STRUCTURAL CALCULATIONS

FOR

COMMUNITY CENTER AND STAGE
MISSION TWENTYFIVE35
DOMINICAN REPUBLIC

MISSION
TWENTYFIVE 35

JUNE 17, 2017

PREPARED BY:
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1330 MONTEREY STREET, SAN LUIS OBISPO, CA 93401

PROJECT DESCRIPTION:

Location - 19°17'19.07"N, 70°25'20.78"W, Dominican Republic

DESIGN CRITERIA:

Occupancy Classification - A (Assembly)	[IBC Sect 302.1 & 304]
Fire Rating - 3 hours	[IBC Table 706.4]
Type of Construction - Type I-A	[IBC Table 601]
Risk Category - II	[ASCE Table 1.5-1]
Aggregate Type - Carbonate aggregate concrete (limestone)	
Minimum Finished Face-to-Face Wall Thickness - 4.4 inches	[IBC Table 721.1(2)]
Minimum Slab Thickness - 5.7 inches	[IBC Table 721.1(3)]
Allowable Building Height Above Grade Plane - Unlimited	[IBC Table 504.3]
Maximum Floor Area per level - Unlimited	[IBC Table 506.2]
Soil Type - Clayey sand	
Allowable Bearing Pressure - 2000 psf	[IBC Table 1804.2]
Building Life Span - 50 years	

MATERIAL SPECIFICATIONS (TYP UNO):

Concrete –	Normalweight Concrete	150 pcf
	Pad Footings	f'c = 4000 psi
	Slab on Grade	f'c = 4000 psi
	Beams/Girders and Columns	f'c = 400o psi
Reinforcing Steel –	Reinforcing steel per ASTM A615 Grade 60	
	Welded Reinforcing per ASTM A706	
Steel –	HSS Square Tubing	fy = 60 ksi, E = 29,000 ksi
Masonry –	Materials and Workmanship per TMS 402-13/ACI 530-13/ASCE 5-13	
		TMS 602-13/ACI 530 1-13/ASCE 6-13

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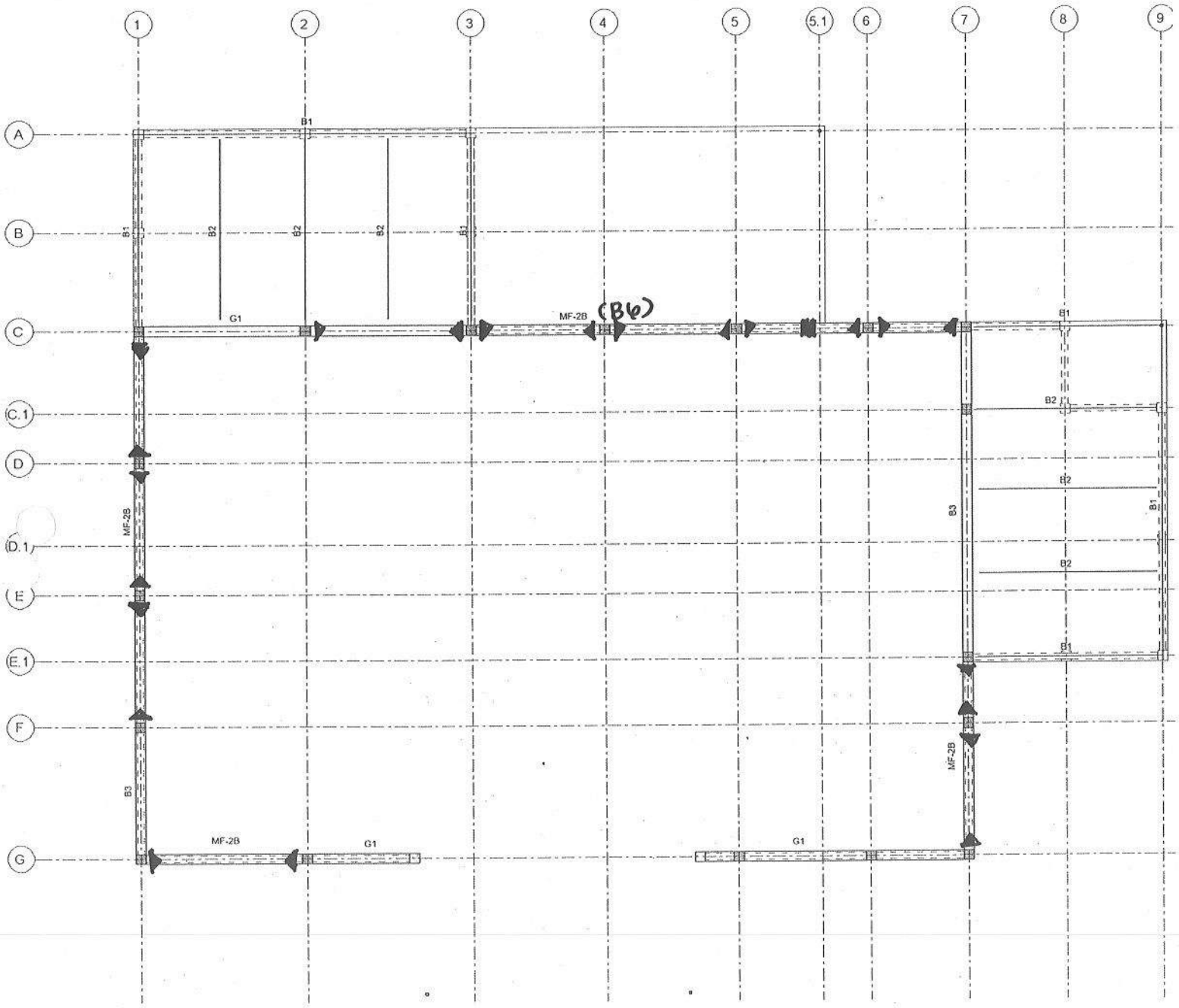
TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. 4 OF
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC Load Take-Off	Journeyman International Organization

Reference

Dead Load Take Off		
3" x 18 GA Galvanized Corrugated Steel Decking (N Deck - Type PLN3)	3.10	
Steel Trusses (16m Span)	6.00	
Misc.	1.90	
	11.00	psf
Beams (Allowance)	30.00	
	41.00	psf
Girders (Allowance)	15.00	
	56.00	psf
Columns (Allowance)	5.00	
	61.00	psf
Wall Load Take Off		
Reinforced Masonry CMU Blocks, Grouted @ 16" O.C. with Normal Wt. Conc.	66.00	
Smooth Concrete Plaster Finish	1.50	
Misc. (Allowance)	1.50	
	69.00	psf
Live Load		
Office (Roof)	20.00	psf
Office (Partitions)	15.00	psf

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. F1 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: 2nd Floor Key Plan		Journeyman International Organization



▶ 4 : moment frame

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F2 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Kitchen/Restroom Beam (B1)	Journeyman International Organization

Reference

Loads:

- Worst case scenario beam was designed (along gridline A) to be conservative when placing this beam in other locations with smaller trib. area

load combo: 1.2D + 1.6L

used girder → DL: 56 psf (3m x 3.28 ft/m)
= 551.04 plf
= 8.04 KN/m

LL: 20 psf + 15 psf = 35 psf
↳ A_T = (10m)(3m) = 30 m²
R_1 = 1.0
R_2 = 1.0 (Beams ≠ no slope)

§4.8.2

$L_r = L_o R_1 R_2$
= (35 psf)(1.0)(1.0)
= 35 psf

LL = (35 psf)(3 m x 3.28 ft/m)
= 344.4 plf
= 5.03 KN/m

$W_T = 1.2D + 1.6L$
= 1.2(8.04 KN/m) + 1.6(5.03 KN/m)
= 17.696 KN/m

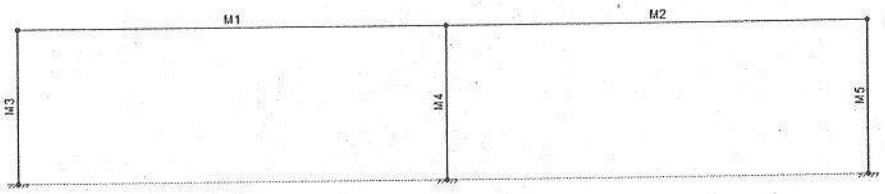
see attached

moments & shears found in RISA

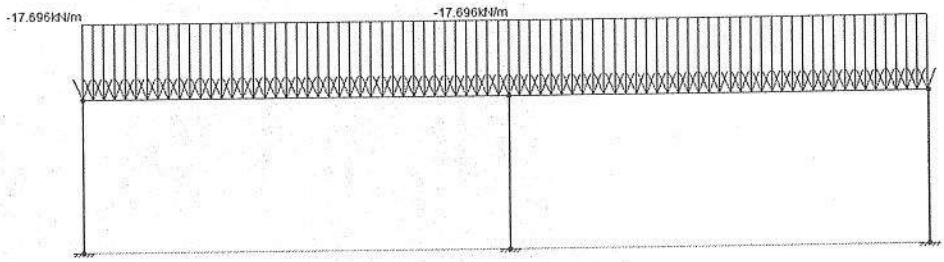
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. F3 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Kitchen/Restroom Beam Analysis (B1)		Journeyman International Organization

Reference

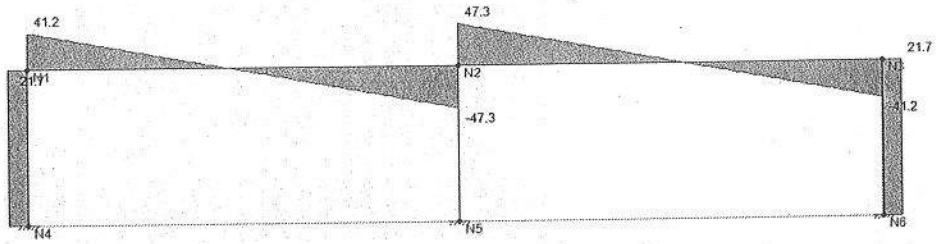
Member Labels:



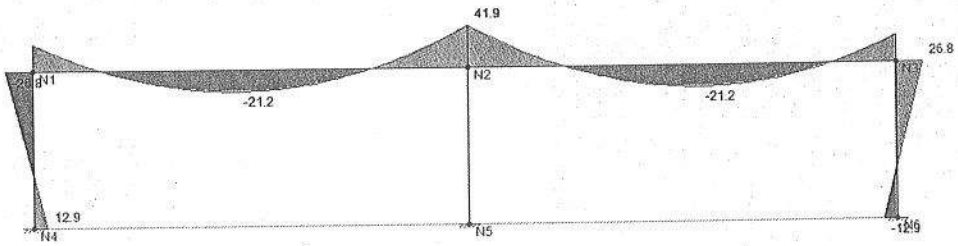
Load Combo (1.2D+1.6L):



Shear Diagram:



Moment Diagram:



Member Forces:

Member Section Forces

	L...	Member Label	S...	Axial[kN]	Shear[...	Mome...
1	1	M1	1	21.659	41.221	26.773
2			2	21.659	-47.259	41.868
3	1	M2	1	21.659	47.259	41.868
4			2	21.659	-41.221	26.773
5	1	M3	1	41.221	-21.659	-26.773
6			2	41.221	-21.659	12.862
7	1	M4	1	94.518	0	0
8			2	94.518	0	0
9	1	M5	1	41.221	21.659	26.773
10			2	41.221	21.659	-12.862

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F4 OF F26
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Kitchen / Restroom Beam (B1)	

Reference

M_u @ max = 41.86 KN·m = 30.9 K-ft

$$\text{Reqd } Z_x = \frac{1.67M}{f_y} = \frac{(1.67)(30.9\text{ K-ft})(12''/1\text{ft})}{50\text{ ksi}} = 12.38\text{ in}^3$$

AISC T1-12

⇒ Try: HSS 5 x 5 x 1/2 , Z_x = 13.1 in³

Trial #1

Check:

$$b/t \le 0.55\sqrt{E/F_y}$$

$$7.75 \le 0.55\sqrt{\frac{29000\text{ ksi}}{50\text{ ksi}}}$$

$$7.75 \le 13.25 \quad \checkmark$$

Beam self-weight: 28.43 plf
= 0.42 KN/m
∴ will not impact DL on beam much
negligible

$\Delta_{allow} = \ell/360$ ← use unbraced length max of 5m

$$= \frac{(5\text{m} \times 3.28\text{ ft/m})(12''/1\text{ft})}{360}$$

$$= 0.546''$$

$$\Delta = \frac{5WL^4}{384EI}$$

$$= \frac{5(1.2(551.04\text{plf} + 28.43\text{ plf}) + 1.6(384.04\text{plf}))(1\text{ ft}/12'')(5\text{m} \times 3.28\text{ ft/m} \times 12''/1\text{ft})^4}{384(29,000,000\text{ psi})(26\text{ in}^4)}$$

$$= \frac{5(103.819\ \#/\text{in})(196.8\text{ in})^4}{384(29,000,000\text{ psi})(26\text{ in}^4)}$$

$$= 2.69\text{ in} > 0.546'' \quad \times$$

⇒ Try: HSS 8 x 8 x 5/8 , Z_x = 44.7 in² ,
W_u = 59.32 plf
∴ will impact moment but Z_x is significantly larger than previous and should suffice

Trial #2

Check #1:

$$b/t \le 0.55\sqrt{E/F_y}$$

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F5 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Kitchen / Restroom Beam (B1)		Journeyman International Organization

Reference

~cont.~

$$\Delta = \frac{5wL^4}{384EI}$$

$$= \frac{5(1.2(551.01\ plf + 59.32\ plf) + 1.6(344.04\ plf))(1\ ft/12")(5m \times 3.28\ ft/m \times 12"/ft)^4}{384(29{,}000{,}000\ psi)(146\ in^4)}$$

$$= \frac{5(106.988\ \#/in)(196.8\ in)^4}{1.63 \times 10^{12}}$$

$\Delta = 0.493" < \Delta_{allow} = 0.546"$ ✓

Use: HSS 8 x 8 x 5/8 A992

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F6 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Kitchen/Bathroom Area Joist (B2)		Journeyman International Organization

Reference

Beam Design (B2)

Load Combination: 1.2D + 1.6L

DL = 35 psf → slope adjustment = 34.9 psf

LL = 20 psf + 15 psf (partitions)

ASCE 7-10 §4.8.2

$A_T = (6)(2.5) = 15\ m^2 \Rightarrow A_T \leq 18.58\ m^2$; $R_1 = 1$

$F = 1.5 \Rightarrow F \leq 4$; $R_2 = 1$

$L_r = L_o R_1 R_2 = (35\ psf)(1)(1) = 35\ psf$

$w_T = (1.2)(34.9\ psf \times 2.5\ m \times 3.28\ m/ft) + (1.6)(35\ psf \times 2.5\ m \times 3.28) = 803.6\ plf$

$M_u = \frac{wL^2}{8} = \frac{(803.6\ plf)(6\ m \times 3.28\ m/ft)^2}{8} = 38904.5\ \#ft \Rightarrow \underline{38.9\ kft}$

$\text{Required } Z_x = \frac{1.67M}{f_y} = \frac{(1.67)(38.9)(12")}{50} = 15.59\ in^3$

A.I.S.C. -12

$\Rightarrow$ Try HSS 6×6×1/2 . $Z_x = 19.8\ in^3$

Check:

$b/t \leq 0.55\sqrt{E/F_y} \Rightarrow 9.90 \leq 0.55\sqrt{29000/50} = 13.25$ ✓ O.K

$F_y = 50\ psi$

Beam weight = 35.24 plf

$w_T = 803.6\ plf + 35.24\ plf = 838.84\ plf$

$M_u = \frac{(838.64)(6 \times 3.28)^2}{8} = 40,610.6\ \#ft \Rightarrow \underline{40.6\ kft}$

$Z_x = \frac{(1.67)(40.6)(12")}{50} = 13.56\ in^3 < Z_{x\ HSS6\times6\times1/2} = 19.8\ in^3$ ✓ O.K.

$\Delta_{allow} = L/360 = (6 \times 3.28\ m/ft)(12")/360 = 0.656"$

$\Delta_{max} = \frac{5wL^4}{384EI} = \frac{(5)(0.287 \times 1/12")(6\ m \times 3.28\ m/ft \times 1/12")^4}{(384)(29000\ ksi)(34.3\ in^4)} = 0.0000000022"$

$\Delta_{max} < \Delta_{allow}$ ✓ O.K.

USE HSS 6×6×1/2 A992 BEAM

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F7 OF F26
AUTHOR	**DATE**
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Main Room Quick Calcs (B3, B4)	

Reference

Beam Sizing:

One-way continuous min depth = $\ell/18.5$

$\frac{\ell}{18.5} = \frac{13.12'}{18.5} = 0.71' \times 12''/1' = 8.5'' \approx \underline{\underline{12''}}$ ← governing min. depth

Both end continuous min depth = $\ell/21$

$\frac{\ell}{21} = \frac{13.12'}{21} = 0.63' \times 12''/1' = 7.5''$

ACI 318 Tb19.3.1.1

Beam width: (1/2 beam depth)

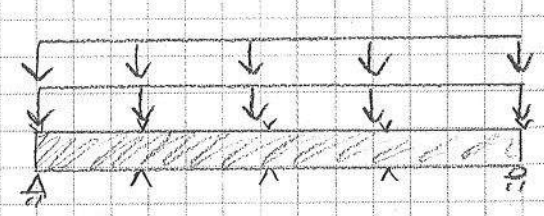
$(1/2)(12'') = 6''$

code minimum width = $\underline{\underline{12''}}$

Estimated Beam Size = 12" × 12"

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F 8 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Main Room, 2nd Flr Beam-(B3)	Journeyman International Organization

Reference



DL = 41 psf (12.5m × (3.28 ft/m))
= 1681 plf
= 1.6811 klf

LL = 20 psf (w/o LL reduction)

ASCE §4.8

↳ A_T = (16m)(12.5m) = 200 m²
R_1 = 0.6 b/c $A_T \geq 55.74$ m²
R_2 = 1.0 b/c no slope

$L_r = L_o R_1 R_2$
= (20 psf)(0.6)(1.0)
= 12 psf
↓
LL = (12 PSF)(12.5m × (3.28 ft/m))
= 492 plf
= 0.492 klf

1.2D+1.6L

W_D = (1.2)(1.6811 klf) = 2.017 klf
W_L = (1.6)(0.492 klf) = 0.7872 klf
W_T = 2.0172 klf + 0.7872 klf = 2.804 klf
= 40.92 kN/m ← use in RISA analysis

⟹ Flexure:

As,min:

ACI 9.6.1

$A_{s,min} = \frac{200}{f_y} b w d$

f_y = 60 ksi
f'c = 4 ksi

$= \frac{200}{60{,}000 psi}(12")(12" - 1.5" - 0.5" - (\frac{5}{8})(\frac{1}{2}))$ (cover, tie, assume #8 bars)

$= 0.38 in^2$

$A_{s,min} = \frac{3\sqrt{f'c}}{f_y} b w d$

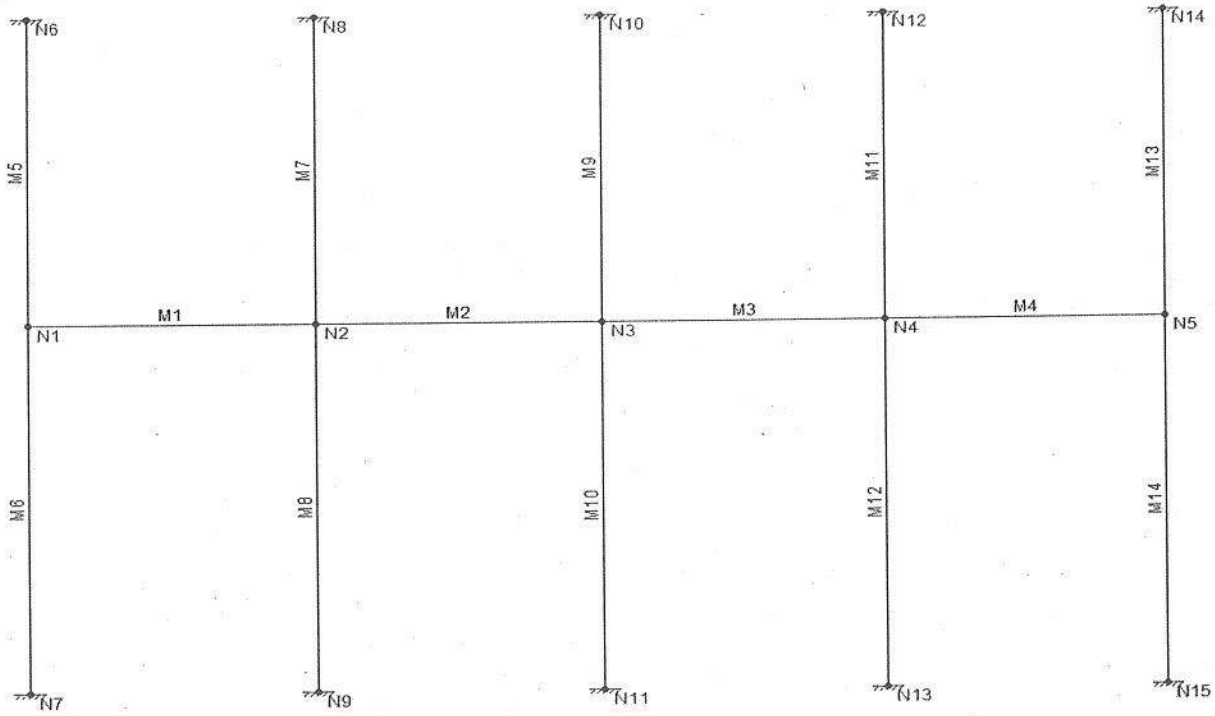
$= \frac{3\sqrt{4000 psi}}{60{,}000 psi}(12")(12")$

$= 0.456 in^2$ ← governs b/c greater

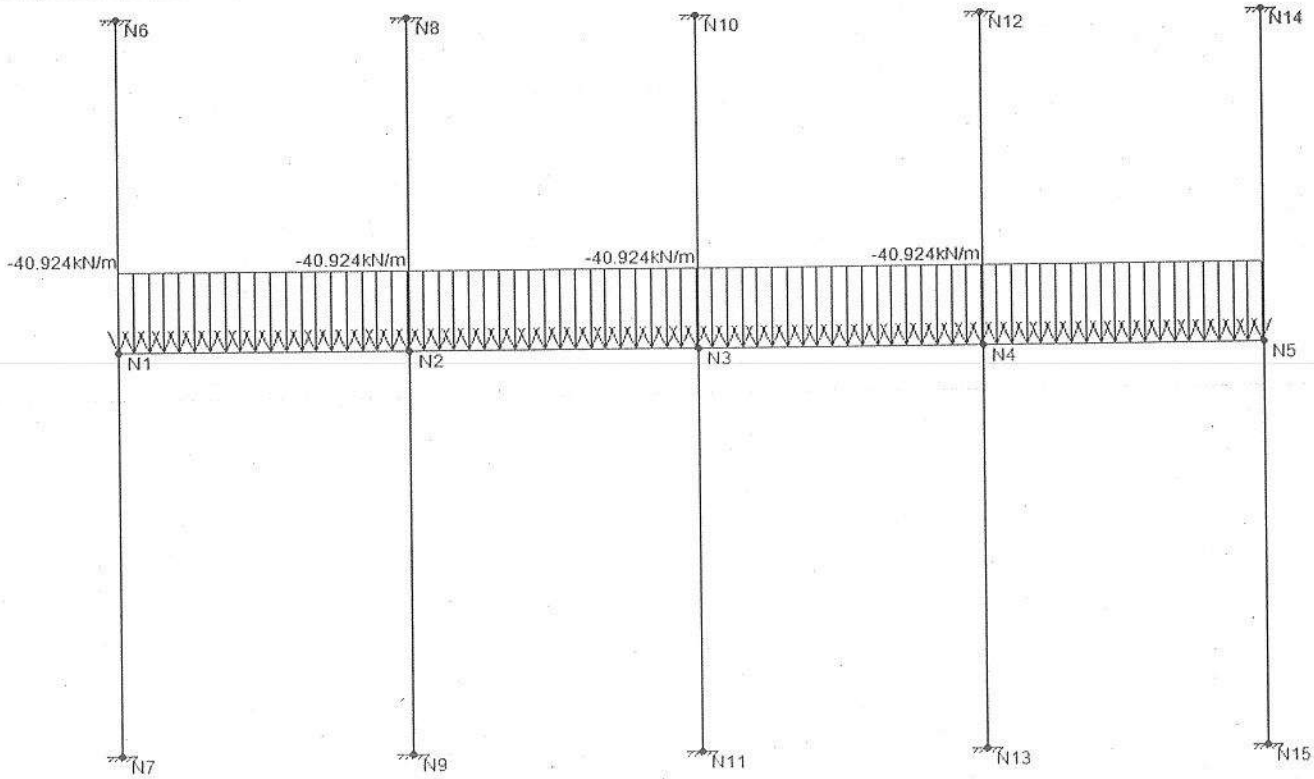
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. F9 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: 2nd Floor - Main Room Beam Analysis		Journeyman International Organization

Reference

Member Labels:



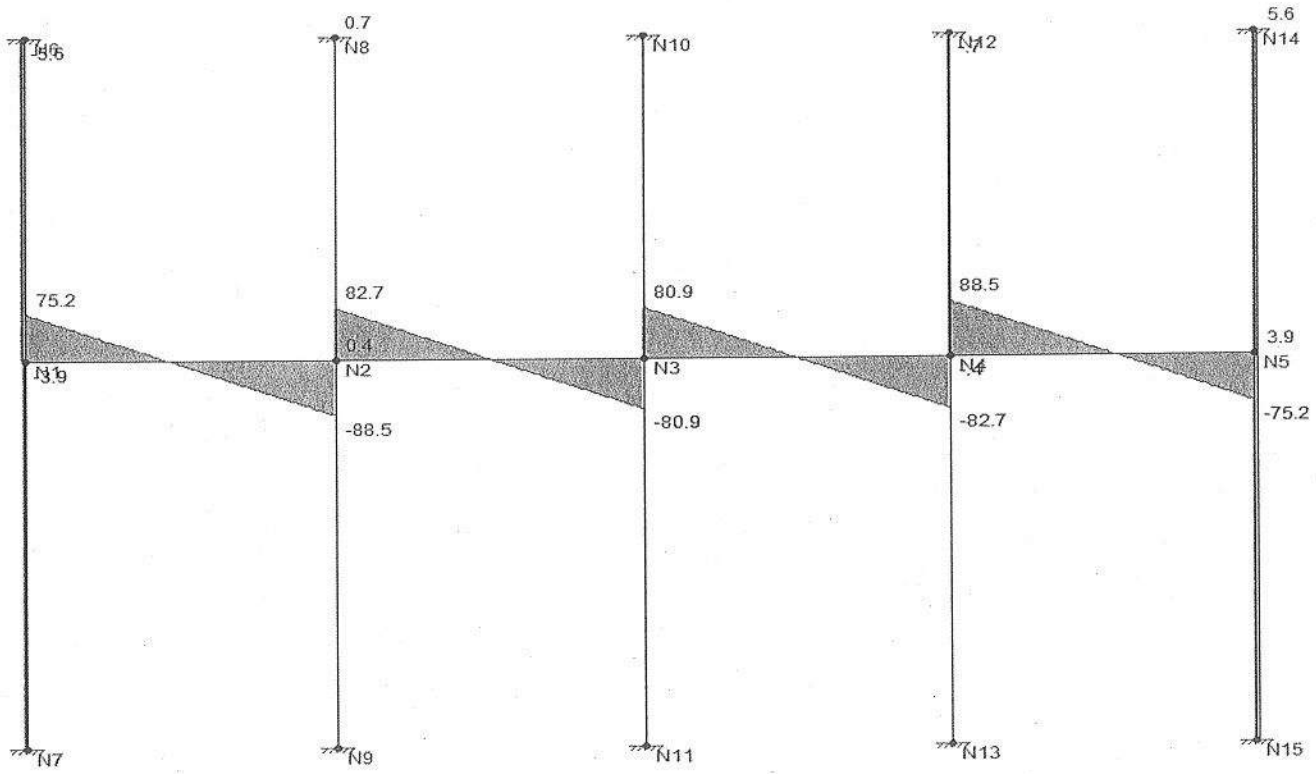
Loading (1.2D + 1.6L):



