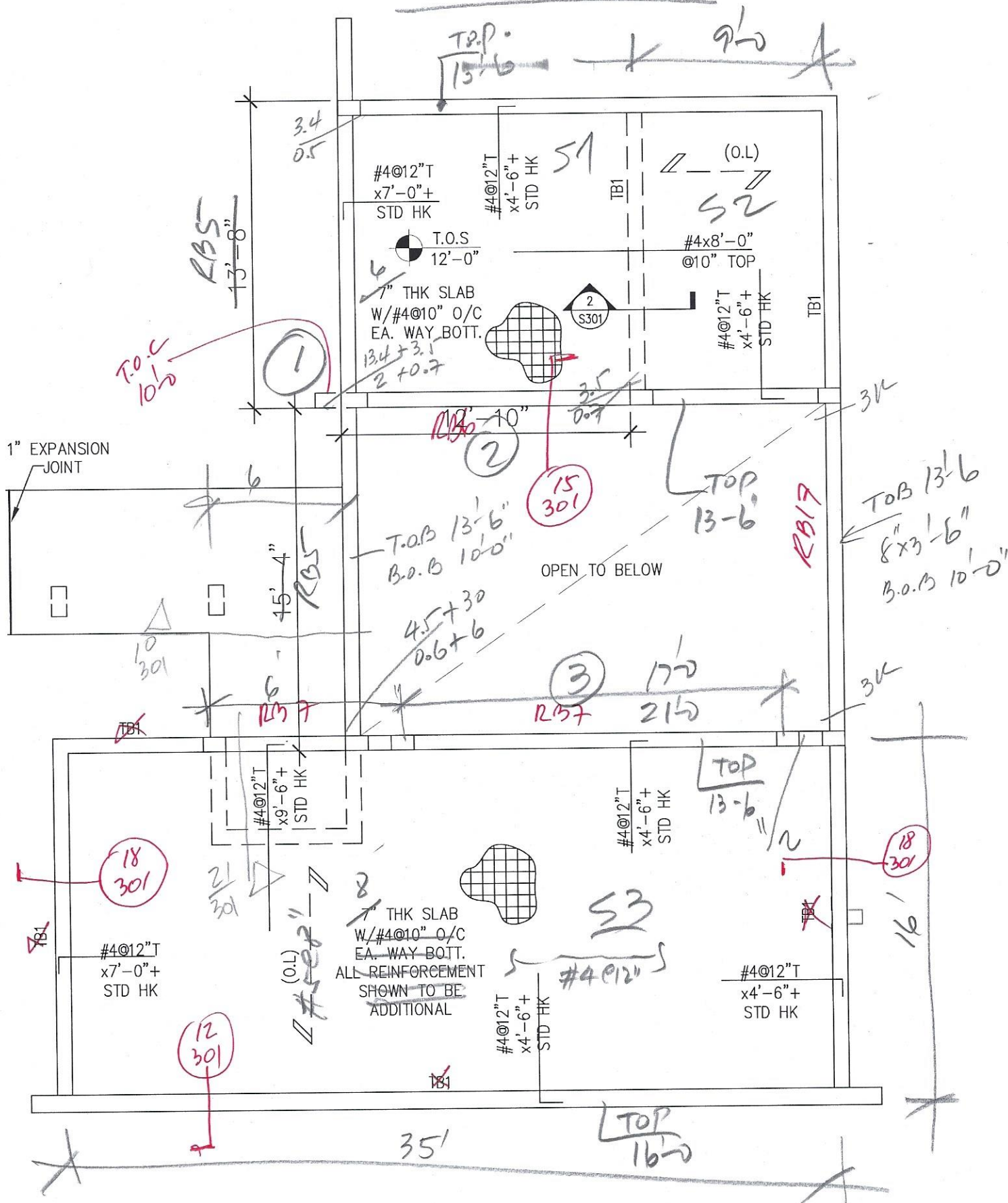
$D = 1.6 + 1.0 = 2.6^k$

$L = 0.4$



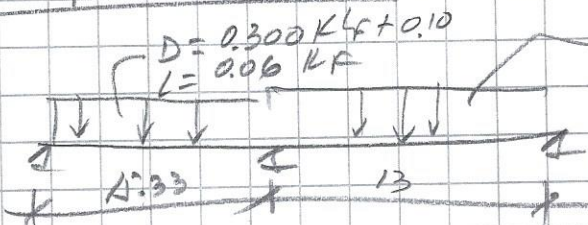


CABANA



# CABANA Beams

①



$$D = 4.5 \text{ K}$$

$$L = 0.6 \text{ K}$$

$$13.4 \text{ K}$$

$$2.0 \text{ K}$$

$$3.4 \text{ K}$$

$$0.5 \text{ K}$$

$$D = 0.300 \text{ KLF} + 0.10$$

$$L = 0.06 \text{ KLF}$$

$$D = 0.30 + 0.10 = 0.40 \text{ KLF}$$

$$L = 0.10 \text{ KLF}$$

8" x 42"  
2#5 T/B  
4#4 C/F  
#3 @ 12"

②



$$D = 3.5 \text{ K}$$

$$L = 0.7 \text{ K}$$

$$3.5 \text{ K}$$

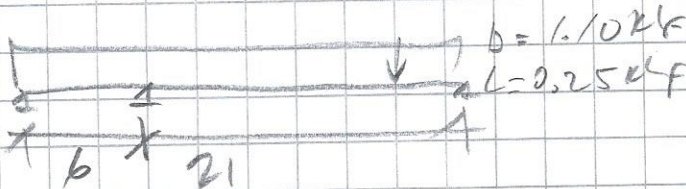
$$0.7 \text{ K}$$

$$D = 0.24 + 0.10 = 0.34 \text{ KLF}$$

$$L = 0.10 \text{ KLF}$$

8" x 24"  
2#5 T/B  
#3 @ 10"