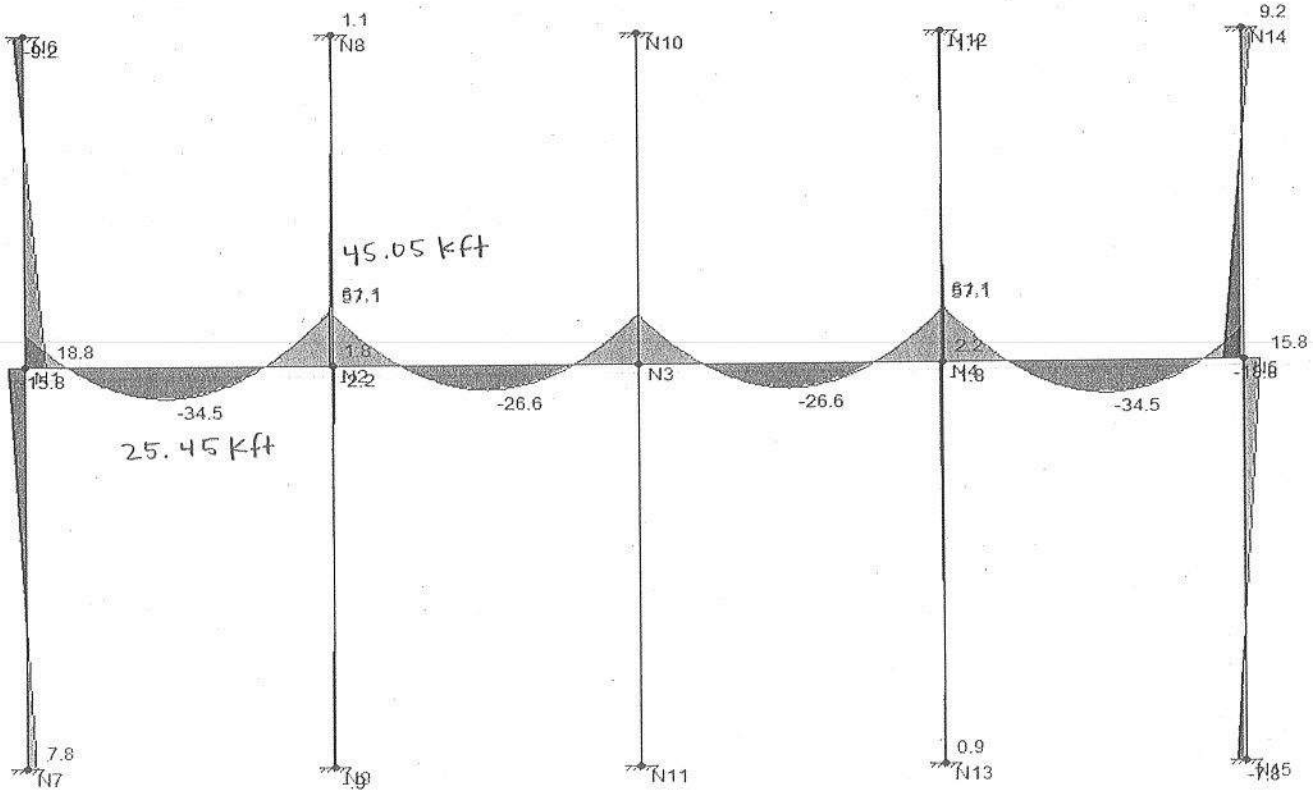
TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: F10 OF F26
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: 2nd Floor - Main Room Beam Analysis	Journeyman International Organization

Reference

Shear Diagram:



Moment Diagram:



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F11 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: 2nd Floor - Main Room Beam Analysis		Journeyman International Organization

Reference

KN KN·m

Member Section Forces

	L...	Member Label	S...	Axial[kN]	Shear[...	Mome...
1	1	M1	1	-1.642	75.235	34.629
2			2	-1.642	-88.461	61.082
3	1	M2	1	-1.429	82.748	57.062
4			2	-1.429	-80.948	53.461
5	1	M3	1	-1.429	80.948	53.461
6			2	-1.429	-82.748	57.062
7	1	M4	1	-1.642	88.461	61.082
8			2	-1.642	-75.235	34.629
9	1	M5	1	-41.037	-5.588	-9.159
10			2	-41.037	-5.588	18.782
11	1	M6	1	34.198	-3.946	-15.847
12			2	34.198	-3.946	7.829
13	1	M7	1	-93.387	.661	1.097
14			2	-93.387	.661	-2.21
15	1	M8	1	77.823	.448	1.809
16			2	77.823	.448	-.881
17	1	M9	1	-88.306	0	0
18			2	-88.306	0	0
19	1	M10	1	73.589	0	0
20			2	73.589	0	0
21	1	M11	1	-93.387	-.661	-1.097
22			2	-93.387	-.661	2.21
23	1	M12	1	77.823	-.448	-1.809
24			2	77.823	-.448	.881
25	1	M13	1	-41.037	5.588	9.159
26			2	-41.037	5.588	-18.782
27	1	M14	1	34.198	3.946	15.847
28			2	34.198	3.946	-7.829

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F12 OF F26
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Main Room 2nd Flr Beam - (B3)	

Reference

longitudinal steel (over supports):

FROM QUICK CALCS: 2"x12" Beam

$M_u = \phi A_s f_y (d - a/2)$

↳ assume: $d = h - 2.5" = 9.5"$

$a = d/3 = 3.17"$

$= 61.082 \text{ kn-m} = 45.051 \text{ k-ft}$

RISA

$(45.051 \text{ k-ft})(12"/1\text{ft}) = (0.9)(A_s)(60 \text{ ksi})\left(9.5" - \frac{3.17"}{2}\right)$

$A_{s\,req'd} = \frac{(45.051 \text{ k-ft})(12"/1\text{ft})}{(0.9)(60 \text{ ksi})(7.915 \text{ in})} = 1.26 \text{ in}^2$

$A_{s\,min}$ = ACI 318 §21.3.2.1

⇒ try: 3 - #6 bars

$A_s = 1.32 \text{ in}^2$

- Check #1:

f_y = 60 ksi

f'_c = 4 ksi

$a = \frac{A_s f_y}{0.85 f'_c b}$

$= \frac{(1.32 \text{ in}^2)(60 \text{ ksi})}{0.85(4 \text{ ksi})(12")}$

$= 1.94 \text{ in}$

$\phi M_n = \phi A_s f_y (d - a/2)$

$= (0.9)(1.94")(60 \text{ ksi})(9.625" - \frac{1.94"}{2})$

$= 906.7 \text{ k-in}$

$= 75.56 \text{ k-ft} > 45.051 \text{ k-ft}$ ✓

- Check #2:

ACI 21.2.2

$c = a/\beta = 1.94"/0.85 = 2.28"$

$d = 12" - 1.5" - 0.5" - (6/8)\,1/2 = 9.625"$

$\epsilon_c \left(\frac{d-c}{c}\right) \geq \epsilon_t$

$0.003\left(\frac{9.625" - 2.28"}{2.28"}\right) \geq 0.004$

$0.009 \geq 0.004$

↳ ∴ tension controlled! ☺

⇒ **use 3-#6 bars over support**

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F13 OF F26
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Main Room 2nd Flr Beam - (B3)	

Reference

longitudinal steel (Between supports ~ 4m = 13.12' span)

$M_u = \phi A_s f_y (d - a/2)$

↳ assume $d = h - 2.5" = 9.5"$

$a = d/3 = 3.17"$

RISA $34.5\ kN\text{-}m = 25.45\ k\text{-}ft$

$$A_{s\,req'd} = \frac{M_u}{\phi f_y (d - a/2)}$$

$$= \frac{(25.45\ k\text{-}ft)(12"/1ft)}{(0.9)(60\ ksi)(9.5" - \frac{3.17"}{2})}$$

$$= 0.714\ in^2$$

⇒ try: 2 - #6 bars

$A_s = 0.88\ in^2$

- check #1

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(0.88\ in^2)(60\ ksi)}{(0.85)(4\ ksi)(12")} = 1.29\ in$$

$$\phi M_n = \phi A_s f_y (d - a/2)$$

$$= (0.9)(0.88\ in^2)(60\ ksi)\left(9.625" - \frac{1.29"}{2}\right)$$

$$= 426.73\ k\text{-}in$$

$$= 35.56\ k\text{-}ft \quad > 25.45\ k\text{-}ft \ \checkmark$$

- check #2

$c = a/\beta = 1.29"/0.85 = 1.52"$

$d = 12" - 1.5" - 0.5" - (6/8")(1/2) = 9.625"$

$\varepsilon_c \left(\frac{d-c}{c}\right) \geq \varepsilon_t$

$0.003\left(\frac{9.625" - 1.52"}{1.52"}\right) \geq 0.004$

$0.016 \geq 0.004 \ \checkmark$

↳ ∴ tension controlled

⇒ **use 2 - #6 bars between supports**

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F14 OF F26
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Main Room 2nd Flr Beam - (B3)	

Reference

Hooked Longitudinal bars @ ends:

RISA $M_u = 34.63\ kN\text{-}m = 25.54\ k\text{-}ft$

$$a = d - \sqrt{\frac{-2M_u}{\phi 0.85 f'_c b} + d^2} \qquad w/\ d = 9.625" \text{ from Bars over support (\#6 bars)}$$

$$= 9.625" - \sqrt{\frac{-2(25.54\ k\text{-}ft)(12"/1ft)}{(0.9)(0.85)(4\ ksi)(12")} + (9.625")^2}$$

$$= 9.625" - 8.714"$$
$$= 0.91"$$

$$A_{s\,reqd} = \frac{0.85 f'_c b a}{f_y} = \frac{(0.85)(4\ ksi)(12")(0.91")}{60\ ksi} = 0.62\ in^2$$

$\Rightarrow$ use 2-#6 HOOKED bars
$A_s = 0.88\ in^2$

- check #1:

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(0.88\ in^2)(60\ ksi)}{0.85(4\ ksi)(12")} = 1.29"$$

$$\phi M_n = \phi A_s f_y (d - a/2)$$
$$= (0.9)(0.88\ in^2)(60\ ksi)(9.625" - \tfrac{1.29"}{2})$$
$$= 35.56\ k\text{-}ft > 25.54\ k\text{-}ft \quad \checkmark$$

- check #2:

$$c = a/\beta = 1.29"/0.85 = 1.52"$$

§25.3.3.6 $d = 9.625"$

$$\epsilon_c \left(\frac{d-c}{c}\right) \geq \epsilon_b$$

$$0.003 \left(\frac{9.625" - 1.52"}{1.52"}\right) \geq 0.004$$

§18.6.4.3 $0.016 \geq 0.004$
$\hookrightarrow \therefore$ tension controlled $\checkmark$

$\Rightarrow$ **use 2-#6 HOOKed bars** (closed by a cross-tie)

§25.4.3.1 $l_{dh} = \left(\frac{f_y \psi_e \psi_c \psi_r}{\lambda \sqrt{f'_c}}\right) d_b \geq 8 d_b, 6" = 16.6"$

reater of

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F15 OF F26
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Main Room 2nd Flr Beam - (B3)	

Reference ⟹

Shear:

$V_c = 2\sqrt{f'c}\, b_w d$
$= 2\sqrt{4000\,psi}\,(12")(9.625")$
$= 14.61\,K$

ACI §22.5.1

$\phi V_n = \phi(V_c + V_s)$
$= \phi\, 10\sqrt{f'c}\, b_w d$
$= (0.75)(10)\sqrt{4000\,psi}\,(12")(9.625")$
$= 54.78\,K$

$V_{u\,max} = 88.5\,KN = 19.9\,K$

$\Rightarrow V_c < V_u$ ∴ need shear reinf.
$\phi V_n > V_u$ ∴ don't need to increase beam width

max. spacing:

9.7. .2.2

$\frac{V_u}{\phi} > 6\sqrt{f'c}\, b_w d$

$\frac{19.9K}{0.75} > 6\sqrt{4000\,psi}\,(12")(9.625")$

$26.53K > 43.83K$
↳ use $s_{max} = d/2$, not $d/4$

$s_{max} = d/2$
$= 9.625"/2$
$= 4.81"$

min. shear reinf.:

9.6.3.3 $A_{v,min}/s$ = greater of:

$= 0.75\sqrt{f'c}\, b_w/f_y$
$= (0.75)\sqrt{4000\,psi}\left(\frac{12"}{60{,}000\,psi}\right)$
$= 0.0095\,in^2/in$

$= 50\, b_w/f_y$
$= 50\left(\frac{12"}{60{,}000\,psi}\right)$
$= 0.01\,in^2/in$
↑ governs

$A_{v\,min} = (0.01\,in^2/in)(4.8\,in)$
$= 0.048\,in^2$

$\Rightarrow$ use #3 stirrups:
$A_v = (2)(0.11\,in^2)$
$= 0.22\,in^2$

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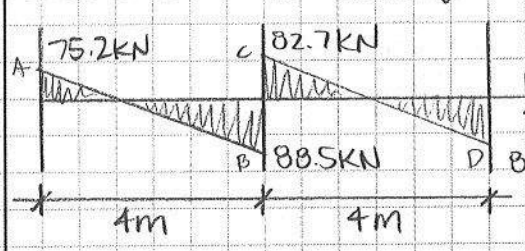
CALCULATION TOPIC: Main Room 2nd Flr Beamm - (B3)		Journeyman International Organization

Reference

Shear Reinf. Spacing:



$\phi = 0.75$

A: 75.2KN = 16.9K/ϕ = 22.5K

B: 88.5KN = 19.9K/ϕ = 26.5K (max)

C: 82.7KN = 18.6K/ϕ = 24.8K

D: 80.9KN = 18.2K/ϕ = 24.3K

A-B slope: $\frac{22.5K + 26.5K}{(4m)\left(\frac{3.28ft}{1m}\right)\left(\frac{12"}{1ft}\right)} = 0.31\ K/in$

C-D slope: $\frac{24.8K + 24.3K}{(4m)\left(\frac{3.28'}{1m}\right)\left(\frac{12"}{1'}\right)} = 0.31\ K/in$

ACI 22.5.10 @ max V

$S_{req'd} = \frac{A_v f_y t d}{\frac{V_u @ d}{\phi} - V_c}$

$= \frac{(0.22in^2)(60\ KSI)(9.625")}{26.5K - 14.61K}$

$= 10.69\ in$

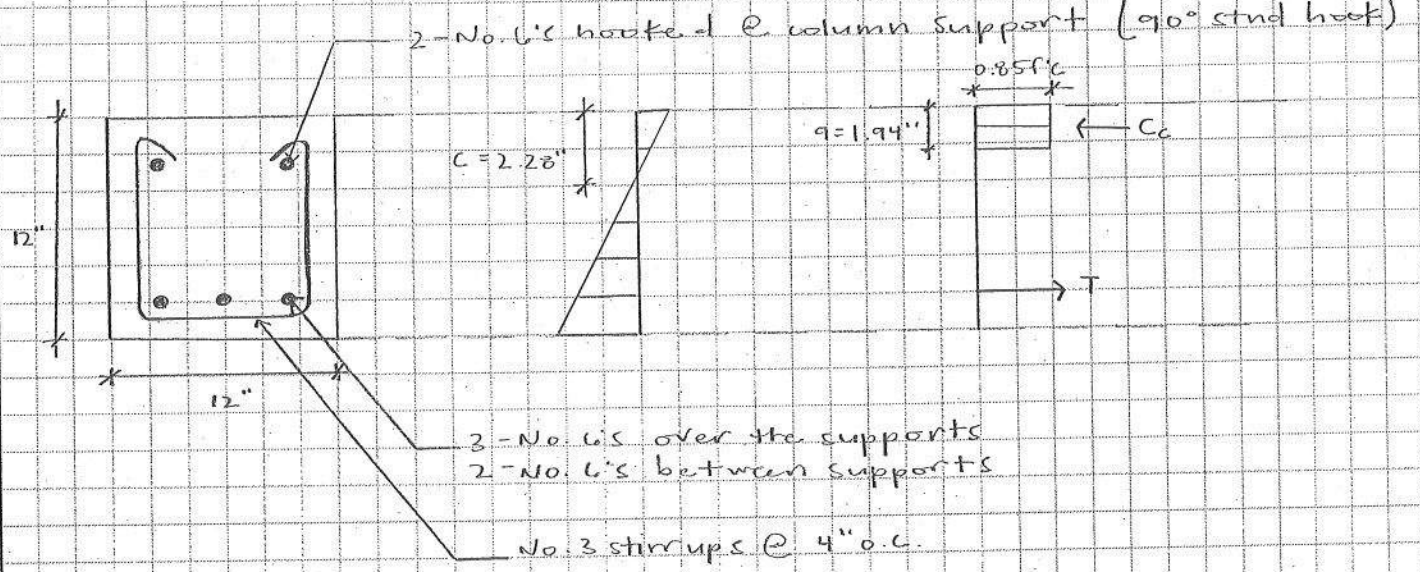
∴ $S_{max} \approx 4"$ & since max shear requires a spacing larger than the code maximum, use max spacing throughout entire beam

→ use **#3 stirrups @ 4" O.C. throughout entire beam**

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F17 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Main Room 2nd Flr Beam - (B3)		Journeyman International Organization

Reference

Final Beam Design (B3):



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F18 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Main Room Quick Calcs G1, G2		Journeyman International Organization

Reference

Girder Sizing:

One way continuous min depth = $\ell/18.5$

$\frac{\ell}{18.5} = \frac{16.4}{18.5} = 0.886' \times 12"/' = 10.6" \approx 12"$ ← governs

Both end continuous min depth = $\ell/21$

$\frac{\ell}{21} = \frac{16.4}{21} = 0.78' \times 12"/' = 9.4"$

ACI 318 Tbl 9.3.1.1

Beam width: (1/2 beam depth)

$(2/3)(12) = 8"$

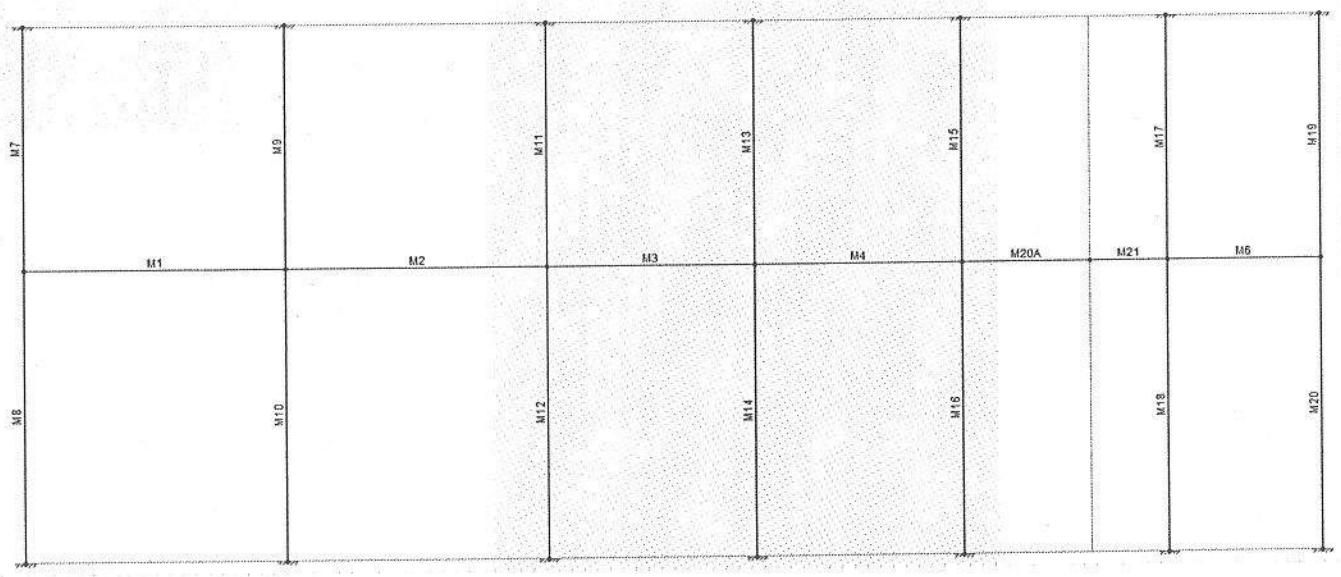
Code minimum width = 12"

Estimated Girder Size = 12" × 12"

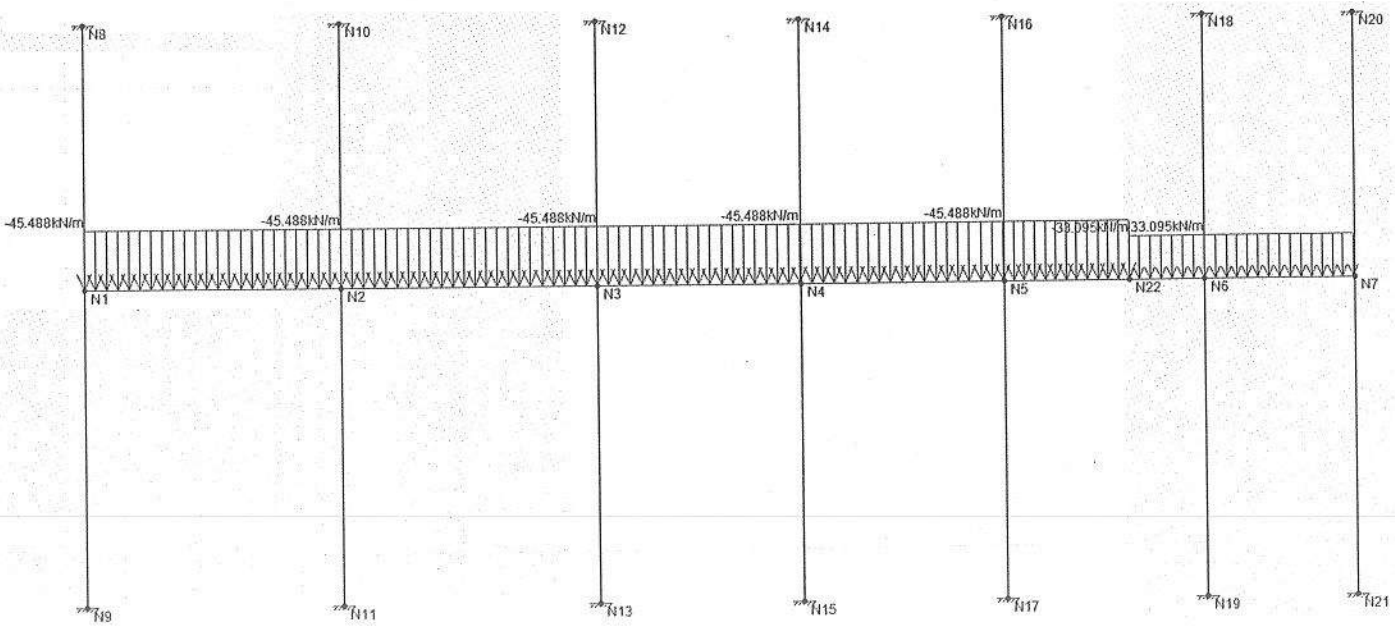
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. F19 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: 2nd Floor - Main Room Girder Analysis (G1)		Journeyman International Organization

Reference

Member Labels:



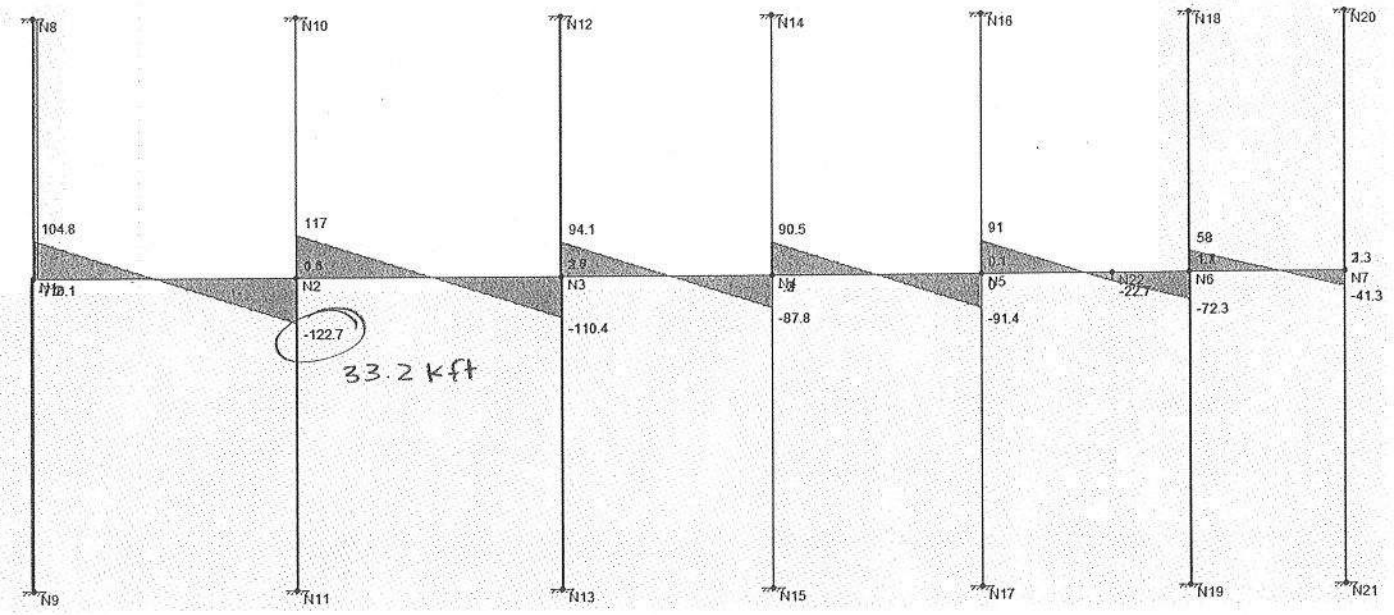
Loading (1.2D + 1.6L):



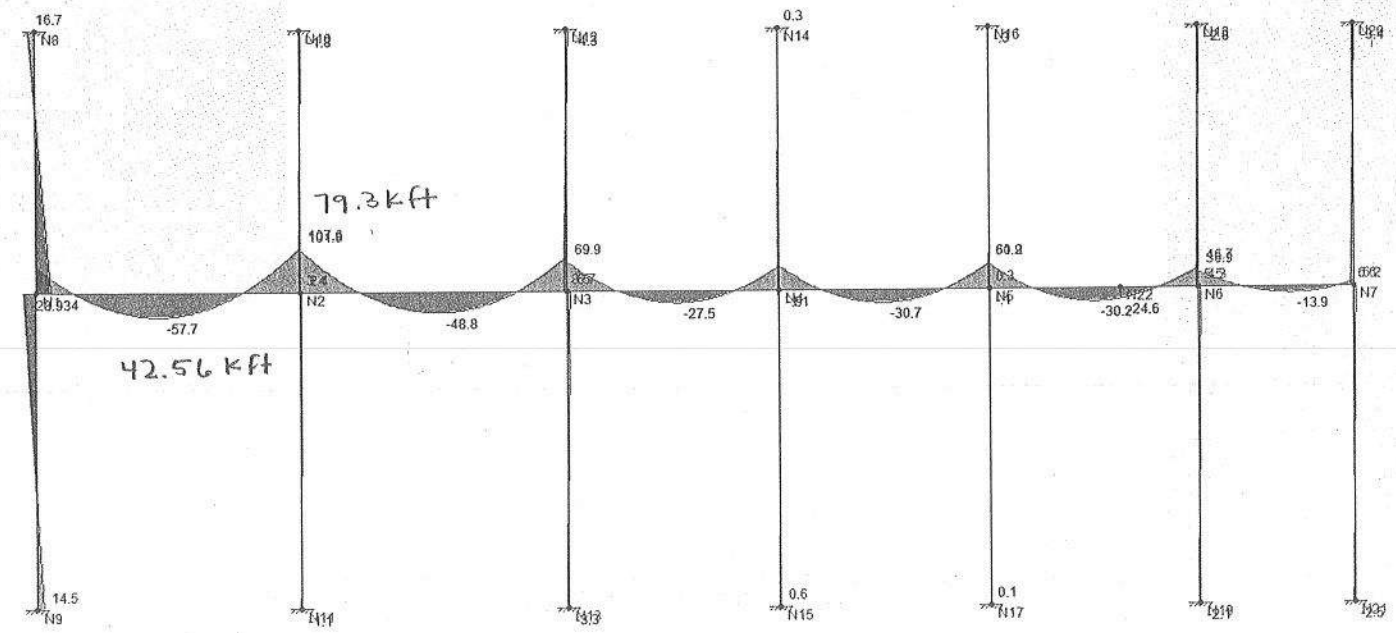
	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: F20 OF F26
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: 2nd Floor - Main Room Girder Analysis (G1)	Journeyman International Organization

Reference

Shear Diagram:



Moment Diagram:



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F21 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: 2nd Floor - Main Room Girder Analysis (G1)		Journeyman International Organization

Reference

[KN] [KN] [KN/m]

Member Section Forces

	L...	Member Label	S...	Axial[kN]	Shear[...	Mome...
1	1	M1	1	-2.9	104.778	62.939
2			2	-2.9	-122.662	107.649
3	1	M2	1	-2.433	117.036	101.766
4			2	-2.433	-110.404	85.187
5	1	M3	1	-1.524	94.133	69.936
6			2	-1.524	-87.819	57.309
7	1	M4	1	-1.475	90.519	59.34
8			2	-1.475	-91.433	61.167
9	1	M6	1	-.71	57.997	36.886
10			2	-.71	-41.288	11.823
11	1	M7	1	-57.152	-10.134	-34.009
12			2	-57.152	-10.134	16.66
13	1	M8	1	47.626	-7.234	-28.93
14			2	47.626	-7.234	14.472
15	1	M9	1	-130.744	1.059	3.444
16			2	-130.744	1.059	-1.849
17	1	M10	1	108.953	.591	2.439
18			2	108.953	.591	-1.11
19	1	M11	1	-111.566	2.573	8.52
20			2	-111.566	2.573	-4.344
21	1	M12	1	92.971	1.663	6.731
22			2	92.971	1.663	-3.25
23	1	M13	1	-97.275	-.246	-.905
24			2	-97.275	-.246	.326
25	1	M14	1	81.063	-.295	-1.125
26			2	81.063	-.295	.643
27	1	M15	1	-99.534	.123	.337
28			2	-99.534	.123	-.28
29	1	M16	1	82.945	-.029	-.064
30			2	82.945	-.029	.111
31	1	M17	1	-71.081	1.668	5.508
32			2	-71.081	1.668	-2.832
33	1	M18	1	59.234	1.055	4.281
34			2	59.234	1.055	-2.05
35	1	M19	1	-22.521	1.997	6.612
36			2	-22.521	1.997	-3.375
37	1	M20	1	18.767	1.288	5.211
38			2	18.767	1.288	-2.514
39	1	M20A	1	-1.323	91.046	60.895
40			2	-1.323	-22.674	-24.569
41	1	M21	1	-1.323	-22.674	-24.569
42			2	-1.323	-72.317	46.675

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: F22 OF F26
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Main Room 2nd Flr Girder – (G1)	Journeyman International Organization

Reference

Girder Design (G1)

Load combination: 1.2D + 1.6L

DL = 56 psf

LL = 20 psf

$A_T = (8m \times 25m) + 30m^2 + 31.5m^2 = 261.5m^2 \Rightarrow A_r \geq 55.74 m^2$; $R_1 = 0.6$

fy = 60ksi
f'c = 4ksi

$F = 1.5 \rightarrow F \leq 4$; $R_2 = 1$

$L_r = L_o R_1 R_2 = (20)(0.6)(1) = 12$ psf

$w_{D_1} = (1.2)(56psf)(11m \times 3.28 ft/m) = 2424.48$ plf $= 35.376$ kN/m

$w_{L_1} = (1.6)(12psf)(11 \times 3.28 ft/m) = 692.74$ plf $= 10.112$ kN/m

$w_{D_2} = (1.2)(56psf)(8m \times 3.28 ft/m) = 1763.28$ plf $= 25.74$ kN/m

$w_{L_2} = (1.6)(12psf)(8m \times 3.28 ft/m) = 503.808$ plf $= 7.355$ kN/m

* Analyzed Beam in RISA *

R. Analysis pg.

$M_u = 107.65$ kN/m $\Rightarrow$ 79.3 kft (over the support)

$M_u = \phi A_s f_y (d - \frac{a}{2})$; $\phi = 0.9$

↳ assume: $a = \frac{d}{3} = 5.83$

$d = h - 2.5" = 17.5"$

Girder quick Calcs: 12" x 12" * inc depth to 20"

$A_{s\,req'd} = \frac{M_u}{\phi f_y (d - \frac{a}{2})} = \frac{(79.3 kft)(12"/1)}{(0.9)(60)(17.5 - \frac{5.83}{2})} = 1.208 in^2$

$\Rightarrow$ Try 3- No.6's , $A_s = 1.32 in^2$ (over the supports)

Check:

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.32)(60)}{(0.85)(4)(12)} = 1.94"$

$\beta = 0.85$

$c = \frac{a}{\beta} = \frac{2.64"}{0.85} = 2.28"$

$d' = 1.5"$ clear space $+ \left(\frac{3}{8}\right)_{\text{assumed No.3 stirrup}} + \left(\frac{6}{16}\right)$ No.6 rebar $= 2.27" \approx 2.5"$

$\varepsilon_s = 0.003 \left| \frac{d - c}{c} \right| = 0.003 \left(\frac{17.5 - 2.28}{2.28} \right) = 0.020 > 0.005$ ✓

$\therefore \phi = 0.9$

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Mission Twenty-Five 35 Community Center-Dominican Republic	F23 OF F26
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CALCULATION TOPIC: Main Room 2nd Flr Girder – (G1)	Journeyman International Organization

Reference

ACI 9.6.1

$A_{s\min} = \frac{3\sqrt{f'c}}{f_y} b_w d = \frac{3\sqrt{4000}}{60{,}000}(12)(17.5) = 0.664\ in^2 < 1.32\ in^2$ ✓

$A_{s\min} = \frac{200}{f_y} b_w d = \frac{200}{60000}(12)(17.5) = 0.7\ in^2 < 1.32\ in^2$ ✓

$\phi M_n = (0.9)(1.32)(60)\left(17.5 - \frac{1.74}{2}\right) = 1178.26\ k\text{-}in \Rightarrow 98.19\ kft$

$\phi M_n = 98.19\ kft \geq M_u = 79.3\ kft$ ✓ O.K.

* Some assumptions.

$M_u = 57.7\ kN/m \Rightarrow 42.6\ kft$ (between the span)

RISA Analysis

$A_{s\,req'd} = \frac{(42.6)(12")}{(0.9)(60)\left(17.5 - \frac{5.83}{2}\right)} = 0.649\ in^2$

$\Rightarrow$ Try 2 - No. 6's, $A_s = 0.88\ in^2$ (b/w the supports)

Check:

$a = \frac{A_s f_y}{0.85 f'c\, b} = \frac{(0.88)(60)}{(0.85)(4)(12)} = 1.29"$

$\beta = 0.85$

$c = \frac{a}{\beta} = \frac{1.29}{0.85} = 1.522"$

$\varepsilon_s = 0.003\left(\frac{d-c}{c}\right) = 0.003\left(\frac{17.5 - 1.522}{1.522}\right) = 0.0315 > 0.005$ ✓

$\therefore \phi = 0.9$

$A_{s\min} = 0.70\ in^2 < 0.88\ in^2$ ✓

$\phi M_n = (0.9)(0.88)(60)\left(17.5 - \frac{1.29}{2}\right) = 800.95\ k\text{-}in \Rightarrow 66.7\ kft$

$\phi M_n = 66.7\ kft \geq 42.6\ kft$ ✓ O.K.

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F24 OF F26
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Main Room 2nd Flr Girder - (G1)		Journeyman International Organization

Reference

RISA 2"x20" girder

Hooked long. bars @ ends:

$M_u = 62.4\ kN\text{-}m = 46\ K\text{-}ft$

$a = d - \sqrt{\frac{-2M_u}{\phi 0.85 f'c\ b} + d^2}$ w/ d = 17.5" (From prev.)

$= 17.5" - \sqrt{\frac{-2(46\ Kft)(12"/1ft)}{(0.9)(0.85)(4Ksi)(12")} + (17.5")^2}$

$= 0.881"$

$A_{s\ req'd} = \frac{0.85 f'c\ b\ a}{f_y} = \frac{(0.85)(4Ksi)(12")(0.881")}{60\ Ksi} = 0.599in^2$

$\Rightarrow$ use 2-#6 hooked bars, $A = 0.88in^2$

- Check #1:

$a = \frac{A_s f_y}{0.85 f'c\ b} = \frac{(0.88in^2)(60Ksi)}{0.85(4Ksi)(12")} = 1.29"$

$\phi M_n = \phi A_s f_y (d - a/2)$
$= (0.9)(0.88in^2)(60\ Ksi)(17.625" - \frac{1.29"}{2})$
$= 67.24\ Kft > 46\ K\text{-}ft$ ✓

- Check #2:

$c = a/\beta = 1.29"/0.85 = 1.52"$

$d = 20" - 1.5" - 0.5" - \frac{1}{2}(\frac{7}{8}") = 17.625"$

$\epsilon_c(\frac{d-c}{c}) \geq \epsilon_t$

$0.003\left(\frac{17.625" - 1.52"}{1.52"}\right) \geq 0.004$

$0.03 \geq 0.004$ → tension controlled ✓

§18.6.4.3 $\Rightarrow$ use **2-#6 hooked bars** (closed by a crosstie)

§24.4.3.1 l_{dh} = greater of: $\frac{f_y \psi_e \psi_c \psi_r}{50\lambda\sqrt{f'c}}\ d_b$, $8d_b$, 6"

$= 14.23"$

$l_{ext} = 9"$

PROJECT	SHEET NO.
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AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Main Room 2nd Flr Girder - (G1)	Journeyman International Organization

Reference

$V_u = 33.2K$ RISA Analysis

Shear Demand:

$\phi V_{nmax} = \phi 10\sqrt{f'c}\, b_w d = (0.75)(10)\sqrt{4000}(12")(13.5) = 76.8K$

$V_{umax} = 33.2K$

$V_c = \phi 2\lambda\sqrt{f'c}\, b_w d = (0.75)(2)\sqrt{4000}(12)(13.5) = 20.5K$

↳ $V_{umax} = 33.2K \neq V_c = 20.5K$ ⇒ Reinforcement required.

$\phi V_n = 76.8K \geq V_{umax} = 27.6K$ ✓ Do not need to inc beam width

spacing requirements - $\frac{V_u}{\phi} \geq 6\sqrt{f'c}\, b_w d$

$6\sqrt{f'c}\, b_w d = (6)\sqrt{4000}(12)(17.5) = 79.7K$

$\frac{V_u}{\phi} = \frac{33.2}{0.75}k = 44.3k \neq 79.7 \Rightarrow S_{max} = \frac{d}{2}$, not $\frac{d}{4}$

Maximum shear reinf - greater of A_{Vmin}

$A_{Vmin} = \frac{0.75\sqrt{f'c}\, b_w}{f_{yt}} = \frac{(0.75)\sqrt{4000}(12")}{60,000} = 0.009in^2$

$A_{Vmin} = \frac{50 b_w}{f_{yt}} = \frac{(50)(12)}{60,000} = 0.01 in^2$ ← governs

⇒ Use No.3 stirrups, $A_V = (2)(0.11) = 0.22 in^2$

Shear spacing:

$S_{max} = d/2 = 17.5/2 = 8.75"$ ← governs

$S_{req'd} = \frac{A_V f_{yt} d}{\frac{V_u}{\phi} - V_c}$

$\frac{(0.22)(60)(13.5)}{(44.3 - 20.5)} = 7.48"$

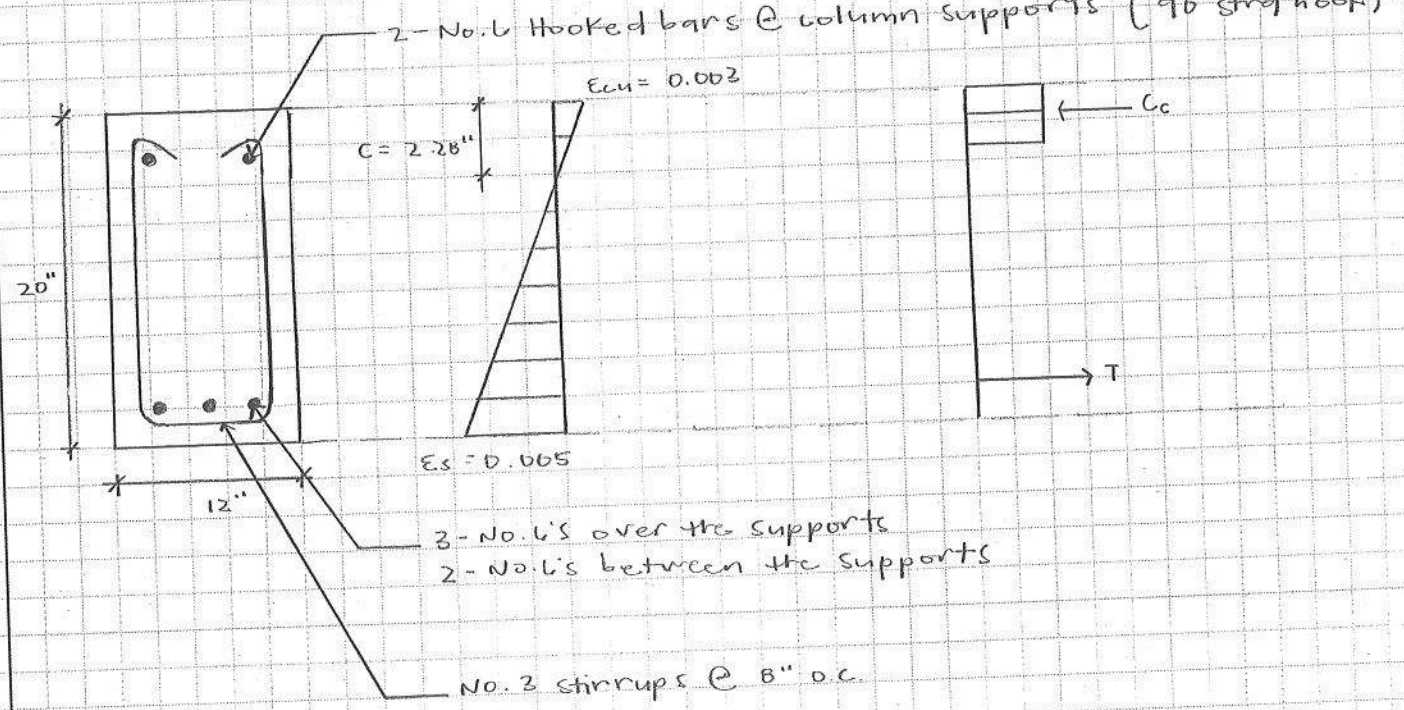
∴ $S_{max} < S_{req'd}$, use S_{max} for entire beam b/c spacing is based on highest shear load.

USE NO.3 STIRRUPS @ 8" O.C. THROUGHOUT

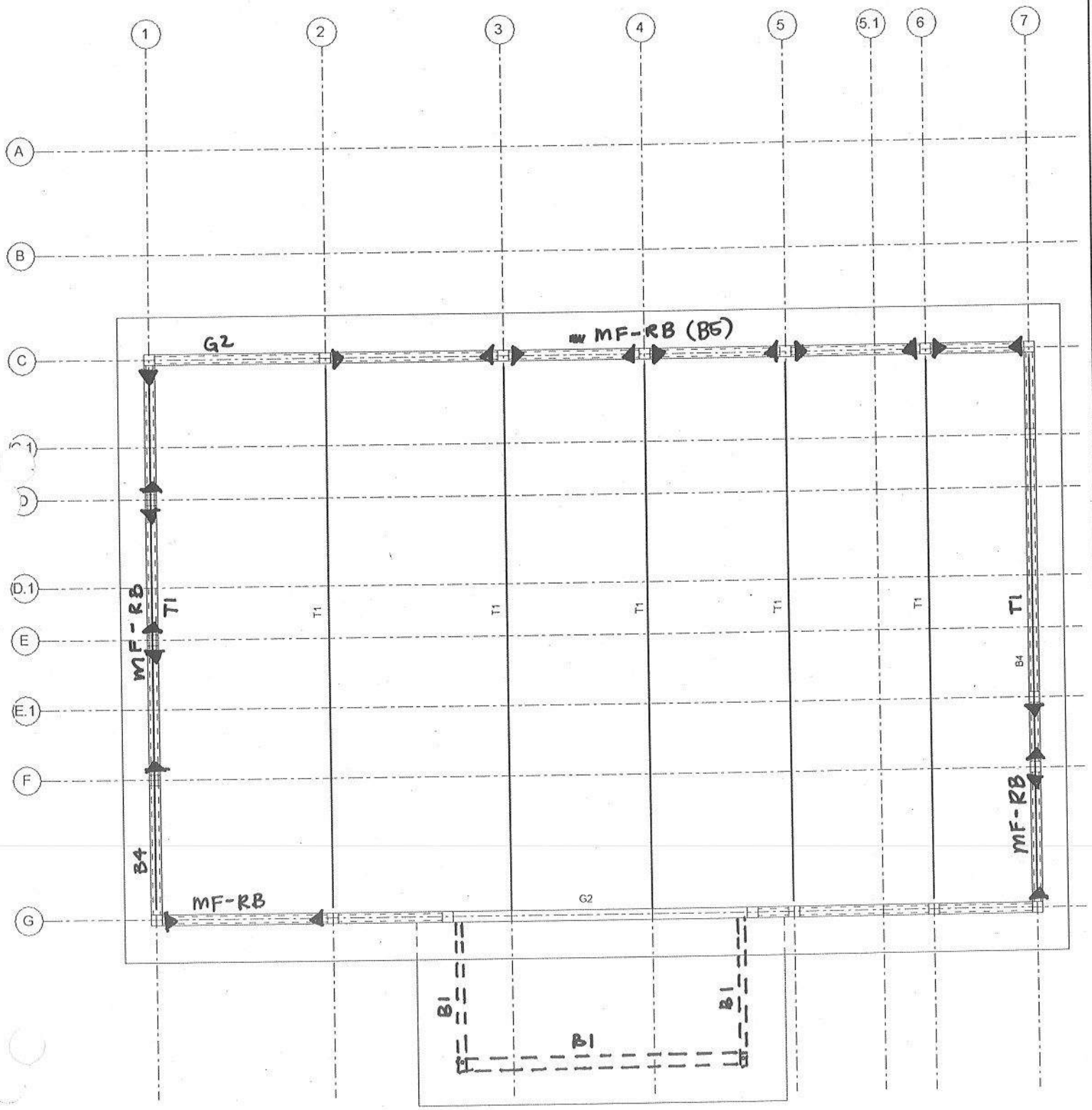
PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	F26 OF F26
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Main Room 2nd Flr Girder -(G1)	

Reference

Final Girder Design (G1):



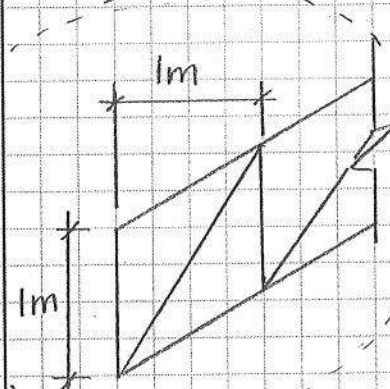
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. R1 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: ~~2nd Floor~~ RDOF Key Plan		Journeyman International Organization



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: R2 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Roof Truss Preliminary Analysis		Journeyman International Organization

Reference

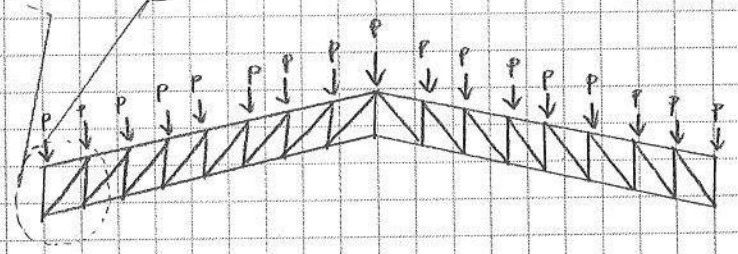
All trusses will be the same, but design will be based on worst case scenario. see column line between gridline 1 & 2.



truss shape: HOWE
each bay = 1m in length
= 3.28' in length

trib width = 5m
= 16.41'

ROOF slope: 1.5 : 12



Load combo:
- 1.2D + 1.6L
- 1.4D
- 1.2D + 1.0W + 0.5L
- 0.9D + 1.0W

Live load reduction

ASCE 7-10 §4.8

$A_T = (1.6\,m)(5\,m) = 80\,m^2 \Rightarrow R_1 = 0.6$ b/c $A_T \geq 55.74\,m^2$

$F = 1.5 \Rightarrow R_2 = 1.0$ b/c $F \leq 4$

$L_r = L_o R_1 R_2$
$= (20\,psf)(0.6)(1.0)$
$= 12\,psf$

Load (gravity):

HSC 2-10 & load takeoff

A_T per node $= (5m \times 1m)\left(\frac{53.82\,ft^2}{5m^2}\right)$
$= 269.1\,ft^2$

$P_{uDL} = (11\,psf)(269.1\,ft^2)$
$= 2960\,\#$
$= 13.17\,kN$

$P_{uLL} = (12\,psf)(269.1\,ft^2)$
$= 3229\,\#$

unfactored, will be factored on RISA to account for load combinations

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. R3 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: ROOF Truss preliminary analysis (cont.)		Journeyman International Organization

Reference

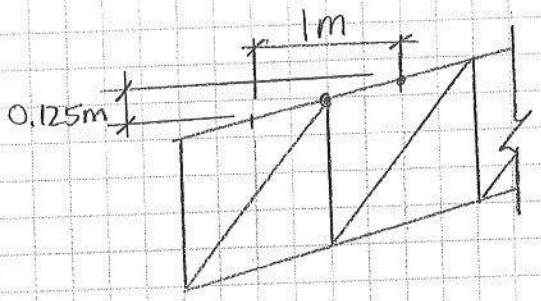
Load (lateral):

used wind pressure b/c it directly hits each truss joint

see wind analysis

P = 57.23 psf

A_T of each node = (0.125m)(5m)
= $0.625 m^2$
= $6.727 ft^2$



P_{uw} = (57.23 psf)(6.727 ft^2)
= 384.9 #
= 1.71 KN

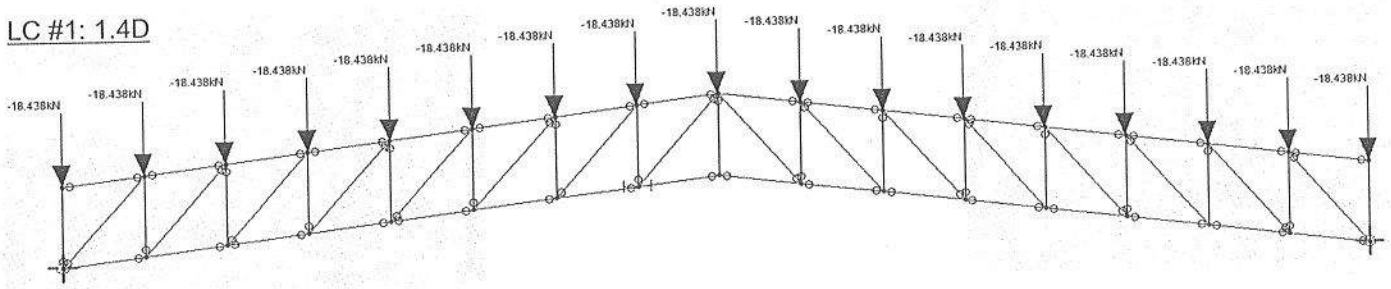
~Truss Analysis from RISA~
see next page

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. R 4 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Roof Truss Analysis		Journeyman International Organization

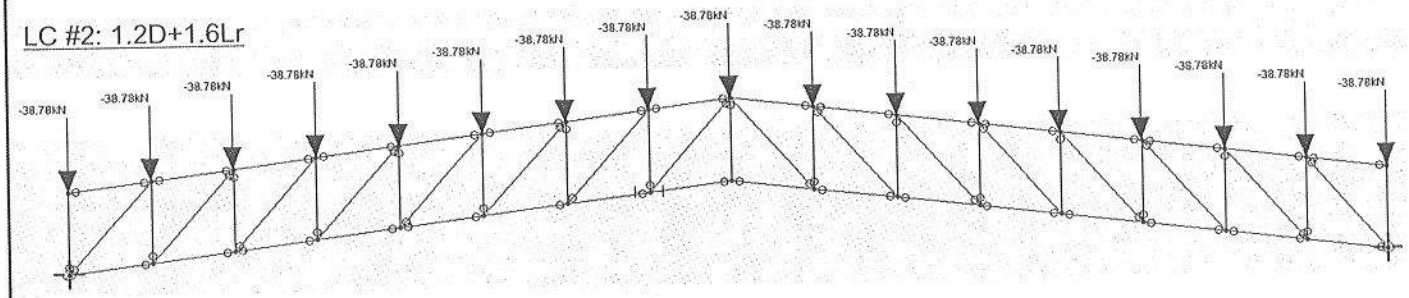
Reference

Load Combinations:

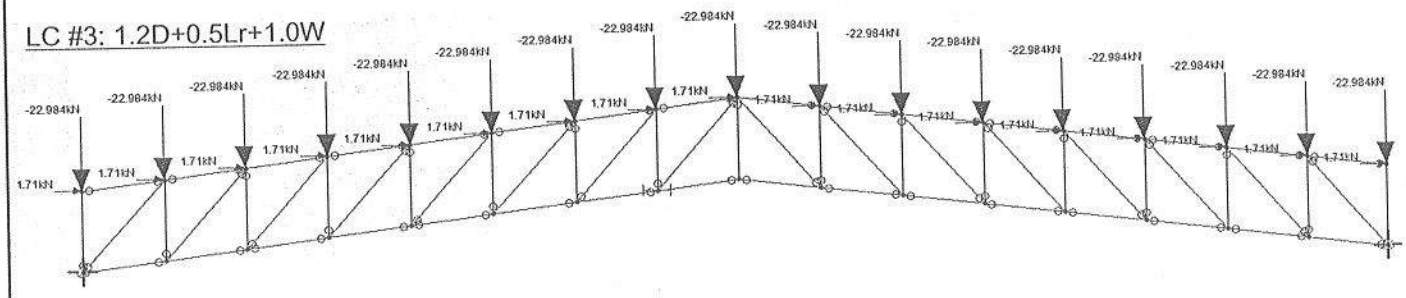
LC #1: 1.4D



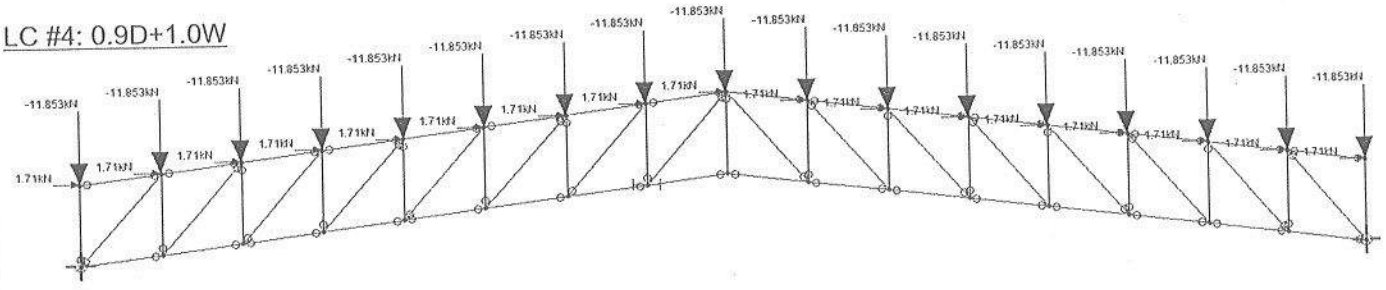
LC #2: 1.2D+1.6Lr



LC #3: 1.2D+0.5Lr+1.0W



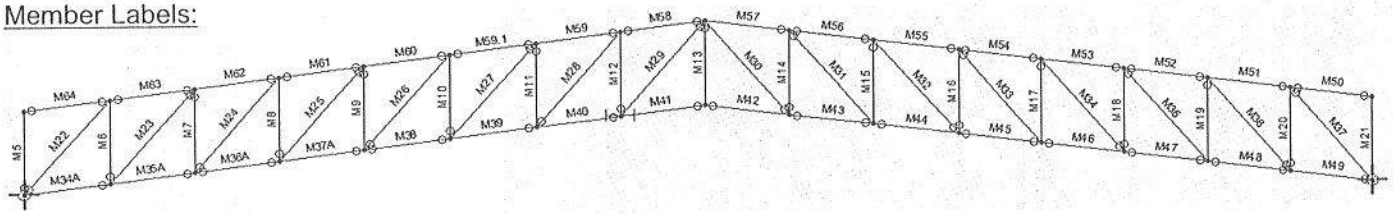
LC #4: 0.9D+1.0W



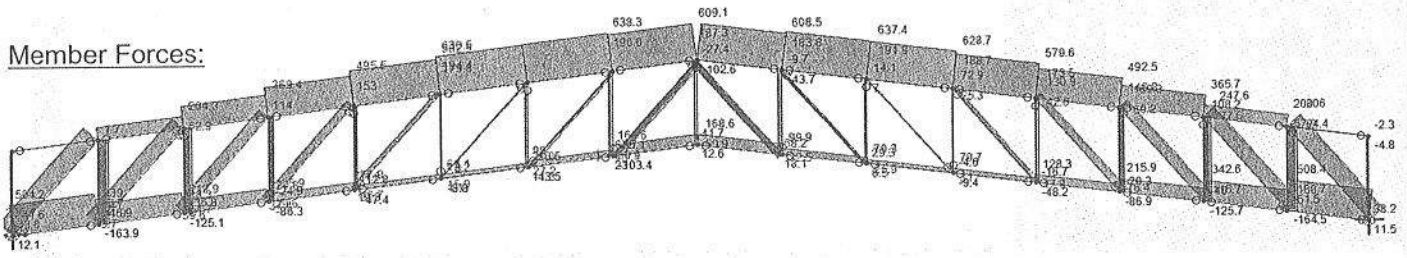
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. R5 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Roof Truss Analysis		Journeyman International Organization

Reference

Member Labels:



Member Forces:



Top Chord:

Member	S...		Axial[kN]
M59	1	max	638.291
		min	196.602

Web:

Member	S...		Axial[kN]
M22	1	max	305.077
		min	88.823

Bottom Chord:

Member	S...		Axial[kN]
M49	1	max	508.388
		min	168.724

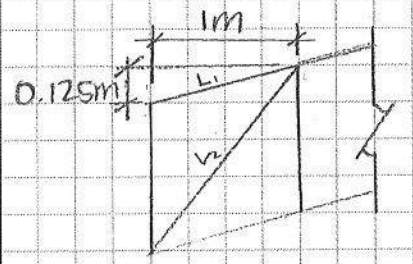
PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	R6 OF R17
AUTHOR	**DATE**
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
ROOF TRUSS DESIGN - (T1)	

Reference

governing axial loads:

prev. page
Top chord: 638.291 KN = 143.5 K
Web: 305.077 KN = 68.6 K
btm chord: 508.388 KN = 114.3 K

length of top/btm chord:



$L_1 = \sqrt{(1m)^2 + (0.125m)^2}$
$= 1.008\ m \left(\frac{3.28\ ft}{1\ m}\right)$
$= 3.31\ ft$

length of web:

$L_2 = \sqrt{(1m)^2 + (1.125m)^2}$
$= 1.505\ m \left(\frac{3.28ft}{1\ m}\right)$
$= 4.94\ ft$

Design

Top chord: $KL = (1.0)(3.31f)$
$= 3.31\ ft$
$Pu = 143.5\ K$
⟩ use **HSS 4 x 4 x 5/16, $\phi Pn = 158\ K$**

check:
$b/t \leq 0.55\sqrt{E/Fy}$
$\frac{4"}{0.325} \leq 0.55\sqrt{\frac{29000KSI}{46\ KSI}}$
$12.8 \leq 13.81$ ✓

Web: $KL = (1)(4.94\ ft)$
$= 4.94\ ft$
$Pu = 68.6\ K$
⟩ use **HSS 3 x 3 x 1/4, $\phi Pn = 83\ K$**

check:
$b/t \leq 0.55\sqrt{E/Fy}$
$3/0.25 \leq 13.81$ ✓

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: R7 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: ROOF TRUSS design -(T1)		Journeyman International Organization

Reference

design cont.:

Bottom chord: $KL = (1.0)(3.31')$ $= 3.31 ft$, $P_u = 114.3 K$ } use: HSS 3x3x3/8, $\phi P_n = 122 K$

check:

$b/t \leq 0.55\sqrt{E/f_y}$

$3''/0.375'' \leq 13.81$

$8 \leq 13.81$ ✓

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. R8 OF R17
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC Main Room Roof Beam, - (B4)	Journeyman International Organization

Reference

-See B3 QUICK calc for starter size: 12"x 12"

-See B3 calcs for loads since tnb widths are the same

↳ DL = 1.6801 klf = 24.53 KN/m
LL = 0.492 klf = 7.12 KN/m

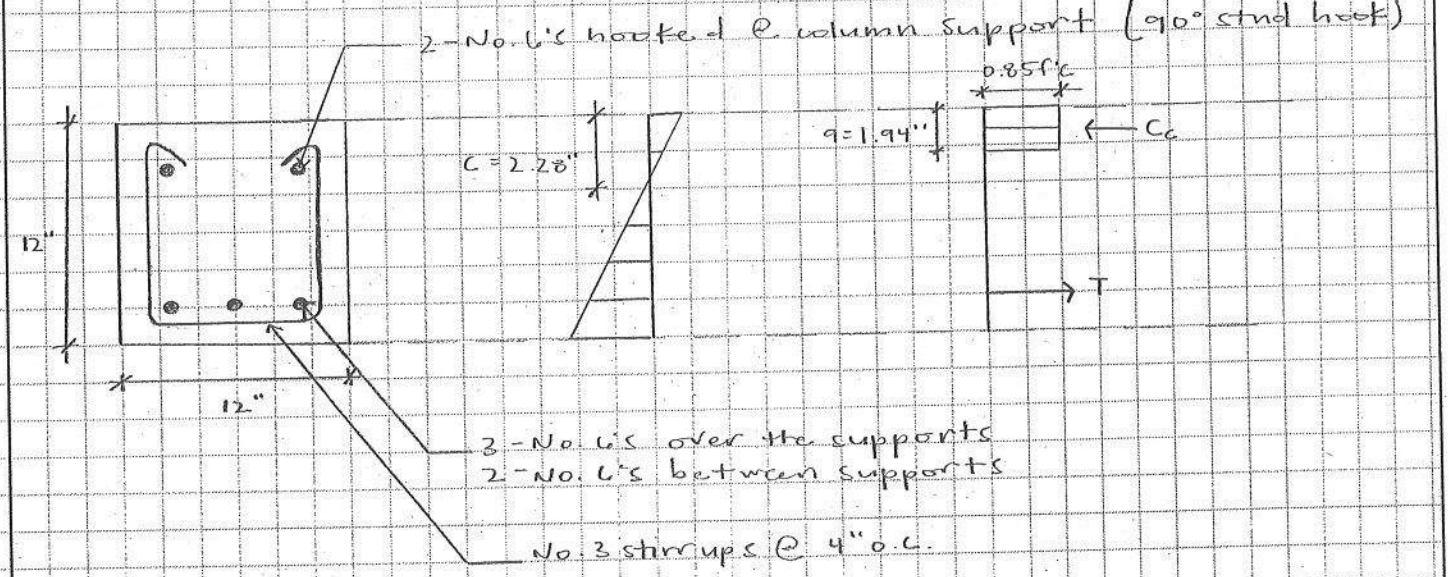
∴ since loads and tnb area is the same, B3 = B4

→ 12" x 12" conc Bm
3-#6 longitudinal bars over supports
2-#6 longitudinal bars between supports
#3 stirrups @ 4" O.C. throughout beam

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. R9 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Main Room Roof Beam – (B4)		Journeyman International Organization

Reference

Final Beam Design (B4):



PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	R 10 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Main Room Roof Girder - (G2)	Journeyman International Organization

Reference

-see G1 QUICK calc for girder starting size: 12" x 12"

Loads:

Load combo: 1.2D + 1.6L

DL = 5lb psf (8m x 3.28ft/m)
= 1469.4 plf
= 1.47 klf
= 21.4 kN/m

ASCE §4.8

LL = 20 psf
↳ A_T = (25m)(8m) = 200 m²
R_1 = 0.6 b/c $A_T \geq 55.74 m^2$
R_2 = 1.0 b/c no slope

Lr = (0.6)(1.0)(20 psf)
= 12 psf

LL = (12psf)(8m x 3.28ft/m)
= 314.88 plf
= 4.6 kN/m

W_T = 1.2D + 1.6L
= 2.27 klf
= 33.04kN/m

* moment & shear found w/ Risa analysis (attached) *

12"x12"

As,min

ACI §9.6.1

$A_{s,min} = \frac{200}{f_y} b_w d$ ← h - cover - ½ bar - long.

$= \frac{200}{60{,}000 psi} (12")(9.5")$

$= 0.38 in^2$ ← governs

$A_{s,min} = \frac{3\sqrt{f'c}}{f_y} b_w d$

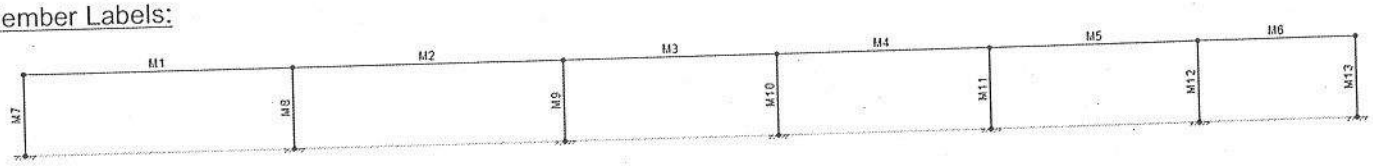
$= \frac{3\sqrt{4000 psi}}{60000 psi} (12")(9.5")$

$= 0.36 in^2$

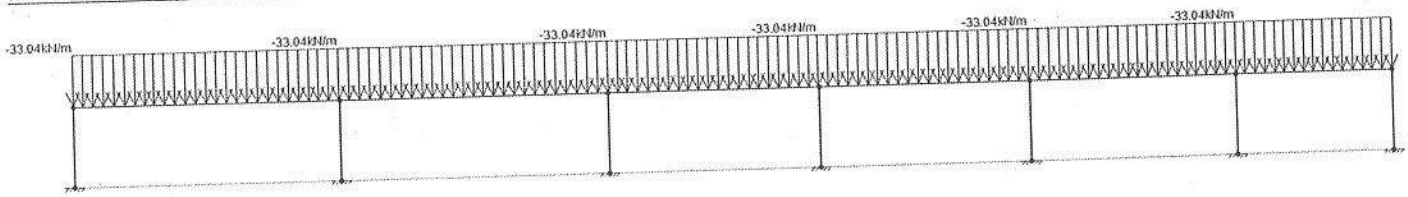
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: R 11 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Roof - Main Room Girder Analysis		Journeyman International Organization

Reference

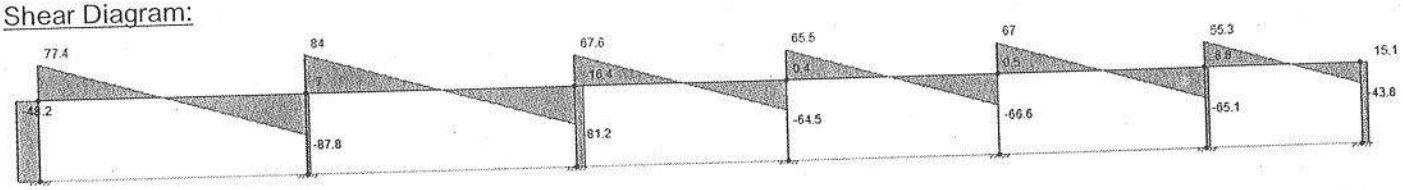
Member Labels:



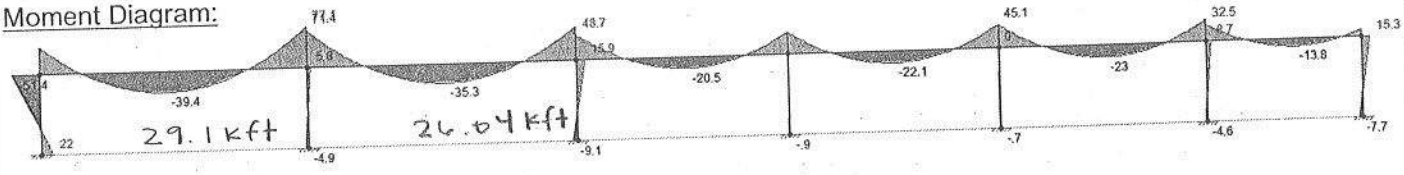
Load Combo (1.2D+1.6L):



Shear Diagram:



Moment Diagram:



29.1 kft

26.04 kft

Member Forces:

Member Section Forces

	LC	Member Label	Sec	Axial[kN]	Shear[kN]	Moment[kN-...
1	1	M1	1	48.243	77.447	51.358
2			2	48.243	-87.753	77.122
3	1	M2	1	41.202	83.968	71.354
4			2	41.202	-81.232	64.516
5	1	M3	1	24.766	67.621	48.655
6			2	24.766	-64.539	42.489
7	1	M4	1	24.406	65.525	42.841
8			2	24.406	-66.635	45.062
9	1	M5	1	23.899	67.028	45.035
10			2	23.899	-65.132	41.241
11	1	M6	1	15.092	55.3	32.498
12			2	15.092	-43.82	15.279
13	1	M7	1	77.447	-48.243	-51.358
14			2	77.447	-48.243	21.972
15	1	M8	1	171.72	7.042	5.768
16			2	171.72	7.042	-4.935
17	1	M9	1	148.854	16.435	15.862
18			2	148.854	16.435	-9.12
19	1	M10	1	130.063	.36	-.352
20			2	130.063	.36	-.9
21	1	M11	1	133.664	.507	.027
22			2	133.664	.507	-.743
23	1	M12	1	120.431	8.807	8.743
24			2	120.431	8.807	-4.644
25	1	M13	1	43.82	15.092	15.279
			2	43.82	15.092	-7.661

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	R12 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Main Room Roof Girder - (G2)	Journeyman International Organization

Reference

longitudinal steel (over supports):

FROM QUICK calcs: 12"x12" girder

$M_u = \phi A_s f_y (d - a/2)$

↳ assume: $d = h - 2.5" = 9.5"$

$a = d/3 = 3.17"$

$M_{umax} = 71.354$ KNM
$= 52.63$ K-ft

$$A_{s,req'd} = \frac{M_u}{\phi f_y (d - a/2)}$$

$$= \frac{(52.63 \text{ kft})(12"/1\text{ft})}{(0.9)(60\text{ksi})(9.5" - \frac{3.17"}{2})}$$

$= 1.48 \text{ in}^2$

⇒ try 3-#7 bars
$A_s = 1.80 \text{ in}^2$ > $A_{s,min}$

check #1:

$f_y = 60$ ksi
$f'_c = 4$ ksi

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.80 \text{ in}^2)(60 \text{ ksi})}{0.85(4 \text{ ksi})(12")} = 2.65"$$

$d = h - \text{cover} - \text{stirrup} - \frac{1}{2}(\text{long. bar})$

$$\phi M_n = \phi A_s f_y (d - a/2)$$
$$= (0.9)(1.80 \text{ in}^2)(60 \text{ ksi})(9.5625" - \frac{2.65"}{2})$$
$= 800.68$ k-in
$= 66.7$ K-ft > 52.63 kft ✓

check #2:

$c = a/\beta = 2.65"/0.85 = 3.12"$

ACI T21.2.2

$d = 12" - 1.5"\text{ cover} - 0.5" - \frac{1}{2}(7/8") = 9.5625"$
↑ assume #4 tie

$\varepsilon_c \left(\frac{d-c}{c}\right) \geq \varepsilon_t$

$$0.003\left(\frac{9.5625" - 3.12"}{3.12"}\right) \geq 0.004$$

$0.006 \geq 0.004$ ✓
↳ tension controlled ☺

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	R13 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Main Room Roof Girder - (G2)	Journeyman International Organization

Reference

longitudinal steel (between supports):

worst case span: 5m ≈ 16.4'

$M_u = \phi A_s f_y (d - a/2)$

↳ $M_u = 89.4\ kNm = 29.1\ kft$

$d = h - 2.5" = 9.5"$

$a = d/3 = 3.17"$

$A_{s\,req'd} = \frac{M_u}{\phi f_y (d - a/2)} = \frac{(29.1\ kft)(12"/1ft)}{(0.9)(60\ ksi)(9.5" - 3.17"/2)} = 0.82\ in^2$

⇒ try: 2-#6 bars
$A_s = 0.88\ in^2$ > $A_{s\,min}$

check #1:

$a = \frac{A_s f_y}{0.85 f'c\, b} = \frac{(0.88\ in^2)(60\ ksi)}{(0.85)(4\ ksi)(12")} = 1.29"$

$\phi M_n = \phi A_s f_y (d - a/2)$
$= (0.9)(0.88\ in^2)(60\ ksi)(9.625" - 1.29"/2)$
$= 426.73\ kin$
$= 35.56\ kft > 29.1\ k\text{-}ft$ ✓

check #2:

$c = a/\beta = 1.29"/0.85 = 1.52"$

$d = 12" - 1.5"\ cover - 0.5" - \frac{1}{2}(\frac{6}{8}") = 9.625"$
↑assume #4 tie

$\epsilon_c \left(\frac{d-c}{c}\right) \geq 0.004$

$0.003\left(\frac{9.625" - 1.52"}{1.52"}\right) \geq 0.004$

$0.016 \geq 0.004$ ✓
↳ tension controlled ☺

⇒ use 2-#6 bars between supports

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: R 14 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Main Room Roof Girder - (G2)		Journeyman International Organization

Reference

Hooked long. bars @ ends:

RISA

$M_u = 51.4\ KN\text{-}M = 37.9\ k\text{-}ft$

12"x12" girder

$a = d - \sqrt{\frac{-2M_u}{\phi 0.85 f'c b} + d^2}$ w/ d = 9.625" (#6 bar)

$= 9.625" - \sqrt{\frac{-2(37.9 kft)(12"/1ft)}{(0.9)(0.85)(4ksi)(12")} + (9.625")^2}$

$= 1.39"$

$A_{s\,req'd} = \frac{0.85 f'c\, b\, a}{f_y} = \frac{(0.85)(4\ ksi)(12")(1.39")}{60 ksi} = 0.945 in^2$

$\Rightarrow$ try 2-#7 hooked bars, $A_s = 1.20\ in^2$

- check #1:

$a = \frac{A_s f_y}{0.85 f'c\, b} = \frac{(1.2 in^2)(60 ksi)}{0.85(4 ksi)(12")} = 1.76"$ & $d = 12" - 1.5" - 0.5" - \frac{1}{2}(7/8") = 9.5625"$

$\phi M_n = \phi A_s f_y (d - a/2)$

$= (0.9)(1.20 in^2)(60 ksi)\left(9.5625" - \frac{1.76"}{2}\right)$

$= 46.8\ kft > 37.9\ kft$ ✓

- check #2:

$c = a/\beta = 1.76"/0.85 = 2.1"$

$d = 9.5625"$

$\epsilon_c\left(\frac{d-c}{c}\right) \geq \epsilon_t$

$0.003\left(\frac{9.5625" - 2.1"}{2.1"}\right) \geq 0.004$

$0.01 \geq 0.004$ ✓ → tension controlled

§18.6.4.3 ⇒ use 2-#7 Hooked Bars (closed by a crosstie)

§25.4.3.1 l_{dh} = greater of: $\frac{f_y \psi_e \psi_c \psi_r}{50 \lambda \sqrt{f'c}}$, 8db, 6"

$= 16.6"$

schedule $l_{ext} = 10.5"$

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: R15 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Main Room Roof Girder - (G2)		Journeyman International Organization

Reference

Shear Reinf.:

$V_c = 2\sqrt{f'c}\, b_w d$
$= 2\sqrt{4000 psi}\,(12")(9.5625")$
$= 14514.8\ \#$
$= 14.5\ K$

ACI §22.5.1
$\phi V_n = \phi(V_c + V_s)$
$= \phi 10\sqrt{f'c}\, b_w d$
$= (0.75)(10)\sqrt{4000 psi}\,(12")(9.5625")$
$= 54.4\ K$

$V_u max = 87.8 kN = 19.74 kip$

$\Rightarrow V_c < V_u$ ∴ need shear reinf.
$\phi V_n > V_u$ ∴ don't need to increase beam width

- **max spacing:**

C 6.2.2
$\frac{V_u}{\phi} > 6\sqrt{f'c}\, b_w d$
$\frac{19.74K}{0.75} > 6\sqrt{4000 psi}\,(12")(9.5625")$
$26.32K > 43.54K$ X
↳ use $s_{max} = d/2$, not $d/4$

$s_{max} = d/2$
$= 9.5625" / 2$
$= 4.78 in$

- **min shear reinf.:**

T9.6.3.3 $A_{v min}/s$ = greater of:

$= 0.75\sqrt{f'c}\, b_w/f_y$
$= 0.75\sqrt{4000 psi}\,(12"/60000 psi)$
$= 0.0095 in^2/in$

$= 50\, b_w/f_y$
$= 50(12"/60000 psi)$
$= 0.01 in^2/in$ ↑ governs

$A_{v min} = (0.01 in^2/in)(4.78")$
$= 0.0478 in^2$

⇒ use #3 stirrups
$A_v = 2(0.11 in^2)$

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	R16 OF R17
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Main Room Roof Girder - (G2)	

Reference

ACI 22.5.10 ≥ max V

$$s_{req'd} = \frac{A_v f_{yt} d}{\frac{V_u}{\phi} - V_c}$$

$$= \frac{(0.22\,in^2)(60\,ksi)(9.5625")}{(26.32k) - 14.5k}$$

$$= 10.67"$$

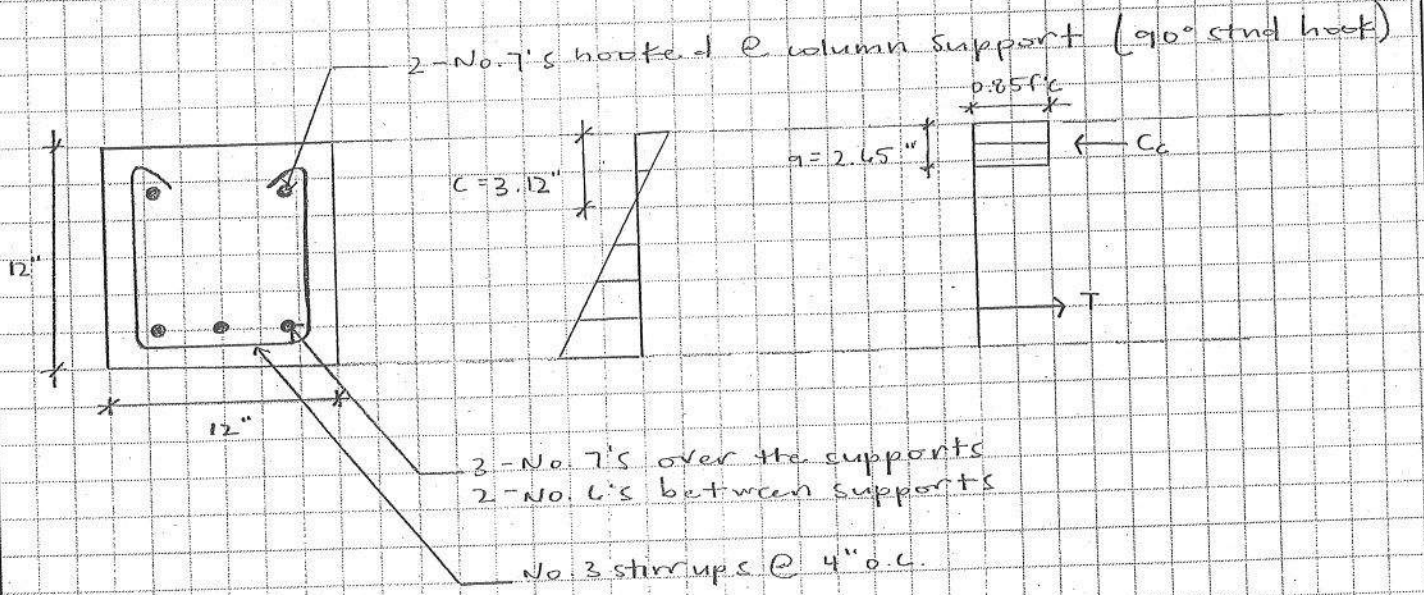
∴ $s_{max} \geq 4"$ & max shear location requires a spacing larger than code maximum, so use max spacing throughout

⇒ use **#3 stirrups @ 4" o.c. throughout beam**

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. R17 OF R17
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Main Room Roof Girder - (G2)		Journeyman International Organization

Reference

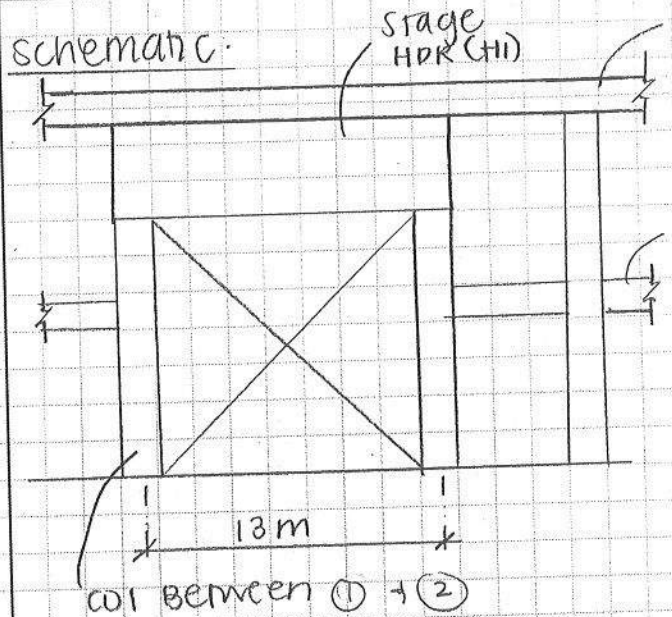
Final Girder Redesign (G2):



PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	H1 OF H14
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Stage Header (H1)	Journeyman International Organization

Reference

Schematic:



NOT TO SCALE

Based upon allowable space above stage opening, beam preliminary size will be:

12" x 53"