③



$$D = 5 \text{ K}$$

$$L = 2 \text{ K}$$

$$30 \text{ K}$$

$$6 \text{ K}$$

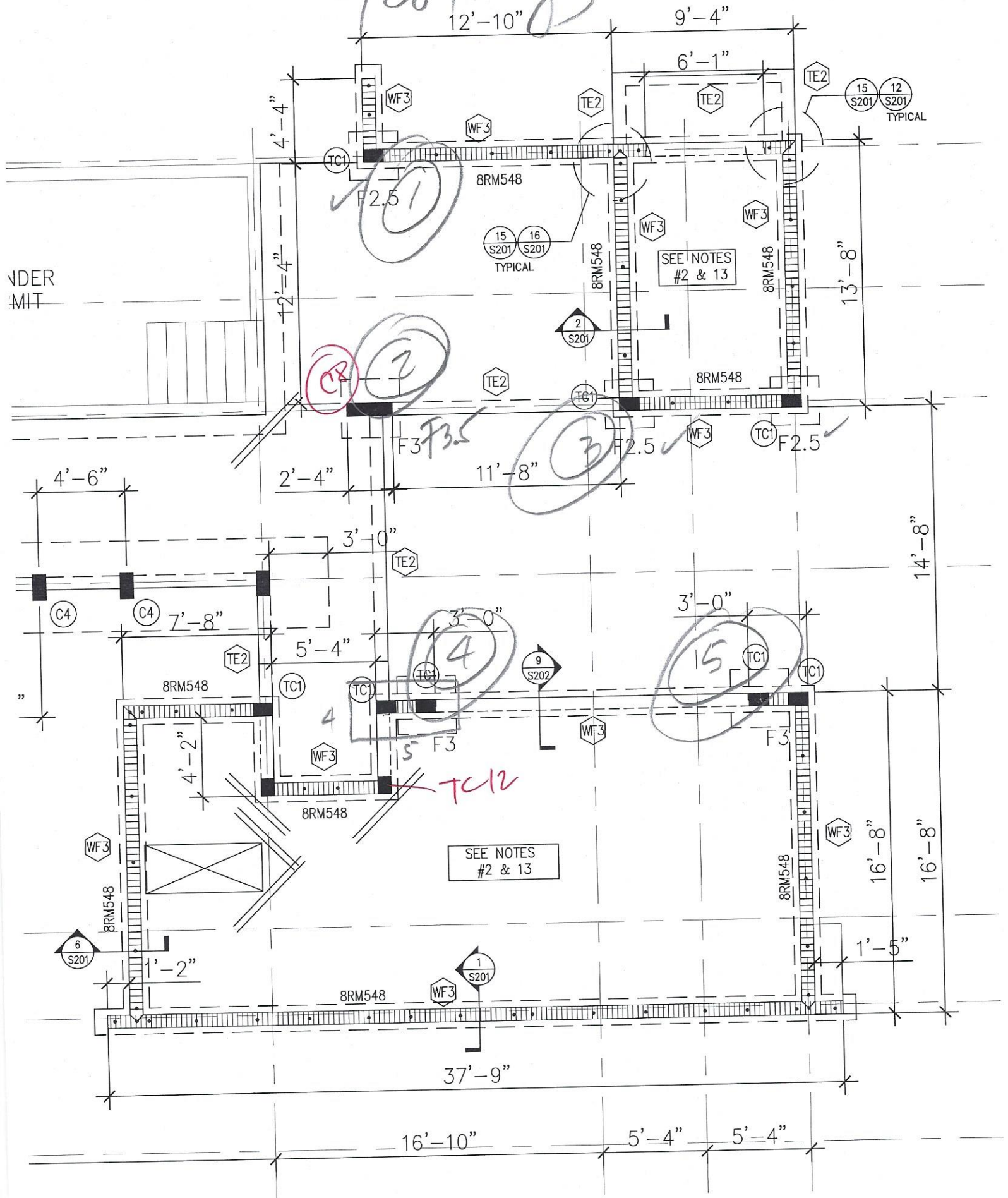
$$11 \text{ K}$$

$$2 \text{ K}$$

8" x 24"  
2#6 B  
4#6 T  
#3 @ 10"



## TYPICAL





CABANA Footings

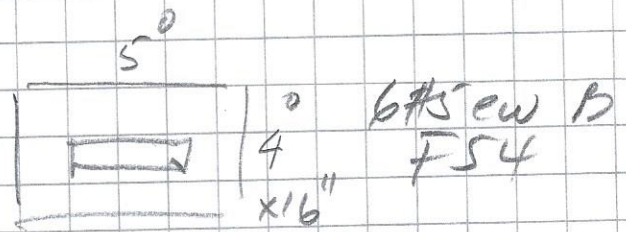
$\gamma = 3 \text{ KSF}$

①  $P_d = 4 \text{ K}$   $\rightarrow$   $F2.0$   
 $P_L = 1 \text{ K}$

②  $P_d = 21 \text{ K}$   $\rightarrow$   $F3.5$   
 $P_L = 3 \text{ K}$

③  $P_d = 5 \text{ K}$   $\rightarrow$   $F2.0$   
 $P_L = 1 \text{ K}$

④  $P_d = 40 \text{ K}$   $\rightarrow$   $P_L = 7 \text{ K}$



⑤  $P_d = 15 \text{ K}$   
 $P_L = 2 \text{ K}$