Loads:

long ul length

DL_1 = 2F girder loads + ROOF girder self wt.
= (56 PSF)(8m x 3.28 ft/m) + (150 PCF)(12" x 1ft/12")(12" x 1ft/12")
= 1.47 KLF + 0.15 KLF
= 1.62 KLF = 23.6 KN/m

stage RF engm = 34' = 10.4m

DL_2 = (41 PSF)(18')
= 0.738 KLF
= 10.77 KN/m
↳ additional load only where the stage is:
(7' from left col. = 2.1m
2' from right col. = 0.61m)

ASCE §4.8.2

LL = 20 PSF
↳ AT = (8m)(13m) = 104 m^2
R_1 = 0.6 b/c AT ≥ 55.74 m^2
R_2 = 1 b/c NO SLOPE

Lr = (0.6)(1.0)(20 PSF)
= 12 PSF

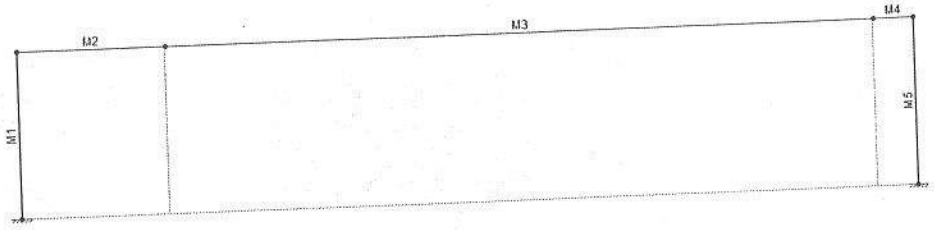
LL = (12 PSF)(8m x 3.28 ft/m)
= 314.88 PLF
= 0.315 KLF
= 4.6 KN/m

Load combo = 1.2D + 1.6L

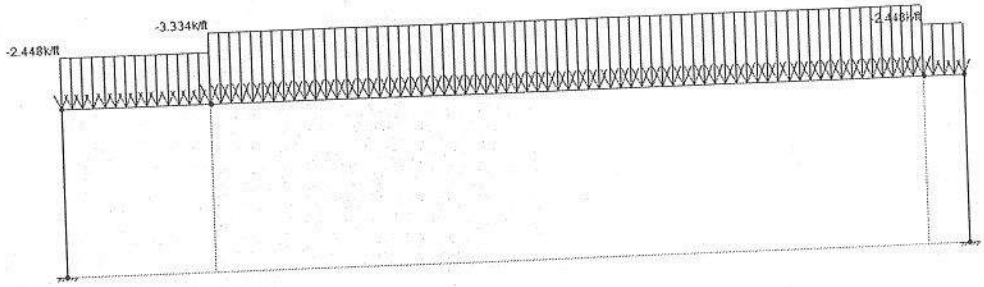
	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. H2 OF 414
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Stage Header Analysis (H1)	Journeyman International Organization

Reference

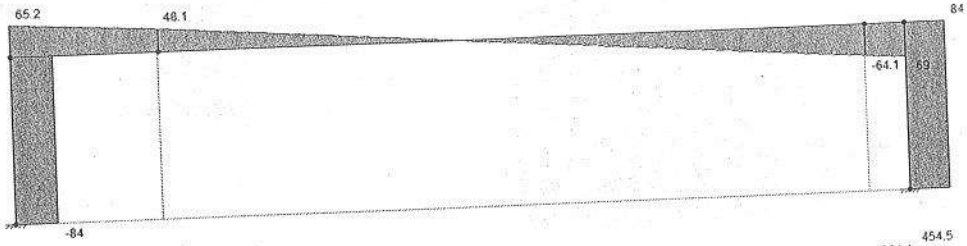
Member Labels:



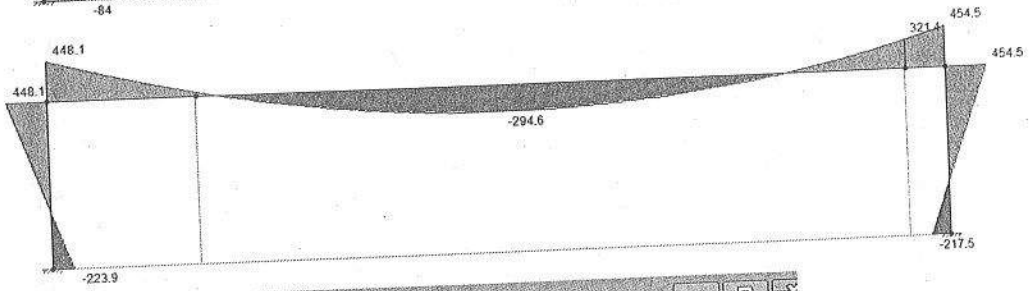
Load Combo (1.2D+1.6L):



Shear Diagram:



Moment Diagram:



Member Forces:

Member Section Forces

	L...	Member Label	S...	Axial[k]	Shear[k]	Mome...
1	1	M1	1	65.191	-84	-223.879
2			2	65.191	-84	-55.88
3			3	65.191	-84	112.119
4			4	65.191	-84	280.118
5			5	65.191	-84	448.117
6	1	M2	1	84	65.191	448.117
7			2	84	60.907	337.782
8			3	84	56.623	234.943
9			4	84	52.339	139.601
10			5	84	48.055	51.756
11	1	M3	1	84	48.055	51.756
12			2	84	20.02	-234.498
13			3	84	-8.016	-284.972
14			4	84	-36.052	-99.667
15			5	84	-64.087	321.417
16	1	M4	1	84	-64.087	321.417
17			2	84	-65.311	353.766
18			3	84	-66.535	386.728
19			4	84	-67.759	420.301
20			5	84	-68.983	454.487
21	1	M5	1	68.983	84	454.487
22			2	68.983	84	286.488
23			3	68.983	84	118.489
			4	68.983	84	-49.51

imperial units

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. H3 OF H14
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Stage Header (H1)		Journeyman International Organization

Reference

Longitudinal steel (between supports):

ACI

$M_u = 294.6$ k-ft

$$a = d - \sqrt{\frac{-2M_u}{\phi 0.85 f'_c b} + d^2}$$

w/ $d = 53" - 1.5" - 0.5" - 1.5" = 49.5"$

$$= 49.5" - \sqrt{\frac{-2(294.6\ k\text{-}ft)(12"/1ft)}{(0.9)(0.85)(4ksi)(12")} + (49.5")^2}$$

$$= 49.5" - 47.52"$$

$$= 1.98"$$

$$A_{s\,req'd} = \frac{0.85 f'_c b a}{f_y} = \frac{(0.85)(4ksi)(12")(1.98")}{60\ ksi} = 1.346\ in^2$$

Appx. D

$\Rightarrow$ use 2-#8 long. bars, $A_s = 1.58\ in^2$

$d = 53" - 1.5" - 0.5" - \frac{1}{2}(8/8") = 50.5"$

- **check #1:**

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.58\ in^2)(60ksi)}{0.85(4ksi)(12")} = 2.33"$$

$$\phi M_n = \phi A_s f_y (d - a/2)$$

$$= (0.9)(1.58\ in^2)(60\ ksi)(50.5" - 2.33"/2)$$

$$= 350.8\ k\text{-}ft > 294.6\ k\text{-}ft \checkmark$$

check 2

$$c = a/\beta = 2.33"/0.85 = 2.74"$$

$$\epsilon_c \left(\frac{d-c}{c}\right) \geq \epsilon_t$$

$$0.003 \left(\frac{50.5" - 2.74"}{2.74"}\right) \geq 0.004$$

$$0.052 \geq 0.004 \checkmark$$ tension controlled

$\Longrightarrow$ use 2-#8 long. Bars

must satisfy reqt by increasing steel, will still pass checks

min req'd

$$A_{s\,min} = \frac{200}{f_y}(b_w d) = \frac{200}{60{,}000}(12")(50.5") = 2.02\ in^2 \Rightarrow$$

Use: 3-#8 long. Bars

$$= \frac{3\sqrt{f'_c}}{f_y}(b_w d) = \frac{3\sqrt{4000}}{60000}(12")(50.5") = 1.92\ in^2$$

Reference

Hooked Bars (@ ends):

RISA: $M_u = 454.5$ k-ft

$$a = d - \sqrt{\frac{-2M_u}{\phi 0.85 f'_c b} + d^2}$$

=50.5" from before

$$= 50.5" - \sqrt{\frac{-2(454.5\text{k-ft})(12"/1\text{ft})}{(0.9)(0.85)(9\text{ksi})(12")} + (50.5")^2}$$

$$= 50.5" - 47.47"$$

$$= 3.03"$$

$$A_{s\,req'd} = \frac{0.85 f'_c b a}{f_y} = \frac{(0.85)(9\text{ksi})(12")(3.03")}{60\text{ ksi}} = 2.06\text{in}^2$$

Appx D: $\Rightarrow$ use 3-#8 Hooked bars, $A_s = 2.37\text{in}^2$

$d = 50.5"$ b/c still assumes #8 bars

check #1:

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(2.37\text{in}^2)(60\text{ksi})}{(0.85)(9\text{ksi})(12")} = 3.49"$$

$$\phi M_n = \phi A_s f_y (d - a/2)$$
$$= (0.9)(2.37\text{in}^2)(60\text{ksi})(50.5" - 3.49"/2)$$
$$= 519.9\text{ k-ft} > 454.5\text{ k-ft} \checkmark$$

check #2:

$$c = a/\beta = 3.49"/0.85 = 4.11"$$

$$\varepsilon_c \left(\frac{d-c}{c}\right) \geq \varepsilon_t$$

$$0.003\left(\frac{50.5" - 4.11"}{4.11"}\right) \geq 0.004$$

$0.034 \geq 0.004$ ✓ tension controlled

§18.6.4.3

$\Rightarrow$ use **3-#8 Hooked Bars** (closed by a crosstie)

§ 5.4.3.1 l_{dh} = greater of $\frac{f_y \psi_e \psi_c \psi_r}{50\lambda\sqrt{f'_c}}$, $8d_b$, 6"

$= 18.98"$

$l_{ext} = 12"$

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: H5 OF H14
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: stage header (H1)		Journeyman International Organization

Reference

shear reinf.:

$V_c = 2\sqrt{f'c}\, b_w d$
$= 2\sqrt{4000psi}\,(12")(50.5")$
$= 76.65\,K$

§22.5.1 $\phi V_n = \phi(V_c + V_s)$
$= \phi 10\sqrt{f'c}\, b_w d$
$= (0.75)(10)\sqrt{4000psi}\,(12")(50.5")$
$= 287.5\,K$

RISA $V_u max = 68.9\,K$

$\Rightarrow V_u < V_c$ ∴ don't need shear reinforcement
$\phi V_n > V_u$ ∴ won't need to increase beam width

$\Rightarrow$ will add minimum shear reint. reqd by code for constructability purposes

max spacing:

$\frac{V_u}{\phi} > 6\sqrt{f'c}\, b_w d$

T.9.7.6.2.2 $\frac{68.9K}{0.75} > 6\sqrt{4000psi}\,(12")(50.5")$

$68.9K > 230K$ X
↳ use $s_{max} = d/2$, not $d/4$

$s_{max} = d/2$
$= 50.5" / 2$
$= 25.25"$
$\approx 24"$

min. shear reint size:

T.9.6.3.3 $A_{v\,min/s}$ = greater of:

$= 0.75\sqrt{f'c}\, b_w / f_y$
$= 0.0095\,in^2/in$

$= 50\, b_w / f_y$
$= 0.01\,in^2/in$
↑ governs

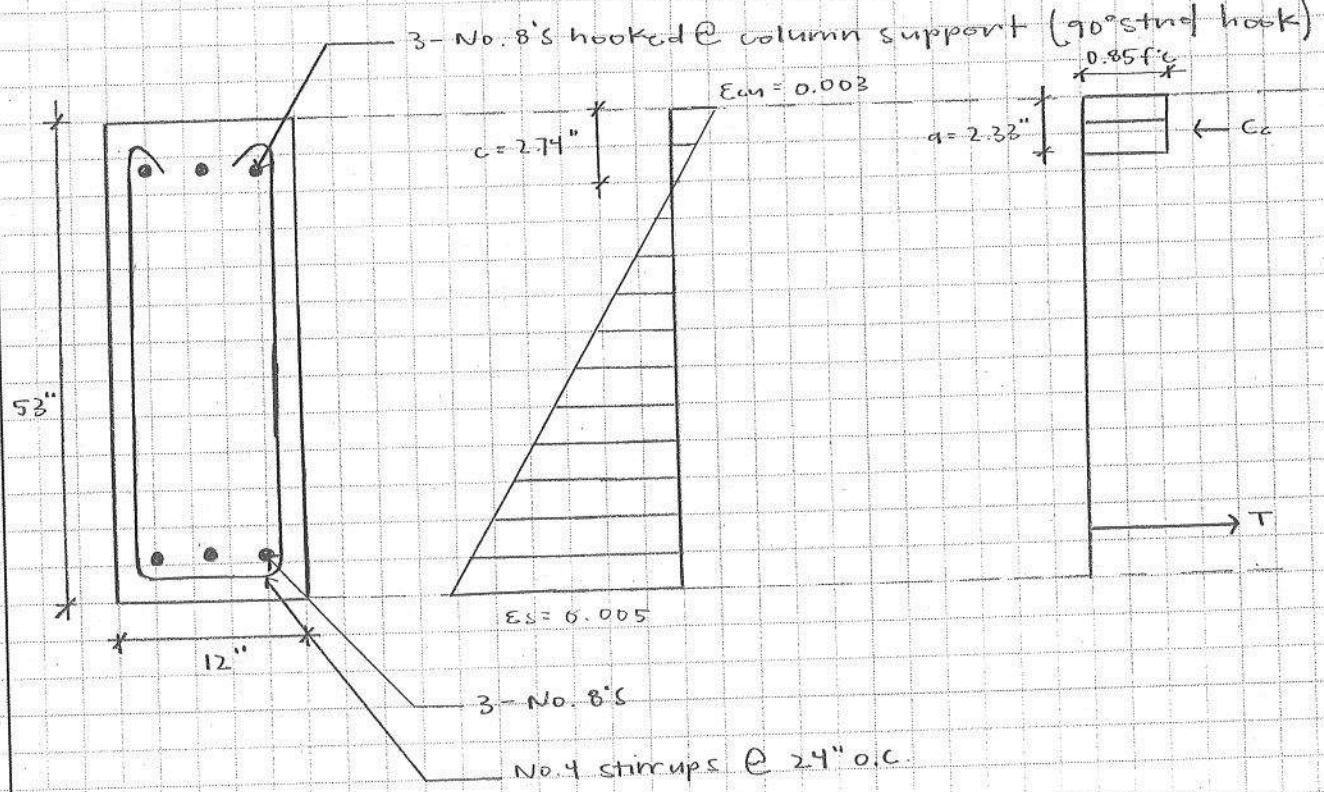
$A_{v\,min} = (0.01\,in^2/in)(24")$
$= 0.24\,in^2$

$\Rightarrow$ use #4 stirrups @ 24" O.C throughout
$A_v = 2(0.2\,in^2)$
$= 0.4\,in^2$

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: H6 OF H14
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Stage Header		Journeyman International Organization

Reference

Final Header Design (H1):



PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	H7 OF H14
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Window/Door Headers on Gridlines B & D.	Journeyman International Organization

Reference

Header Design - H2

Restrictions:
Height from lvl 2 to top of window = 3'-2"
Depth of lvl 2 girder on gridline B and D (G1) = 20"
Max Depth = 38" - 20" = 18"

Max width = width of lvl 2 girder (G1) = 12"

Quick Calc: 12" x 18" header.

f_y = 60ksi
f'_c = 4ksi

Load Combination: 1.2D + 1.6L
DL = 69 psf (wall load) + (150 pcf)(12"/12"/1) ← self weight of beams above
LL = 20 psf

$A_T = (5\,m)(3.55\,m) = 17.8\,m^2 \Rightarrow A_T \leq 18.58\,m^2$; $R_1 = 1.0$

$F_1 = 1.5 \Rightarrow F \leq 4$; $R_2 = 1.0$

$L_r = L_o R_1 R_2 = (20\,psf)(1.0)(1.0) = 20\,psf$

$w_D = 1.2\left[(69\,psf \times 9') + \left(150\,psf \times \left(\frac{20"}{12"/1} + \frac{12"}{12"/1}\right)\right)\right] = 1225.2\,plf$

$w_L = 1.6\,(20\,psf \times 11.67) = 373\,plf$

$w_T = 1225.2 + 373 = 1598.53\,plf = 1.6\,klf$

$M_u = \frac{w_T L^2}{8} = \frac{(1.6\,klf)(16.4')^2}{8} = 53.8\,kft$ (max moment b/w span)

Flexure:
$M_u = \phi A_s f_y \left(d - \frac{a}{2}\right)$
↳ assume: $d = h - 2.5" = 15.5"$
$a = d/3 = 5.2"$

$A_s = \frac{M_u}{\phi f_y \left(d - \frac{a}{2}\right)} = \frac{(53.8 \times 12"/1)}{(0.9)(60ksi)\left(15.5 - \frac{5.2}{2}\right)} = 0.926\,in^2$

$A_{s\,min}$ = greater of $\frac{200}{f_y} b_w d$

or

$\frac{3\sqrt{f'_c}}{f_y} b_w d$

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	H 8 OF H14
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Window/Door Headers on Gridline B & D	Journeyman International Organization

Reference

ACI 318 §9.6.1.2

$A_{s\min} = \frac{200}{f_y} b_w d = \frac{200}{60{,}000}(12"\times 15.5") = 0.62\ in^2 < 0.926\ in^2$ ✓

$A_{s\min} = \frac{3\sqrt{f'_c}}{f_y} b_w d = \frac{3\sqrt{4000}}{60{,}000}(12"\times 15.5") = 0.62\ in^2 < 0.926\ in^2$

$A_{s\,req'd} = 0.926\ in^2 \Rightarrow$ Try 3 - No. 6's, $A_s = 1.32\ in^2$ ✓

Check:

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.32)(60)}{(0.85)(.9)(12")} = 1.94"$

ACI 318 T6.12.1.2.2

$c = \frac{a}{\beta} = \frac{1.94}{0.85} = 2.28"$

β .85

$d = 18" - 1.5"_{\text{clear spacing}} - \left(\frac{3}{8}\right)_{\text{assumed No.3 stirrup}} - \left(\frac{6}{16}\right)_{\text{No.6 rebar}} = 15.8" \approx 15.5"$

$\varepsilon_s = 0.003\left(\frac{d-c}{c}\right) = 0.003\left(\frac{15.5-2.28}{2.28}\right) = 0.0174 > 0.005$ ✓
tens controlled → $\phi = 0.9$

$\phi M_n = (0.9)(1.32)(60)(15.5 - 1.94/2) = 1025.7\ k\cdot"/12"/' = \underline{86.3\ k\text{-}ft}$

$\phi M_n = 86.3\ k\text{-}f \rightarrow M_u = 53.8\ k\text{-}ft$ ✓ O.K.

Note: Designed as simply supported - no moments @ the ends. Add 2 - No.6 hooks @ ends. (90° stnd. hook)

Shear:

$A_{v\min}$ is not required if: 1) $h \le 24"$
2) $V_u \le \phi 2\sqrt{f'_c} b_w d$

ACI 318 T9.6.3.1. T21.2.1

$h = 18" \le 24"$ ✓

$V_u = \frac{wL}{2} = \frac{(1.6\ k/f')(11.4')}{2} = 13.12\ k$

$\phi 2\sqrt{f'_c} b_w d = (0.75)(2)\sqrt{4000}(12\times 15.5) = 17.64\ k$

$\Big\} V_u \le \phi 2\sqrt{f'_c} b_w d$ ✓

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	#9 OF #14
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Window/Door Headers on Gridline B:D	Journeyman International Organization

Reference

$V_c = 2\sqrt{f'c}\, b_w d$

$= 2\sqrt{4000}\,(12)(15.5)$

ACI §22.5.1 $= 23.5\ k$

$\phi V_n = \phi 10 \sqrt{f'c}\, b_w d$

$= (0.75)(10)(\sqrt{4000})(12)(15.5)$

$= 82.3\ K$

$V_{u\,max} = 13.12K$

↳ $\phi V_n > V_u$ ∴ do not need to increase beam width

Max Spacing $= \frac{A_v f_y}{\phi} < 6\sqrt{f'c}\, b_w d$

$\frac{13.12}{0.75} < 6\sqrt{4000}\,(12)(15.5)$

ACI 318 T9.7.6.22 $17.5\ K \not< 70.6\ K \Rightarrow S_{max} = \frac{d}{4}$

$S_{max} = \frac{d}{4} = \frac{15.5}{4} = 3.875" \approx \underline{3"}$

$\frac{A_{v\,min}}{s} = \frac{50\, b_w}{f_y} = \frac{(50)(12)}{60{,}000} = \underline{0.01\ in^2/in}$

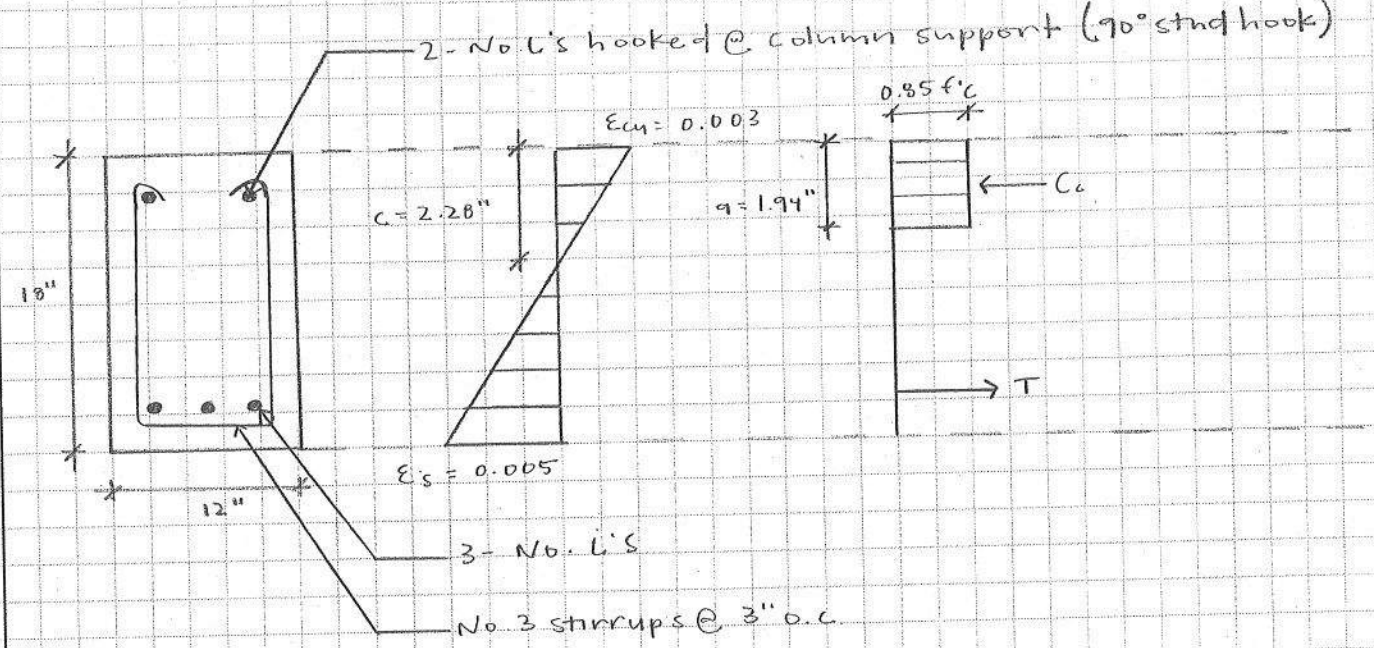
$A_{v\,min} = (0.01)(3) = 0.03\ in^2 \Rightarrow$ No. 3 stirrups

- use No. 3 stirrups @ 3" o.c
- use 3 - No. 6's for flexural reinf.
- use 2 - No. 6 hooks @ column support

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: H10 OF H14
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Window / Door Headers on Gridline B & D		Journeyman International Organization

Reference

Final Header Design (H2):



Reference

Header Design - H3

Restrictions:
Height from lvl 2 to top of window = 3'-2"
Depth of lvl 2 beam (B3) on gridlines 1&3 = 12"
Max Depth = 38" - 12" = 26"

Max width = width of lvl 2 beam (B3) = 12"

Quick Calc = 12" x 26" header.

fy = 60ksi
f'c = 4ksi

Load Combo: 1.2D + 1.6L
DL = 69psf (wall load) + (150pcf)(12"/12"/1) ↑ self wt of beams above
LL = 20 psf

$A_T = (4m)(3.55\ m) = 14.2\ m^2 \Rightarrow A_T \leq 18.58\ m^2$; $R_1 = 1$

$F = 1.5 \Rightarrow F \leq 4$; $R_2 = 1$

$L_r = L_o R_1 R_2 = (20\ psf)(1)(1) = 20\ psf$

$w_D = 1.2\left[(69psf \times 9') + (150\ psf \times (12"/12"/1 \times 12"/12"/1))\right] = 1105.2\ plf$

$w_L = 1.6\,(20psf \times 11.67') = 373\ plf$

$w_T = 1105.2 + 373 = 1478.2\ plf = 1.5\ klf$

$M_u = \frac{(1.5klf)(4m \times 3.28\ ft/m)^2}{8} = 32.3\ kft$ (max moment b/w span)

Flexure:
$M_u = \phi A_s f_y (d - \frac{a}{2})$
↳ assume: $a = d/3 = 7.83"$
$d = h - 2.5" = 26 - 2.5 = 23.5"$

$A_{s\,req'd} = \frac{M_u}{\phi f_y (d - \frac{a}{2})} = \frac{(32.3\ kft \times 12"/1)}{(0.9)(60)(23.5 - \frac{7.83}{2})} = 0.366\ in^2$

$A_{s\,min}$ = greater of $\frac{200}{f_y} b_w d$

or

$\frac{3\sqrt{f'c}}{f_y} b_w d$

Reference

$A_{s\,min} = \frac{200}{60,000}(12)(23.5) = 0.94\ in^2$ ← governs

ACI 318 §9.6.1.2

$A_{s\,min} = \frac{3\sqrt{4000}}{60,000}(12 \times 23.5) = 0.89\ in^2$

$A_{s\,req'd} = 0.94\ in^2 \Rightarrow$ Try 3 - No.6's - $A_s = 1.32\ in^2$

Check:

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.32)(60)}{(0.85)(4)(12)} = 1.94"$

ACI 318 §21.2.2

$c = \frac{a}{\beta} = \frac{1.94}{0.85} = 2.28"$

β .85

$d = 26" - 1.5"_{\text{clear spacing}} - \left(\frac{3}{8}\right)_{\text{assumed No.3 stirrups}} - \left(\frac{6}{16}\right) = 23.75" \approx 24"$

$\varepsilon_s = 0.003\left(\frac{d-c}{c}\right) = 0.003\left(\frac{24 - 2.28}{2.28}\right) = 0.028 \geq 0.005$ ✓ tens controlled → $\phi = 0.9$

$\phi M_n = (0.9)(1.32)(60)\left(24 - \frac{1.94}{2}\right) = 1641.6\ \#ft = 136.8\ k\text{-}ft$

$\phi M_n = 136.8\ k\text{-}ft > M_u = 32.3\ k\text{-}ft$ ✓ O.K

Note: Designed as simply supported - no moment @ the ends
Add 2 - No.6 hooks @ ends. (90° std. hook)

Shear:

ACI 318 § 9.6.3.3

$A_{V\,min}$ is greater of: 1) $0.75\sqrt{f'_c}\frac{b_w}{f_{yt}}$

2) $50\ b_w / f_{yt}$

$A_{V\,min} = \frac{0.75\sqrt{4000}}{60,000} \times 12" = 0.009\ in^2$

$A_{V\,min} = \frac{50\ b_w}{f_{yt}} = \frac{(50)(12)}{60,000} = 0.01\ in^2$ ← governs

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: H13 OF H14
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Window / Door headers on Gridlines 1 & 3	Journeyman International Organization

Reference

ACI §22.5.1

$V_c = 2\sqrt{f'c}\, b_w d$

$2\sqrt{4000} \times 12 \times 24 = 36.4\text{k}$

$\phi V_n = \phi(V_c + V_s) = \phi 10\sqrt{f'c}\, b_w d$

$= (0.75)(10)(\sqrt{4000})(12)(24)$

$= 136.6\text{k}$

$V_u = \frac{wL}{2} = \frac{(1.5)(4\text{m} \times 3.28\ \text{ft/m})}{2} = 9.84\text{k}$

$V_c = 36.4\text{k} > V_u = 9.84\text{k} \Rightarrow$ Shear reinf. not reqʼd

$\phi V_n = 136.6\text{k} > V_u \Rightarrow$ Do not need to inc. beam width

*Note: $A_{v\,min}$ governs. $A_{v\,reqʼd} = 0.01\ \text{in}^2 \Rightarrow$ use No. 3 stirrups

ACI 318 T9.7.6.2

Max spacing:

$\frac{V_u}{\phi} > 4\sqrt{f'c}\, b_w d$

$\frac{9.84}{0.75} > (4)(\sqrt{4000})(12)(24)$

$13.12\text{k} \not> 109.3\text{k} \Rightarrow$ use $d/4$

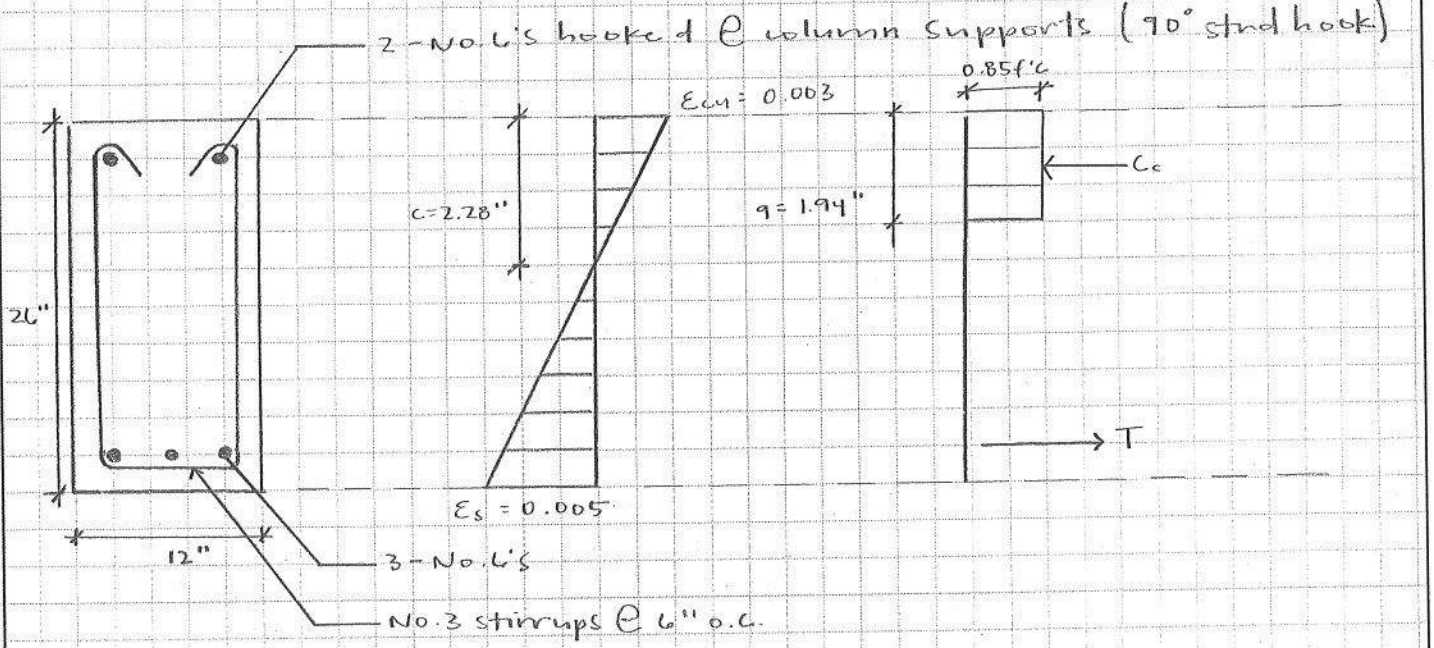
$\frac{d}{4} = \frac{24}{4} = 6"$

- use No. 3 stirrups @ 6" o.c.
- use 3-No. 6's for flexural reinf
- use 2-No. 4's @ ends w/ 90° standard hook

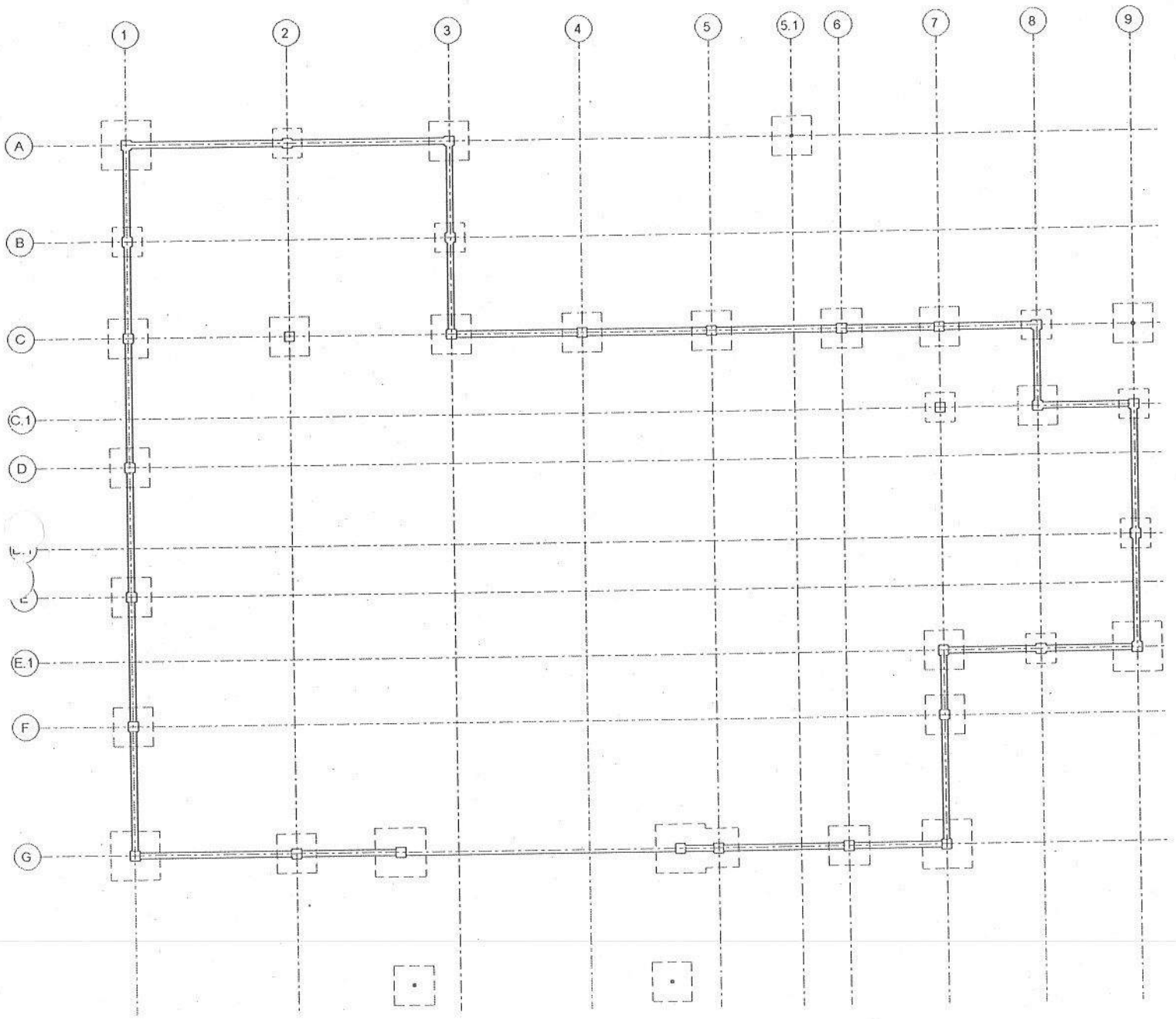
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: H14 OF H14
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Window/Door Headers on Gridlines 1 & 3		Journeyman International Organization

Reference

Final Header Design (#3):



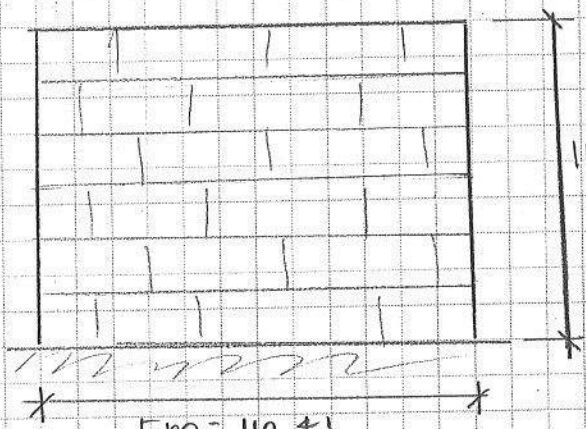
	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. C1 OF C47
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC Column Key Plan	Journeyman International Organization



TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. M1 OF M2
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC masonry wall	Journeyman International Organization

Reference

worst case masonry wall designed for all cases:



CLR HT

8" MUCK BLOCKS 4~16.5 rows

$W_{wall} = 69$ psf
$DL = 56$ psf
$LL = 20$ psf

out of plane load (wind):
$P = 57.23$ psf

& mortar, partially grouted
$f'm = 2000$ psi
Mb width = 8"

$1.394D + 1.0L + 1.0W$

$$M_w = \frac{Pl^2}{8} = \frac{(57.23\ psf)(11')^2}{8} = 865.6\ \#ft$$

$$P_u = (69\ psf + 56\ psf)(1.394) + 20\ psf(1.0)$$
$$= 174.25\ psf\ (8"\ Mb\ width)$$
$$= 116.17\ plf\ (16.4')$$
$$= 1905\ \#$$

$0.05 A_n f'm = 0.05(12" \times 12")(2000\ psi) = 14400\ \#$ $\rangle$ $P_u \leq 0.05 A_n f'm$ ✓

TMS 9.1.9.2

$M_{cr}(1.3) = (1.3) S_n F_r$ ← 84 psi (assume hollow blc is more conservative)

$\frac{bh^2}{6} = \frac{(7\frac{5}{8}")(11')^2}{6} = 153.77\ in^3$

$= (1.3)(153.77\ in^3)(84\ psi)$
$= 16791.8\ \#in$
$= 1399.3\ \#ft$

sum forces @ mid wall

$$A_{s\,req'd} = \frac{M_u + P_u(11/2)}{\phi f_y (d - a/2)}$$ assume $a = d/3 = 132"/3 = 44"$
$d = (11' \times 12") - 1\frac{3}{8}" - 1.5" - 0.5"$

$$= \frac{865.4\ ft\ ft\ (12"/ft) + (1905\ \#)(5.5')(12"/ft)}{(0.9)(60{,}000\ psi)(128.7" - \frac{44"}{2})}$$

$= 0.024\ in^2$

$\Rightarrow$ try 1-#4 @ $A_s = 0.2\ in^2$

$$a = \frac{A_s f_y}{0.85 f'm b} = \frac{(0.2\ in^2)(60\ ksi)}{0.85(2\ ksi)(7\frac{5}{8}")} = 0.926"$$

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	M2 OF M2
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: masonry wall	Journeyman International Organization

Reference

$M_n = A_s f_y (d - a/2)$
$= (0.2\,in^2)(60\,ksi)(132" - 0.926"/2)$
$= 1578.4\,k\,in$
$= 131.58\,k\,ft$
$= 131537\,\#ft$

$\phi M_n = (0.9) M_n$
$= 118383.4\,\#ft$

$\therefore M_n > 1.3 M_{cr}$ ✓

TMS EQN 9-16 §9.2.3

lap length:

$l_d = \frac{0.13 d_b^2 f_y \gamma}{k \sqrt{f'_m}}$ w/ $k = 1.5"$ min masonry cover, $\gamma = 1.0$

$= \frac{0.13 (0.5in)^2 (60{,}000\,psi)(1.0)}{(1.5") \sqrt{2000\,psi}}$

$= 29"$

⇒ use 1-#4 longitudinal bar w/ l_d: 29"

SHEAR:

$V_{umax} = \frac{W_u L}{2} = \frac{(116.17\,plf)(16.4')}{2} = 952.6\,\#$

$\frac{M_u}{V_u} = \frac{865.6\,k\,ft + (1905\,\#)(5.5')}{952.6\,\#} = 11.9 > 1.0$

TMS 0-141

$\gamma = 0.75$ partially grouted

$V_{nmax} = 4 A_{nv} \sqrt{f'_m}\, \gamma_g$ $A_{nv} = b \cdot d$

$= 4(7.625")\sqrt{2000\,psi}\,(0.75)(128.7")$

$= 131660\,\#$

$\phi V_{nm} = (0.8)(131660\,\#)$
$= 105328\,\#$

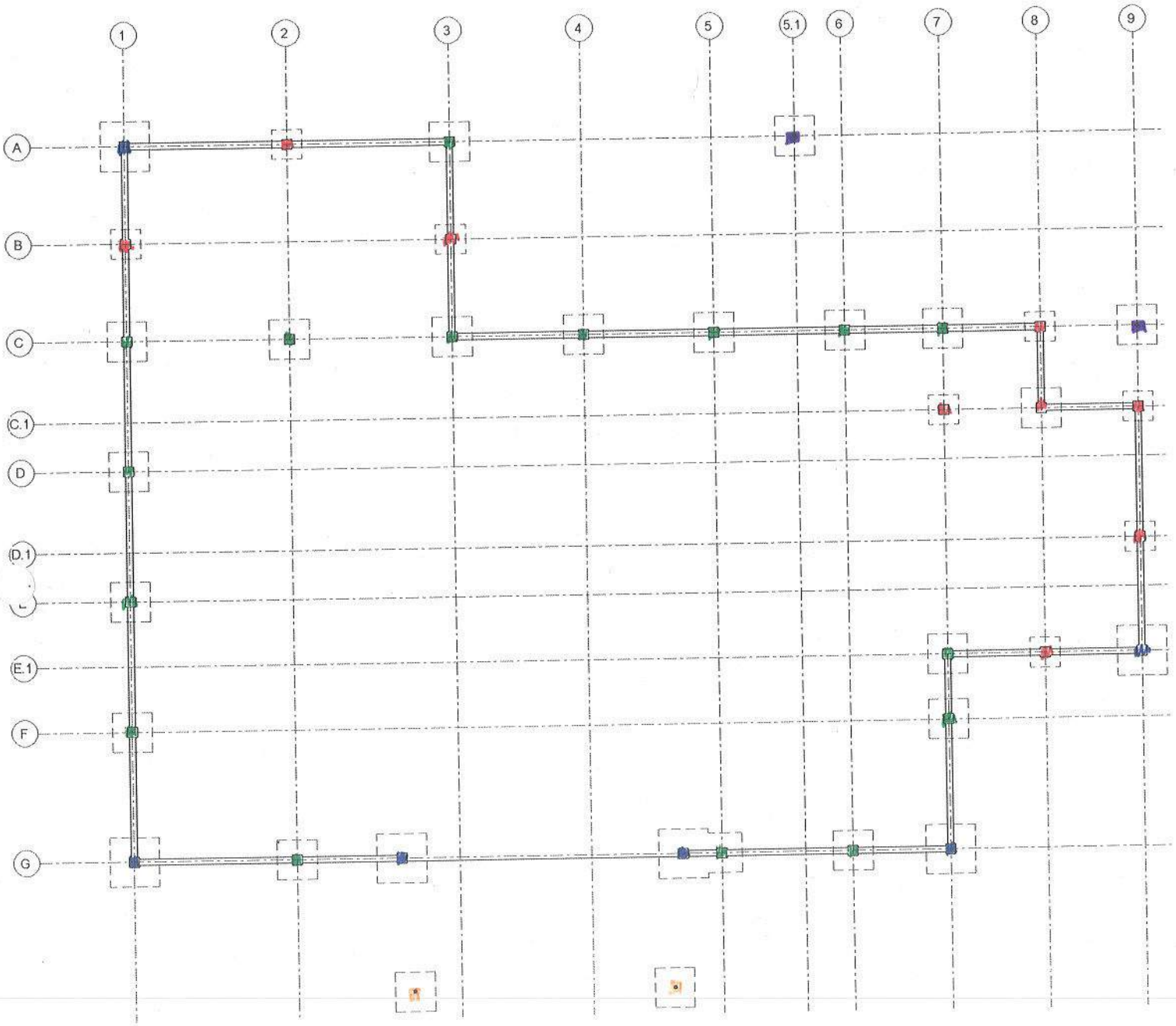
$\phi V_n > V_u$ → don't need shear reinf, but add minimum

$A_{vmin} = 0.0007\,bdv = 0.0007(7.625")(128.7") = 0.691\,in^2$ → try 1-#8 $A_s = 0.79\,in^2$

$V_n = 0.5 \left(\frac{A_v}{s}\right) f_y d_v$ ⇒ $952.6\,\# = 0.5 \left(\frac{0.79\,in^2}{s}\right) 60000\,psi\,(128.7")$ → s = large, use 48" O.C. to be conserv

⇒ use 1-#8 shear reinf. @ 48" O.C.

	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. C1 OF C47
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC Column Key Plan	Journeyman International Organization



-C1, C4, C5, C6

-C2

-C3

-C7

-C8

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. C2 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Column Group # 1 (C1)		Journeyman International Organization

Reference

Column Design - C1

ACI 318 T.L14.1

Load Combo: 1.2D + 1.6L

DL = 61 psf

LL = 20 psf

$A_T = (4m)(2.5m) = 10 m^2 \Rightarrow A_T \leq 18.58 m^2 \; ; \; R_1 = 1$

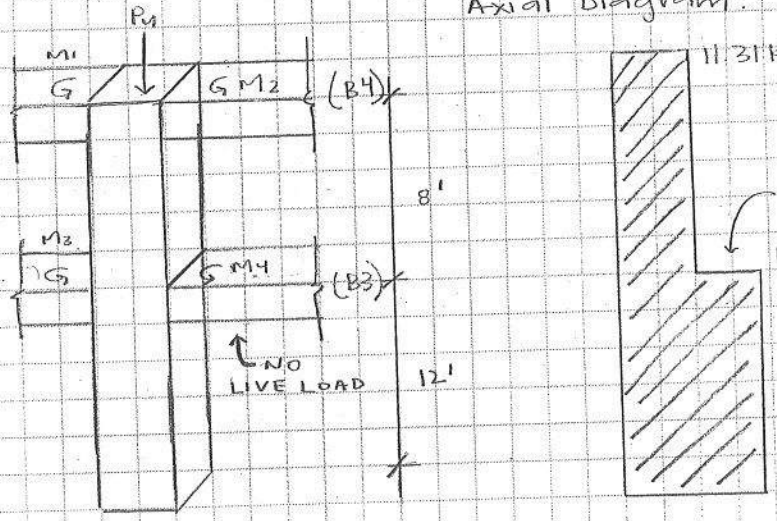
$F_1 = 1.5 \Rightarrow F_1 \leq 4 \; ; \; R_2 = 1$

$L_n = L_o R_1 R_2 = (20)(1)(1) = 20 psf$

Axial Design:

$P_{u_p} = [(1.2)(61psf) + (1.6)(20psf)][4m \times 2.5m \times 3.28^2 ft^2/m^2) = 11.32 K$

Axial Diagram:



ACI 318 T.6.5.2

Flexural Design:

M_3) Face of other supports (B3)

$M_3 = \frac{w_u l_n^2}{11} = \frac{(2.017 K/f)(4m \times 3.28 ft/m)^2}{11} = 31.56 K ft$

M_4) Exterior face of the first interior support (B3)

$M_4 = \frac{w_u l_n^2}{10} = \frac{(2.017 K/f)(4m \times 3.28 ft/m)^2}{10} = 34.71 K ft$

M_1) Face of other supports (B4)

$M_1 = \frac{w_u l_n^2}{11} = \frac{(2.804 K/f)(4m \times 3.28)^2}{11} = 43.9 K ft$

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	C3 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Column Group # 1 (C1)	Journeyman International Organization

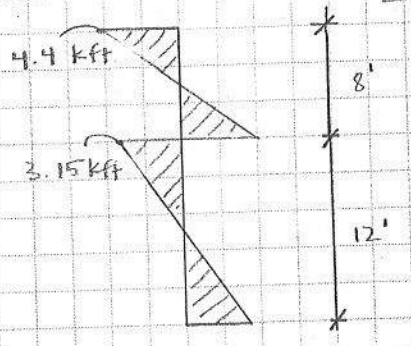
Reference

M2) Exterior face of the first interior support (B4)

$$M_2 = \frac{w_u l_n^2}{10} = \frac{(2.804)(4-3.28)^2}{10} = 48.3 \text{ k-ft}$$

$$M_{roof} = |M_1 - M_2| = |43.9 - 48.3| = 4.4 \text{ k-ft}$$
$$M_{flr} = |M_3 - M_4| = |31.56 - 34.71| = 3.15 \text{ k-ft}$$

Mom. Diag:



Slenderness Check:

12" SQ column

Roof → 2nd Flr

K = 1.0

l_n = 8'-0", l_u = 7'-0" (clear height)

ACI 318 §6.2.5.1

$r = 0.3h = (0.3)(12") = 3.6"$

$$\frac{k l_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$$

Eqn 6.2.5b

$$\frac{(1)(7')(12"/')}{3.6} \leq 34 + 12\left(\frac{3.15}{4.4}\right)$$

$23.3 \leq 42.6$ ✓ Braced against sidesway

2nd Flr → Ground

K = 1.0

l_n = 12', l_u = 11'-6" (clear height)

$r = 0.3h = 3.6"$

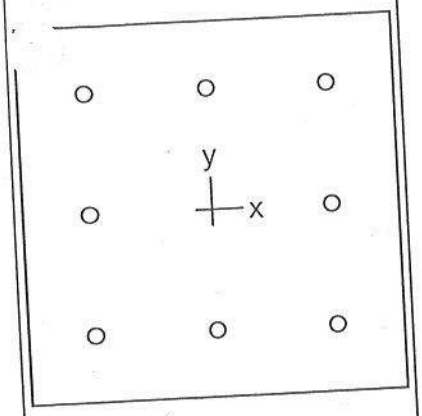
$$\frac{k l_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$$

$$\frac{(11.5)(12"/')}{3.6} \leq 34 + 12\left(\frac{3.15}{4.4}\right)$$

$38.33 \leq 42.6$ ✓ Braced against sidesway

∴ column is not slender

Column Group #1 - C1



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: About X-axis

Run option: Investigation

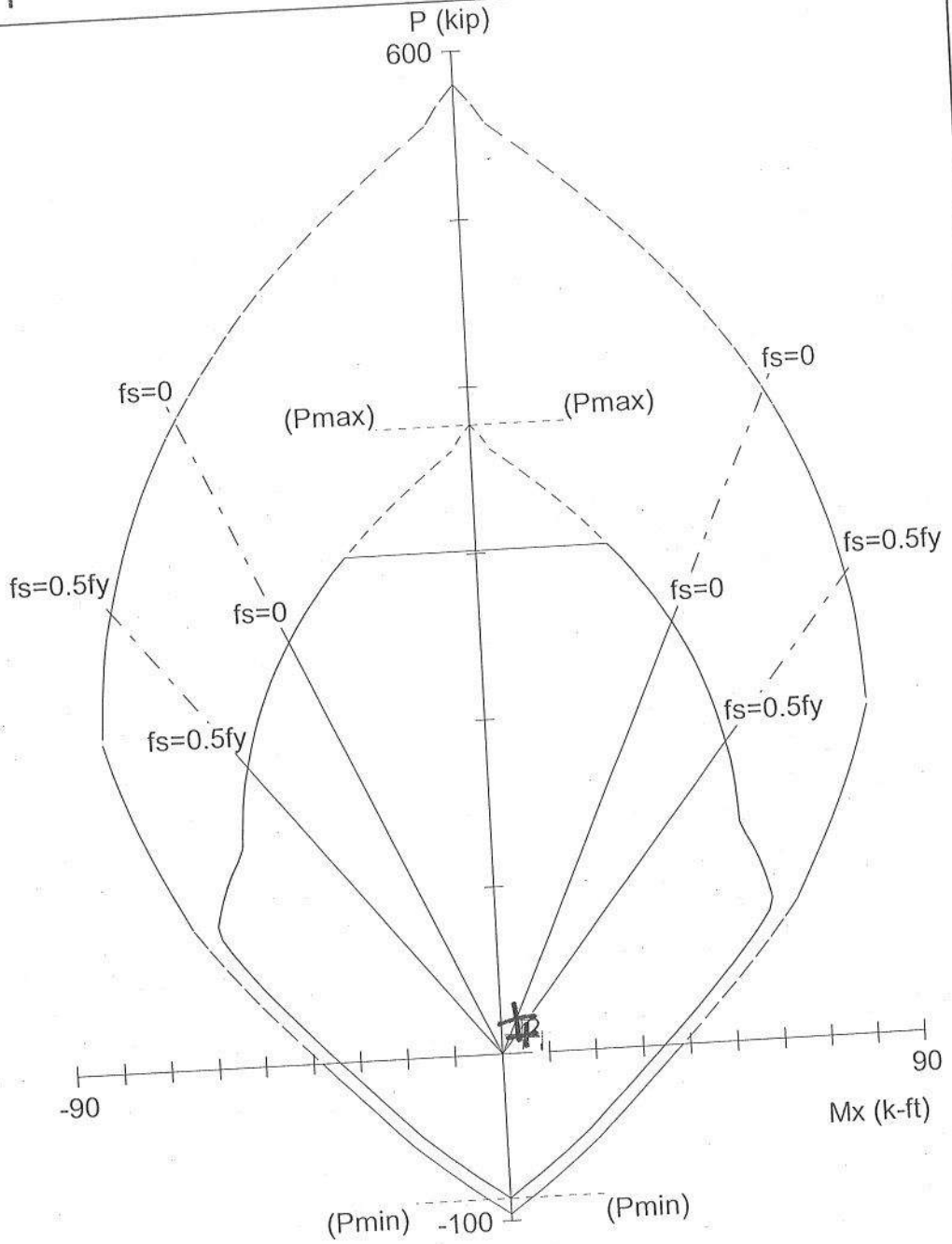
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 06/10/17

Time: 19:33:44



File: untitled.col

Project:

Column:

Engineer:

f'c = 4 ksi

fy = 60 ksi

Ag = 144 in^2

8 #4 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 1.60 in^2

rho = 1.11%

fc = 3.4 ksi

e_yt = 0.00206897 in/in

Xo = 0.00 in

Ix = 1728 in^4

e_u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

Beta1 = 0.85

Min clear spacing = 3.38 in

Clear cover = 1.88 in

Confinement: Tied

C5

STRUCTUREPOINT - spColumn v5.11 (TM)
Licensed to: Cal Poly University. License ID: 64929-1050703-4-2356E-200AE
untitled.col

General Information:
==========
File Name: untitled.col
Project:
Column:
Code: ACI 318-14

Engineer:
Units: English

Run Option: Investigation
Run Axis: X-axis

Slenderness: Not considered
Column Type: Structural

Material Properties:
==========
Concrete: Standard
f'c = 4 ksi
Ec = 3605 ksi
fc = 3.4 ksi
Eps_u = 0.003 in/in
Beta1 = 0.85

Steel: Standard
fy = 60 ksi
Es = 29000 ksi
Eps_yt = 0.00206897 in/in

Section:
========
Rectangular: Width = 12 in

Depth = 12 in

Gross section area, Ag = 144 in^2
Ix = 1728 in^4
rx = 3.4641 in
Xo = 0 in

Iy = 1728 in^4
ry = 3.4641 in
Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 0.88 in^2 at rho = 0.61% (Note: rho < 1.0%)
Minimum clear spacing = 3.56 in

8 #3 Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	PhiMnx k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	11.32	4.39	25.02	5.699	1.57	9.94	0.01595	0.900
2	19.18	4.39	27.86	6.345	1.73	9.94	0.01426	0.900

*** End of output ***

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	C6 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Column Group #1 (C1)	Journeyman International Organization

Reference	
ACI 318 § 10.6.1.1	Vertical Reinf. check:

A_S = 8 - No. 4's = $1.6\ in^2$

$A_{s,min} = 0.01 A_g = (0.01)(12" \times 12") = 1.44\ in^2 < A_S$ ✓

$A_{s,max} = 0.08 A_g = (0.08)(12" \times 12") = 11.52\ in^2 > A_S$ ✓

USE 8 - NO. 4 LONGITUDINAL BARS IN 12" SQ COLUMN

ACI 318 § 15.3 — Column Transmission Req't:

$f'c_{column}$ = 4 ksi, $f'c_{floor}$ = 4 ksi

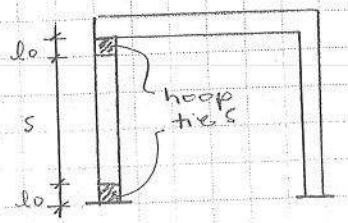
Column transmission requirement doesn't apply because the concrete strengths are equivalent b/w floors and columns.

Tie size and spacing:

ACI 318 § 25.7.2 — Bar size is least of 1) No. 3 enclosing No. 10 bars
2) No. 4 enclosing No. 11 bars

USE NO. 3 TIES (GRAVITY)

Spacing:



ACI 318 § 18.7.5 — l_o is greater of 1) $d_{col} = 12" - 1.5" - 3/8" - 4/2" = 9.875"$
2) $1/6\ l_n = (1/6)(12") = 2' = 24"$
3) 18"

→ 2 governs

s_{lol} is least of 1) $1/4$ (min col dim) $= (1/4)(12") = 3"$ governs
2) 6 (diam of smallest long) $= (12")(4/8) = 6"$

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	C7 OF C47
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Column Group #1 (C1)	

Reference

ACI 318 § 25.7.2

s_1 is least of: 1) $6(d_{long}) = (6")(4/8) = 3"$ ← governs
2) 6"

clear spacing $= (4/3)(d_{agg}) = 4/3 \approx \underline{1.5"}$

Max ℓ spacing is least of: 1) $16\, d_{b long} = 16(4/8) = 8"$
2) $48\, d_{b tie} = 48(3/8) = 18"$ ← governs

ACI 318 § 18.4.3.3

Earthquake Requirements:

Assume elastic capacity of gravity framing is exceeded during an earthquake and some non-linear behavior is required.

Amount of Transverse Required:

$P_u \leq 0.3 A_g f'_c$; $f'_c = 4$ ksi, $P_u = 19.18$K

$19.18 \leq (0.3)(12" \times 12")(4 ksi)$

§ 18.7.5.4

$19.18\text{K} \leq 172.8\text{K}$ ✓ ⇒ Transverse reinf is greater of a & b

$A_{ch} = 12" - 1.5" \times 2 = \underline{9"}$

a) $0.3\left(\frac{A_g}{A_{ch}} - 1\right)\left(\frac{f'_c}{f_y}\right) = 0.3\left(\frac{12^2}{9^2} - 1\right)\left(\frac{4}{60}\right) = \underline{0.015\ in^2}$ ← governs

b) $0.09\left(\frac{f'_c}{f_y}\right) = 0.09\left(\frac{4}{60}\right) = 0.006\ in^2$

$\frac{A_{sh}}{s_{bc}} = 0.015\ in^2$

$A_{sh} = (0.015)(3")(12" - 1.5" - 3/8" - 4/16") = 0.444375\ in^2$

$A_{TIES} = (3)(\#3) = 3(0.11 in^2) = 0.33 in^2 < A_{sh} = 0.44\ in^2$ ⇒ increase ties.

$A_{TIES} = (3)(\#4) = 3(0.20 in^2) = 0.60 in^2 > A_{sh}$ ✓

@ ℓ_o areas

USE NO. 4 TIES @ 3" O.C. (SEISMIC)

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	C8 OF C47
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Column Group #1 (C1)	

Reference

More checks:

§18.5.7.6 does not apply b/c not supporting reactions from discontinued stiff members, such as walls.

§18.7.5.7 does not apply b/c clear spacing = 1.5" < 4"

ACI 318 §18.7.6

Shear Forces - run spColumn w/ $\phi = 1.0$ & $f_y = 1.25 f_y = 75$ ksi

↳ $M_{max} = 81$ k-ft @ balance point

$V_e = \frac{2M_{pr}}{l_u}$ @ full height

$= \frac{2(81)}{20'}$

$= 8.1$ k

$V_e = \frac{2M_{pr}}{l_u}$ @ mid height

$= \frac{2(81)}{10'}$

$= 16.2$ k

$\phi V_n = \phi V_c + \phi V_s$

$= 0 + \phi V_s$

$= 0.75\left(\frac{A_v f_{yt} d}{s}\right)$

$= 0.75\left(\frac{(3)(0.2)(1.0)(12" - 1.5" - 4/8"(1/2))}{3"}\right)$

$= 92.25$ k

$\phi V_n = 92.25$ k $> V_e = 16.2$ k ✓ O.k

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: C9 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: column group #2 (C2)		Journeyman International Organization

Reference

① **Loads:**

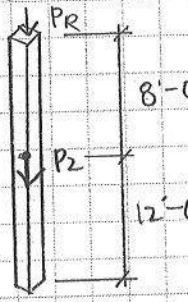
LTD — DL = 61 psf at both levels b/c level 2 isn't a floor

ASCE §4.1 — LL = 20 psf
↳ $A_T = (2m)(2.5m) = 5m^2$ ← worst case scenario
$R_1 = 1.0$ b/c $A_T \leq 18.58m^2$
$R_2 = 1.0$

COL-D — $L_r = (20psf)(1.0)(1.0)$
$= 20psf$

$DL_r = (61psf)(1.2) = 73.2$ psf
$DL_F = (61psf)(1.2) = 73.2$ psf
$LL_r = (20psf)(1.6) = 32$ psf
↳ no LL on 2nd flr on column b/c there's no diaphragm

② **Design axial forces:**

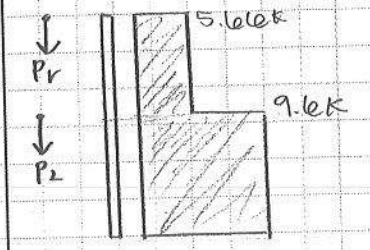


FACTORED — $P = (DL + LL)A_T$ w/ $A_T = 53.8ft^2 = 5m^2$

$P_r = (73.2psf + 32psf)(53.8ft^2)$
$= 5.66K$

$P_2 = 5.66K + (73.2psf)(53.8ft^2)$
$= 9.6K$

axial diag:



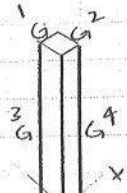
③ **Design bending forces:**

loads from ETABS

1) Int. face of ext. support (BM):

$$\frac{wl^2}{16} = \frac{((41psf)(1.2) + 32psf)((2.5m \times 3.28ft/m)/2)(4m \times 3.28ft/m)^2}{16}$$

$= 35.82K\,ft$



2) Int. face of ext. support (girder):

$$\frac{wl^2}{16} = \frac{((56psf)(1.2) + 32psf)(8m \times 3.28ft/m)(5m \times 3.28ft/m)^2}{16}$$

ETABS §5.2

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	C 10 OF C47
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Column group # 2 (C2)	

Reference

ACI T.6.5.2

~cont.2

3) Int. face of ext. support (BM):

$$\frac{wl^2}{16} = \frac{((41\ psf)(1.2))(12.5m \times 3.28ft/m)(4m \times 3.28ft/m)^2}{16}$$

$$= 21.7\ kft$$

4) Int. face of ext. support (girder):

$$\frac{wl^2}{16} = \frac{((510\ psf)(1.2))(8m \times 3.28\ ft/m)(5m \times 3.28ft/m)^2}{16}$$

$$= 29.6\ kft$$

④ Check slenderness:

> match m/girder w/OMS

12" x 12" SQ COL

§6.2.5

ROOF → 2nd FLOOR:

K = 1

l_u = 7'-0" (CLR HT)

r = 0.3h

= 0.3(12")

= 3.6"

§n 6.2.5b

Braced against sideway:

$$\frac{k l_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$$

x-axis:

$$\frac{(1)(7')(12"/1ft)}{3.6"} \leq 34 + 12\left(\frac{29.6\ kft}{43.8\ kft}\right)$$

$$23.3 \leq 42.1 \checkmark$$

y-axis:

$$\frac{(1)(7')(12"/1ft)}{3.6"} \leq 34 + 12\left(\frac{21.7\ kft}{35.82\ kft}\right)$$

$$23.3 \leq 41.3 \checkmark$$

2nd FLOOR → FND:

> ler ht

K = 1

l_u = 11'-6"

r = 3.6"

$$\frac{k l_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$$

x-axis:

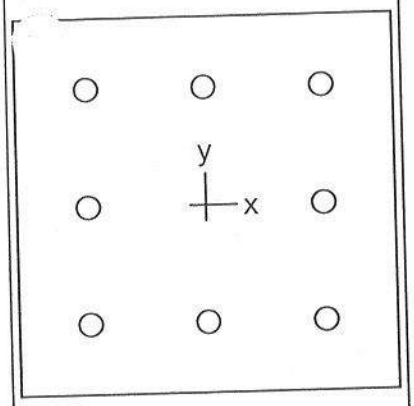
$$\frac{(1)(11.5')(12"/1ft)}{3.6"} \leq 34 + 12\left(\frac{29.6\ kft}{29.6\ kft}\right)$$

$$38.3 \leq 46 \checkmark$$

y-axis:

$$\frac{(1)(11.5')(12"/1ft)}{3.6"} \leq 34 + 12\left(\frac{21.7\ kft}{21.7\ kft}\right)$$

$$38.3 \leq 46 \checkmark$$



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: Biaxial

Run option: Investigation

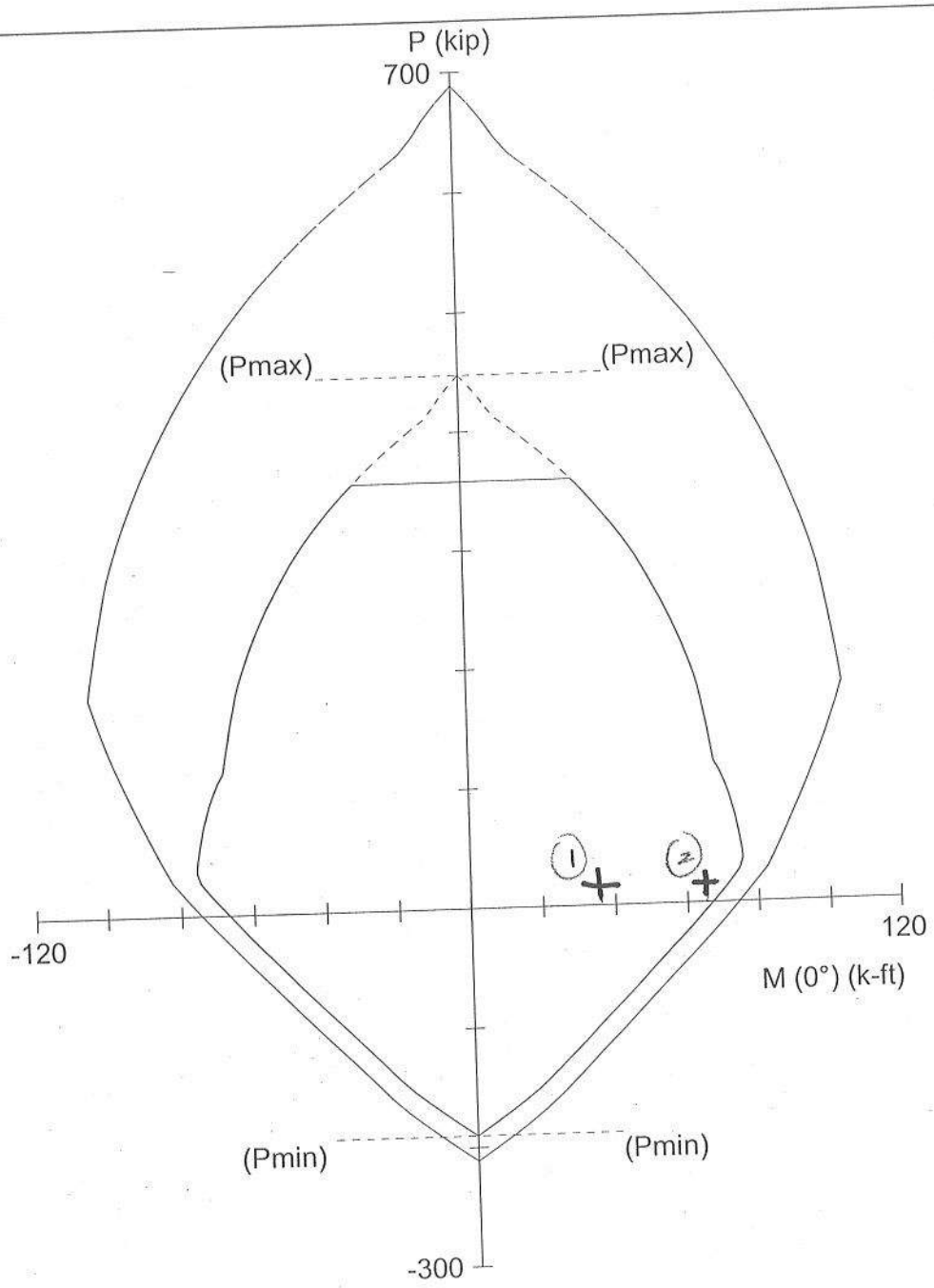
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 06/10/17

Time: 17:45:53



File: u:\senior project - ji\c2.col

Project:

Engineer:

Column:

f'c = 4 ksi

fy = 60 ksi

Ag = 144 in^2

8 #6 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 3.52 in^2

rho = 2.44%

βc = 3.4 ksi

e_yt = 0.00206897 in/in

Xo = 0.00 in

Ix = 1728 in^4

ε_u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

Beta1 = 0.85

Min clear spacing = 3.00 in

Clear cover = 1.88 in

Confinement: Tied

STRUCTUREPOINT - spColumn v5.11 (TM)
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u:\senior project - ji\c2.col

General Information:
==========
File Name: u:\senior project - ji\c2.col
Project:
Column:
Code: ACI 318-14

Engineer:
Units: English

Run Option: Investigation
Run Axis: Biaxial

Slenderness: Not considered
Column Type: Structural

Material Properties:
==========
Concrete: Standard
f'c = 4 ksi
Ec = 3605 ksi
fc = 3.4 ksi
Eps_u = 0.003 in/in
Beta1 = 0.85

Steel: Standard
fy = 75 ksi
Es = 29000 ksi
Eps_yt = 0.00258621 in/in

Section:
========
Rectangular: Width = 12 in

Depth = 12 in

Gross section area, Ag = 144 in^2
Ix = 1728 in^4
rx = 3.4641 in
Xo = 0 in

Iy = 1728 in^4
ry = 3.4641 in
Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 3.52 in^2 at rho = 2.44%
Minimum clear spacing = 3.00 in

8 #6 Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	Muy k-ft	PhiMnx k-ft	PhiMny k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	9.60	29.60	21.70	46.77	34.29	1.580	6.29	13.57	0.00347	0.742
2	5.66	43.80	35.82	44.65	36.52	1.019	6.30	13.69	0.00352	0.746

*** End of output ***

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: C13 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: column group #2 (C2)		Journeyman International Organization

Reference

Use: 8-#6 longitudinal bars in 12" sq column

⑥ Check vertical Reinforcement:

§18.7.4 $A_s = 8-\#6$
$= 8(0.44\,in^2)$
$= 3.52\,in^2$

min $0.01A_g = 0.01(12")(12") = 1.44\,in^2$ ⟩ $A_s > 0.01A_g$ ✓

max $0.06A_g = 0.06(12")(12") = 8.64\,in^2$ ⟩ $A_s < 0.06A_g$ ✓

7. Column Transmission Reqt

§ .3 Will not apply b/c column & floor concrete strength is the same

8. Tie spacing/size:

§25.7.2.2 Bar size:
least of {#3 enclosing #10 bars or less; #4 enclosing #11 bars or larger}

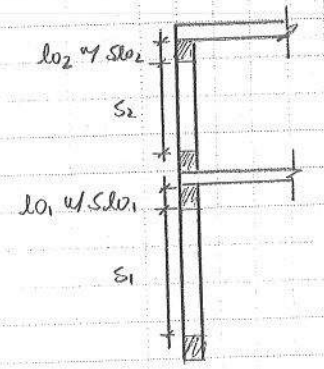
⇒ use #3 ties ← gravity

Bar spacing:
FND → 2nd level:

18.7.5.1 / 18.4.3.3 l_{o1} = greater of {$d_{col} = 12"$; $\frac{1}{6}l_n = \frac{1}{6}(11'-6") = (23")$ ← governs; 18"}

18.7.5.3 / 18.4.3.3 s_{o1} = least of {$\frac{1}{4}b = \frac{1}{4}(12") = (3")$ o.c. ← governs; 6(dia of smallest long) = 4.5"; $s_o = 4 + \left(\frac{14-h_x}{3}\right)$ = min. 4"}

FIP 5.5 s_1 = least of {6(dia long bar) = 4.5" o.c. ← governs, round to 4"; 6"}



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic
DATE: 06/17/17
AUTHOR: Mindy Trieu and Jocelyn Lu
Journeyman International Organization
CALCULATION TOPIC: Column group #2 (C2)

Reference

2nd level → roof:

18.7.5.1 / 18.4.3.3 l_{o2} = greater of { d_{col} = 12" ; 1/6 clear = 1/6 (7'-0") = 14" ; (18") ← governs }

18.7.5.3 / 18.4.3.3 s_{lo2} = least of { 1/4 b = 8" O.C. ← governs ; 6 (dia of smallest long) = 4.5" ; $s_o = 4 + \left(\frac{14 - h_x}{3}\right)$ = min 4" }

18.7.5.5 s_{o2} = least of { 6 (dia long) = 4.5" O.C. ← governs, round down to 4" ; 6" }

Spacing req'd:

25.7.2.1 a) CLR spacing = 4/3 dagg = 4/3" ✓

b) max spacing = least of { 16 (d long) = 12" ; 48 (d tie) = 18" ; (12") ← governs } ✓

9. Traverse reinforcement for SMF:
- assume elastic capacity of gravity framing is exceeded during an earthquake & some nonlinear behavior is reqd

§ 18.7.5.4 $0.3 A_g f'_c = (0.3)(12")(12")(4\,ksi)$
$= 172.8\,K$

$P_u = 9.6\,K < 0.3 A_g f'_c = 172.8\,K$
$f'_c = 4\,ksi < 10\,ksi$

A_{sh}/s_{bc} = greater of:

a) $0.3\left(\frac{A_g}{A_{ch}} - 1\right)\frac{f'_c}{f_{yt}}$

$0.3\left(\frac{(12\,in)^2}{(9\,in)^2} - 1\right)\left(\frac{4\,ksi}{60\,ksi}\right)$

0.015556

b) $0.09\left(\frac{f'_c}{f_{yt}}\right)$

$0.09\left(\frac{4\,ksi}{60\,ksi}\right)$

0.006

$\frac{A_{sh}}{s_{bc}} = 0.015556$

$A_{sh} = (0.015556)(3")(12" - 1.5" - 3/8" - 6/8")$
$= 0.138\,in^2$

$A_{req'd}$ = hoop tie + 1 cross tie
$= 3(0.11\,in^2)$
$= 0.33\,in^2 < 0.438\,in^2$ ✗

→ use #4 tie's @ 3" O.C. ← @ l_{o1}, l_{o2} (seismic)

Reference

10. SMF checks:

§18.7.5.6 doesn't apply b/c column isn't supporting discontinuous members, such as walls

§18.7.5.7 doesn't apply b/c cover = 1.5" < 4"

§18.7.6

11. Shear strength:

re-ran SP-column w ϕ1.0 & $f_y = 1.25 f_y = 75$ ksi

pColumn

M_{max} @ balance pt = 107 K-ft

$V_e = \frac{2M_{pr}}{l_u}$ @ full ht

$= \frac{2(107 \text{ K-ft})}{20'-0"}$

$= 10.7$ K

$V_e = \frac{2M_{pr}}{l_u}$ @ mid-ht

$= \frac{2(107 \text{ K-ft})}{10'-0"}$

$= 21.4$ K

$\phi V_n = \phi V_c + \phi V_s$

$= 0 + \phi V_s$

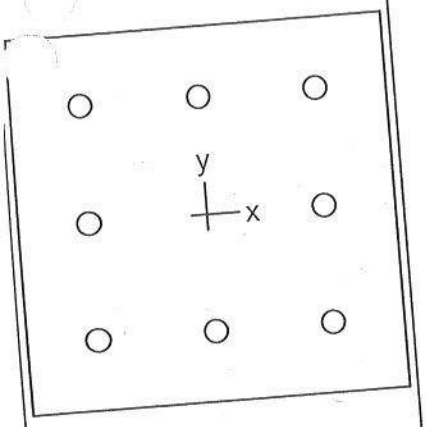
$= (0.75)\left(\frac{A_v f_{yt} d}{s}\right)$

$= 0.75\left(\frac{3(0.2 \text{ in}^2)(60 \text{ ksi})(12" - 1.5" - 4/8" (1/2))}{3"}\right)$

$= 92.25$ K

$\phi V_n > V_e$ ✓

Column Group #2 - C2



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: Biaxial

Run option: Investigation

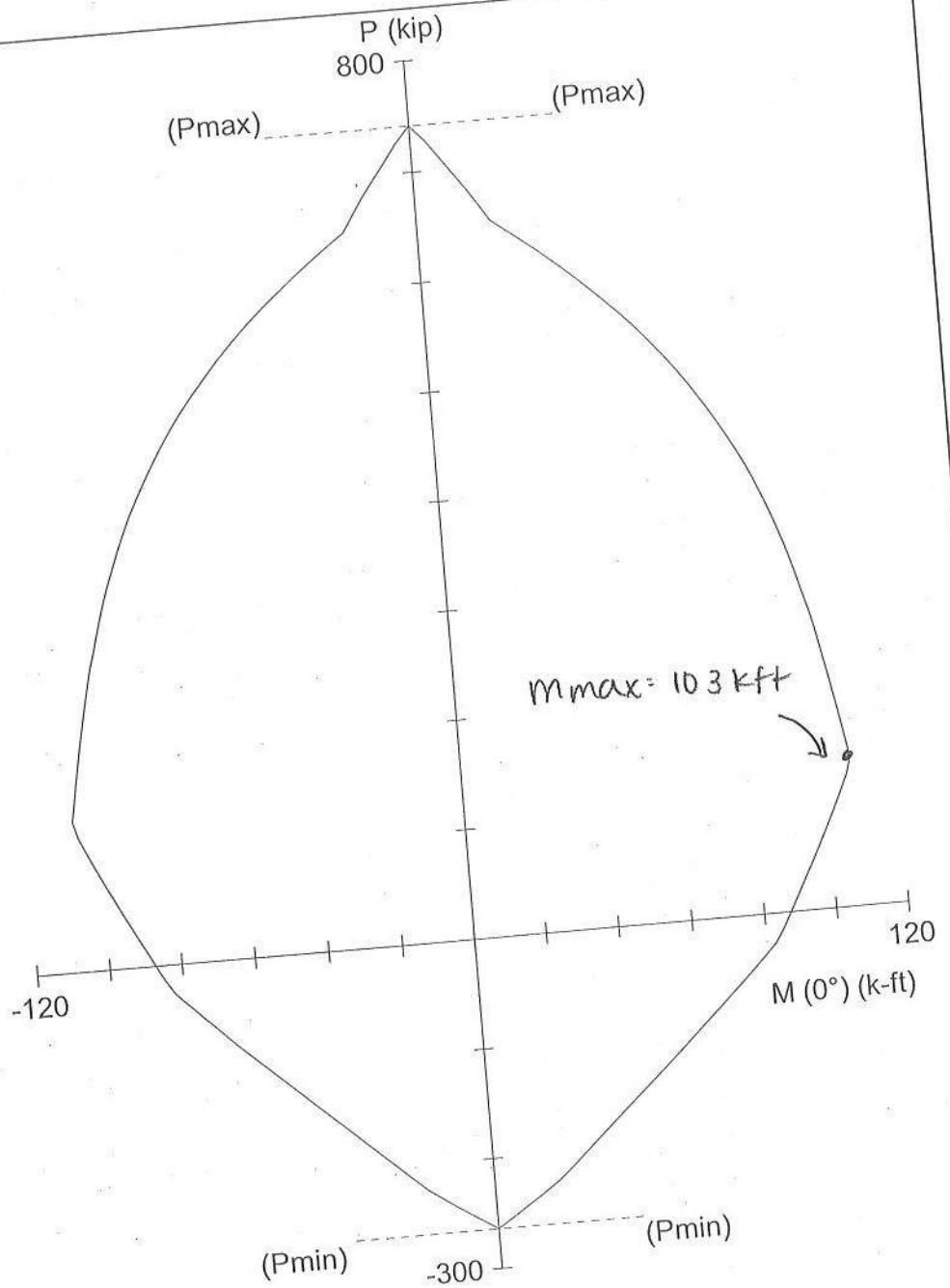
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 06/10/17

Time: 17:44:49



File: u:\senior project - ji\c2.col

Project:

Engineer:

Column:

f'c = 4 ksi

fy = 75 ksi

Ag = 144 in^2

8 #6 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 3.52 in^2

rho = 2.44%

fc = 3.4 ksi

e_yt = 0.00258621 in/in

Xo = 0.00 in

Ix = 1728 in^4

_u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

Beta1 = 0.85

Min clear spacing = 3.00 in

Clear cover = 1.88 in

Confinement: Other

phi(c) = 1

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. C17 OF C47
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC column group #3 (C3)	Journeyman International Organization

Reference

1. Loads:

LTD

DL: 61 PSF

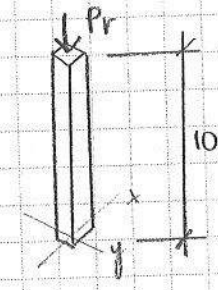
LL: 20 PSF
↳ $A_T = (5m)(3m) = 15m^2$ ← worst case
$R_1 = 1.0$ b/c $A_T < 18.58m^2$
$R_2 = 1.0$

$Lr = 20\,psf\,(1.0)(1.0)$
$= 20\,psf$

$DLr = 61\,PSf\,(1.2) = 73.2\,PSf$
$LLr = 20\,PSf\,(1.6) = 32\,PSf$

2. Design Axial Forces:

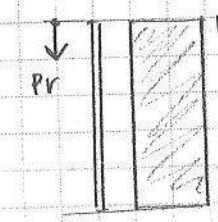
actual



ht: tallest (worse case)
$= 9.5' + 1.23'$ slope
$= 10.73'$

$Pr = (73.2\,PSf + 32\,PSf)(15m^2)(3.28ft/m)^2$
$= 16.98K$

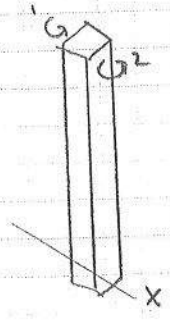
axial diag



3. Design Bending Forces:

10.5.2

G1 ☐ G2

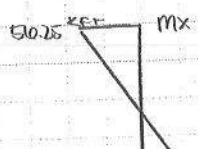


1) Ext. face of first int. support (girder):

$$\frac{wl^2}{10} = \frac{((50\,PSf)(1.2) + 20PSf\,(1.6))(3m \times 3.28\,ft/m)(5m \times 3.28\,ft/m)^2}{10}$$

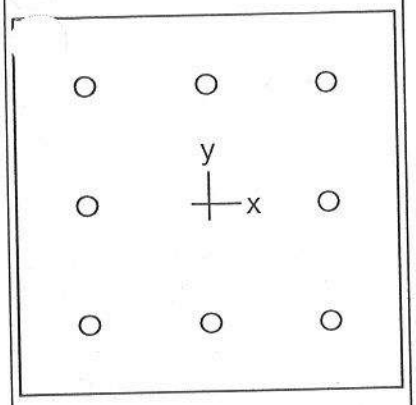
$= 26.25\,K\,ft$

2) same as 1:
$= 26.25\,K\,ft$



$Mx = M_1 + M_2$
$= 52.5\,K\,ft$

column group #3 (C3) C18



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: About X-axis

Run option: Investigation

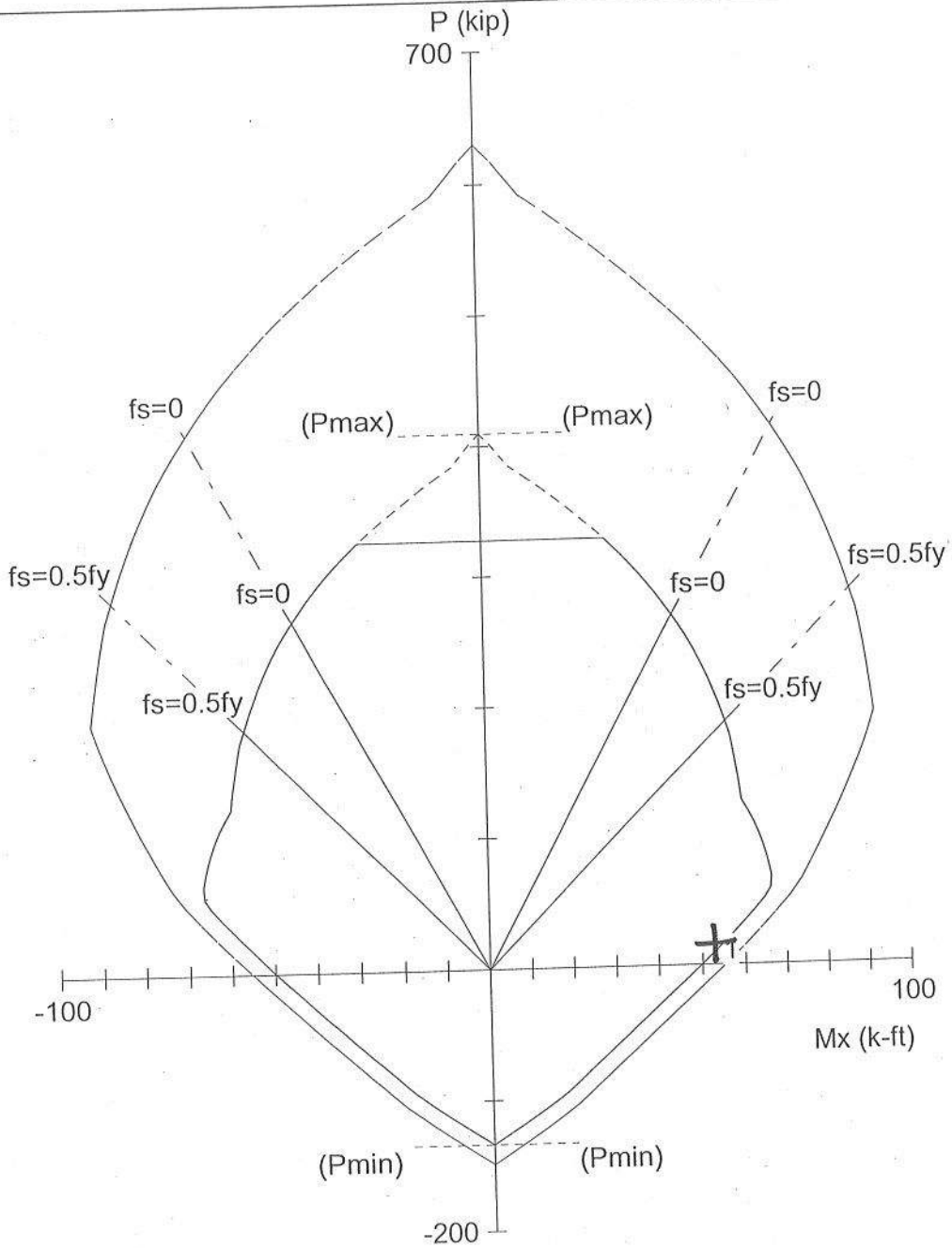
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 06/10/17

Time: 18:53:03



File: untitled.col

Project:

Column:

Engineer:

f'c = 4 ksi

fy = 60 ksi

Ag = 144 in^2

8 #5 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 2.48 in^2

rho = 1.72%

.c = 3.4 ksi

e_yt = 0.00206897 in/in

Xo = 0.00 in

Ix = 1728 in^4

_u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

Beta1 = 0.85

Min clear spacing = 3.19 in

Clear cover = 1.88 in

Confinement: Tied

STRUCTUREPOINT - spColumn v5.11 (TM)
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untitled.col

General Information:
==========
File Name: untitled.col
Project:
Column:
Code: ACI 318-14

Engineer:
Units: English

Run Option: Investigation
Run Axis: X-axis

Slenderness: Not considered
Column Type: Structural

Material Properties:
==========
Concrete: Standard
f'c = 4 ksi
Ec = 3605 ksi
fc = 3.4 ksi
Eps_u = 0.003 in/in
Beta1 = 0.85

Steel: Standard
fy = 60 ksi
Es = 29000 ksi
Eps_yt = 0.00206897 in/in

Section:
========
Rectangular: Width = 12 in

Depth = 12 in

Gross section area, Ag = 144 in^2
Ix = 1728 in^4
rx = 3.4641 in
Xo = 0 in

Iy = 1728 in^4
ry = 3.4641 in
Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 2.48 in^2 at rho = 1.72%
Minimum clear spacing = 3.19 in

8 #5 Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	PhiMnx k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	16.98	52.50	55.21	1.052	2.80	9.81	0.00750	0.900

*** End of output ***

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: C 20 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: column group #3 (C3)		Journeyman International Organization

Reference	
	4. check slenderness:
	12" x 12" SQ COL
	ROOF → FND:
	$k = 1$
§6.2.5	$l_u = 10.73'$
	$r = 0.3h$
	$= 0.3(12")$
	$= 3.6"$
§6.2.5	column braced against sidesway
	$\frac{kl_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$
	$\frac{(1)(10.73' \times 12")}{3.6"} \leq 34 + 12\left(\frac{52.5}{52.5}\ k\text{-ft}\right)$
	$35.8 \leq 46$ ✓
continued next pg	~ SP COLUMN ~
	6. check vertical reinforcement:
	→ use 8 - #5 longi. bars in 12" sq. column
18.7.4	$A_s = 8(0.31 in^2)$
	$= 2.48 in^2$
min	$0.01 A_g = (0.01)(12")(12")$ $= 1.44 in^2$ → $A_s > 0.01 A_g$ ✓
max	$0.06 A_g = 0.06(12")(12")$ $= 8.64 in^2$ → $A_s < 0.06 A_g$ ✓
	7. column transmission req't:
§15.3.1	floor(roof) system = steel w/ f_y = 60 ksi
	column system = concrete w/ $f'c$ = 4 ksi
	$f'c \geq 1.4(f_y)$
	∴ therefore, section will not apply

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: C21 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: column group #3 (C3)		Journeyman International Organization

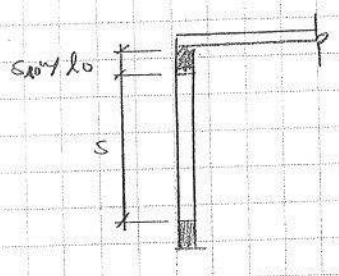
Reference gravity

B. Tie spacing/size

Bar size:

25.7.2.2 least of { #3 enclosing #10 bars; #4 for #11 bars or larger

⇒ use #3 ties (gravity)



Bar spacing

ROOF → FND

18.7.5.1 / 18.4.3.3 l_o = greater of { d_{col} = 12"; 1/6 l_n = 1/6 (10.73') = 21.46" ← governs, round to 22"; 18" }

18.7.5.6 / 18.4.3.3 s_o = least of { 1/4 b' = 3" o.c. ← governs; 6 ($d_{a\,long}$) = 3.75"; $s_o = 4 + \frac{14 - h_x}{3}$ → min 4" }

18.7.5.5 s = least of { 6 ($d_{a\,long}$) = 3.75" ← governs, round to 3"; 6" }

25.7.2.1 a) Spacing req't

clr spacing: 1/3 dagg = 4/3"

b) max spacing: least of { 16 ($d_{a\,long}$) = 10"; 48 ($d_{a\,tie}$) = 18"; 6" ← governs }

9. Traverse reinforcement for SMF

- assume elastic capacity of gravity framing is exceeded during an earthquake & some nonlinear behavior is req'd

18.7.5.4 $0.3 A_g f'_c = 0.3 (12")(12")(4\,ksi)$

$= 172.8\,K$

$P_u = 16.98\,K < 0.3 A_g f'_c = 172.8\,K$

$f'_c = 4\,ksi < 10\,ksi$

A_{sh}/s_{bc} = greater of:

a) $0.3 \left(\frac{A_g}{A_{ch}} - 1\right) \frac{f'_c}{f_{yt}}$

$0.3 \left(\frac{(12")^2}{(9")^2} - 1\right) \left(\frac{4}{60}\right)$

b) $0.09 \left(\frac{f'_c}{f_{yt}}\right)$

$0.09 \left(\frac{4}{60}\right)$

Reference

$\frac{A_{sh}}{sbc} = 0.015556$

$A_{sh} = (0.015556)(3')(12" - 1.5" - 3/8" - 5/8")$
$= 0.443\ in^2$

Ares = hoop he + 1 cross tie
$= 3(.20\ in^2)$
$= 0.6\ in^2$

Try #4

⇒ use #4 ties @ 3" O.C. @ lo (seismic)

10. SMF checks

§18.7.5.6 doesn't apply b/c column isn't supporting discontinuous members, such as walls

§18.7.5.7 doesn't apply b/c cover = 1.5" < 4"

11. shear strength:

§18.7.6 re-ran w spcolumn w $\phi = 1.0$, $f_y = 1.25 f_y = 75$ ksi

M_{max} @ bal. pt = 93 k-ft

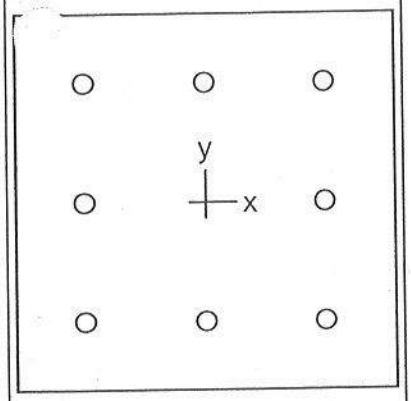
$V_e = \frac{2M_{pr}}{l_u}$ @ full ht
$= \frac{2(93\ k\text{-}ft)}{10.73'}$
$= 17.3\ k$

$V_e = \frac{2M_{pr}}{l_u}$ @ mid ht
$= \frac{2(93\ k\text{-}ft)}{5.37'}$
$= 34.7\ k$

$\phi V_n = \phi V_c + \phi V_s$
$= 0 + \phi V_s$
$= 0.75\left(\frac{A_v f_{yt} d}{s}\right)$
$= (0.75)\left(\frac{3(0.2\ in^2)(60\ ksi)(12" - 1.5" - 4/8" (1/2))}{3"}\right)$
$= 92.25\ k$

$\phi V_n > V_e$ ✓

column group #3 (C3)



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: About X-axis

Run option: Investigation

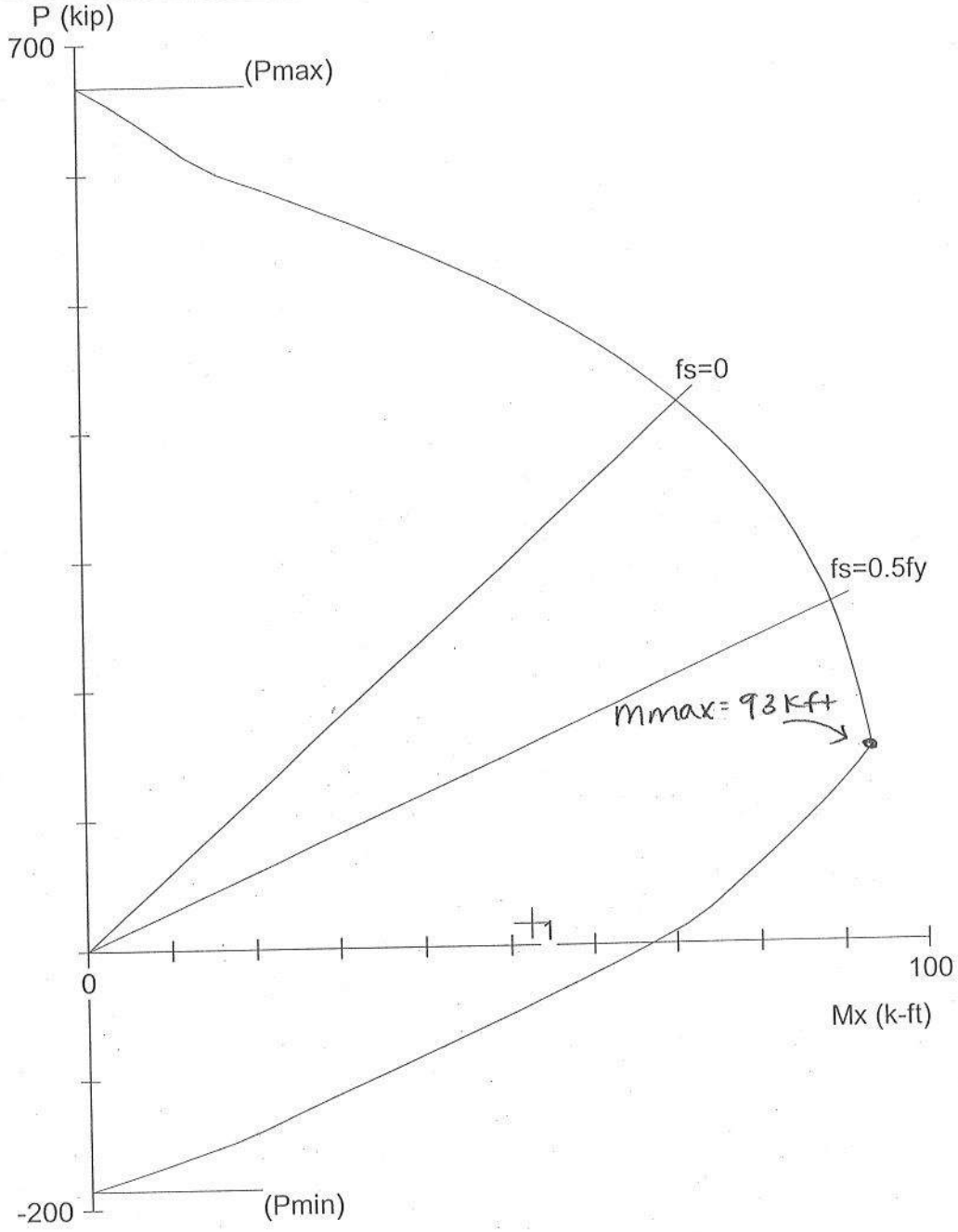
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 06/10/17

Time: 20:23:41



File: U:\Senior Project - JI\C3.col

Project:

Column:

Engineer:

f'c = 4 ksi

fy = 75 ksi

Ag = 144 in^2

8 #5 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 2.48 in^2

rho = 1.72%

= 3.4 ksi

e_yt = 0.00258621 in/in

Xo = 0.00 in

Ix = 1728 in^4

u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

Beta1 = 0.85

Min clear spacing = 3.19 in

Clear cover = 1.88 in

Confinement: Other

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: C24 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Column Group #4 - C4		Journeyman International Organization

Reference

Column Design - C4

Load Combo: 1.2D + 1.6L

DL = 61psf

LL = 20psf

$A_T = (5.5)(1.5) = 8.25\,m^2 \Rightarrow A_T \leq 18.58\,m^2 \; ; R_1 = 1$

$F = 1.5 \Rightarrow F \leq 4 \; ; R_2 = 1$

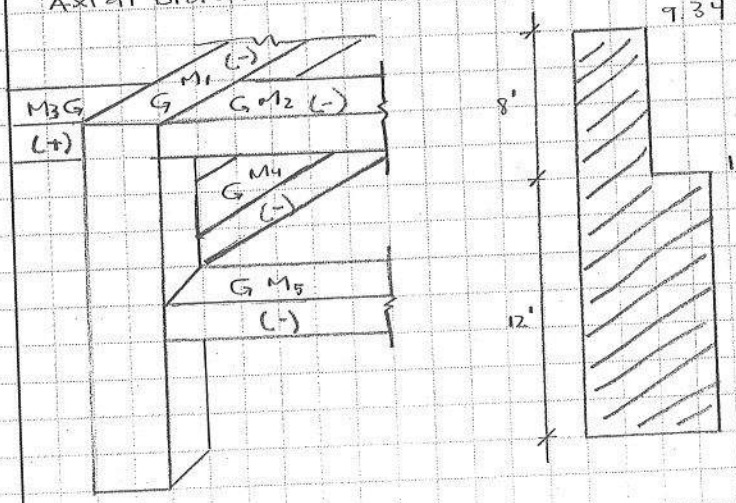
$L_r = L_o R_1 R_2 = (20)(1)(1) = 20\,psf$

Axial Design:

$P_{U_R} = [(1.2)(61psf) + (1.6)(20psf)](5.5 \times 1.5)(3.28\,ft/m)^2 = 9.34\,K$

$P_{U_F} = 9.34K + (1.2)(61)(5.5 \times 1.5)(3.28\,ft/m)^2 = 15.83\,K$

Axial diagram:



Flexural Design:

Load Take off

M_1) Interior face of exterior support

$$M_1 = \frac{w_u l_n^2}{16} = \frac{[(1.2)(41psf) + (1.6)(20\,psf)](3m \times 3.28\,ft/m) \times (9.84ft)^2}{16} = 4.84\,kft$$

M_2) Interior face of exterior support

$$M_2 = \frac{w_u l_n^2}{16} = \frac{[(1.2)(52psf) + (1.6)(20)](5m \times 3.28\,ft/m) \times (16.4\,ft)^2}{16} = 27.3\,kft$$

ACI 318 Ex 5.2

Reference

M_3) End Span

$$M_3 = \frac{w_u l_n^2}{14} = \frac{[(1.2)(11\ psf) + (1.6)(20)](2m \times 3.28\ ft/m) \times (6.56\ ft)^2}{14} = 0.911\ kft$$

M_4) Interior face of exterior support

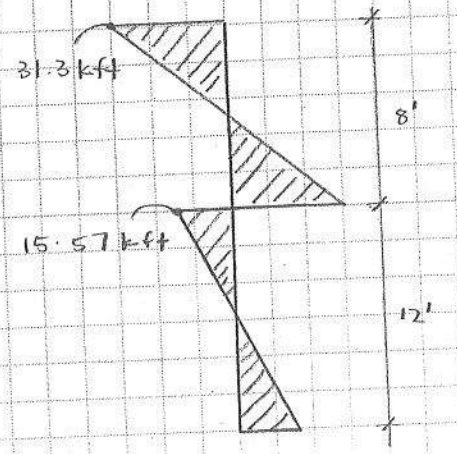
$$M_4 = \frac{w_u l_n^2}{16} = \frac{[(1.2)(41\ psf)(3m \times 3.28\ ft/m)](9.84^2)}{16} = 2.93\ kft$$

M_5) Interior face of exterior support

$$M_5 = \frac{w_u l_n^2}{16} = \frac{[(1.2)(52)(5 \times 3.28)](5 \times 3.28)^2}{16} = 18.5\ kft$$

$M_{Roof} = |M_3 - M_1 - M_2| = |0.911 - 4.84 - 27.3| = 31.3\ kft$

$M_{Flr} = |M_4 - M_5| = |2.93 - 18.5| = 15.57\ kft$



ACI 318 §6.2.5 | Slenderness check:

12" SQ Column
Eqn. 6.2.5.b | Roof → 2nd Flr

$k = 1.0$
$l_u = 7'-0"$ (clear height)
$r = 0.3h = 0.3(12) = 3.6"$

$$\frac{k l_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$$

	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. C26 OF C47
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC Column Group #4 - C4	Journeyman International Organization

Reference

$$\frac{(1)(7')(12'')}{3.6''} \leq 34 + 12\left(\frac{15.57}{31.3}\right)$$

$$23.3 \leq 39.97 \quad \checkmark \text{ Braced against sidesway}$$

2nd Flr → Ground

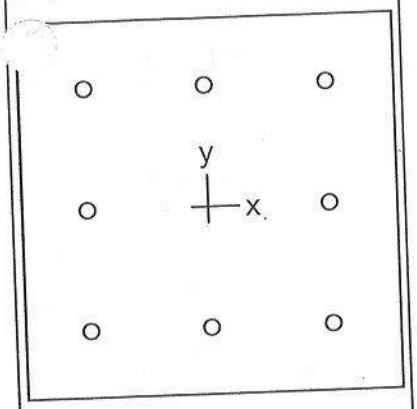
$k = 1.0$
$l_u = 11'-6''$ (clear height)
$r = 3.6''$

$$\frac{(1)(11.5')(12'')}{3.6} \leq 34 + 12\left(\frac{15.57}{31.3}\right)$$

$$10.48 \leq 39.97 \quad \checkmark \text{ Braced against sidesway}$$

COLUMN IS NOT SLENDER

Column Group #4 - C4



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: About X-axis

Run option: Investigation

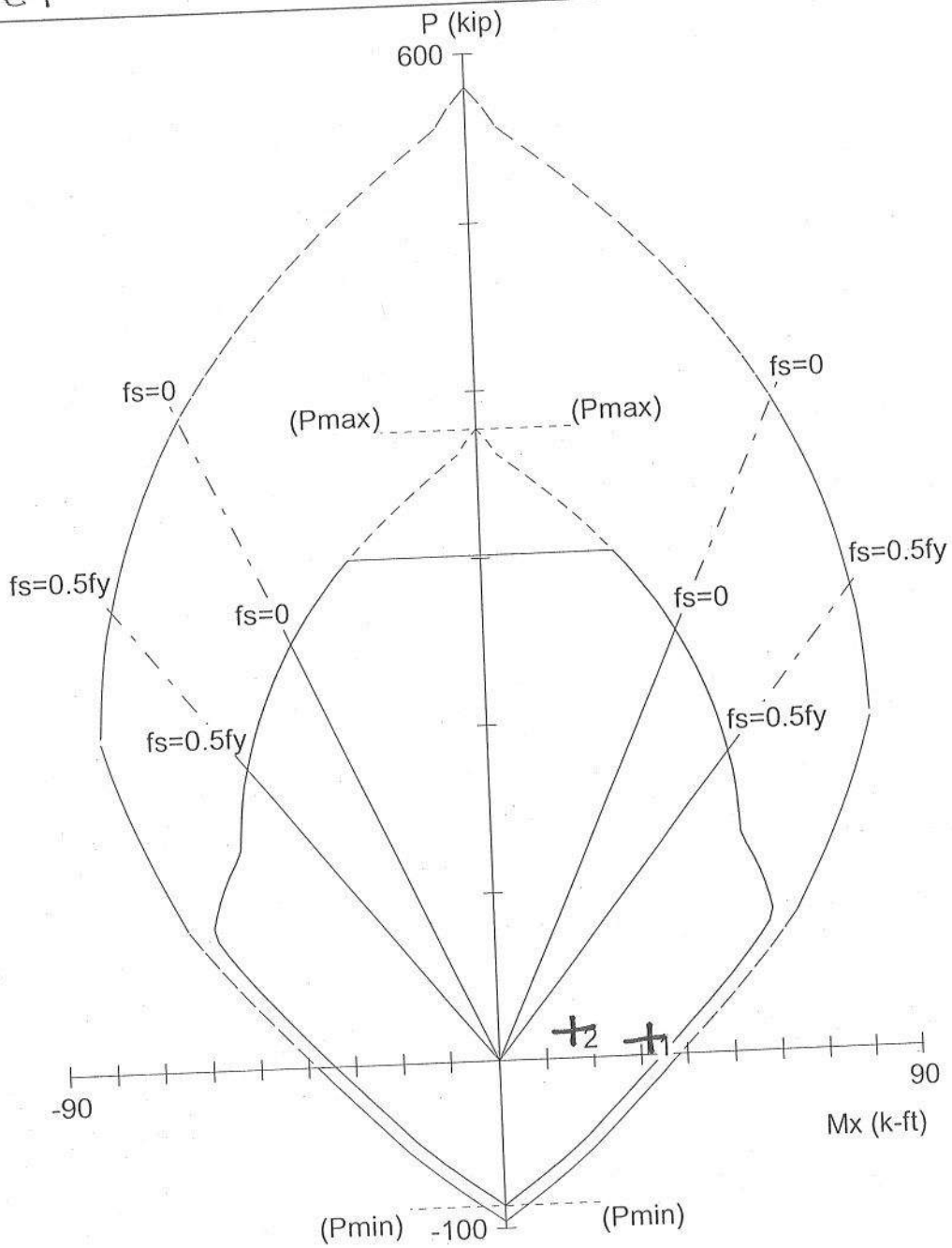
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 06/10/17

Time: 21:09:14



File: untitled.col

Project:

Column:

Engineer:

f'c = 4 ksi

fy = 60 ksi

Ag = 144 in^2

8 #4 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 1.60 in^2

rho = 1.11%

fc = 3.4 ksi

e_yt = 0.00206897 in/in

Xo = 0.00 in

Ix = 1728 in^4

e_u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

Beta1 = 0.85

Min clear spacing = 3.38 in

Clear cover = 1.88 in

Confinement: Tied

STRUCTUREPOINT - spColumn v5.11 (TM)
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untitled.col

General Information:
==========
File Name: untitled.col
Project:
Column:
Code: ACI 318-14

Engineer:
Units: English

Run Option: Investigation
Run Axis: X-axis

Slenderness: Not considered
Column Type: Structural

Material Properties:
==========
Concrete: Standard
f'c = 4 ksi
Ec = 3605 ksi
fc = 3.4 ksi
Eps_u = 0.003 in/in
Beta1 = 0.85

Steel: Standard
fy = 60 ksi
Es = 29000 ksi
Eps_yt = 0.00206897 in/in

Section:
========
Rectangular: Width = 12 in

Depth = 12 in

Gross section area, Ag = 144 in^2
Ix = 1728 in^4
rx = 3.4641 in
Xo = 0 in

Iy = 1728 in^4
ry = 3.4641 in
Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 1.60 in^2 at rho = 1.11%
Minimum clear spacing = 3.38 in

8 #4 Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	PhiMnx k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	9.34	31.30	37.62	1.202	2.07	9.88	0.01131	0.900
2	15.83	15.57	39.83	2.558	2.19	9.88	0.01051	0.900

*** End of output ***

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	29 OF C47
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Column Group #4 - C4	

Reference	
ACI 318 10.6.1.1	Vertical Reinf Check: A_S = 8 - No. 4 = 1.6 in² $A_{S,min}$ = 0.01 A_g = (0.01)(12²) = 1.44 in² < A_S ✓ $A_{S,max}$ = 0.08 A_g = (0.08)(12²) = 11.52 in² > A_S ✓ **USE 8 - NO. 4 LONGITUDINAL BARS IN 12" SQ COLUMN**
ACI 318 ≥ 15.3	Column Transmission Reqt: $f'_{c,col}$ = 4 ksi, $f'_{c,floor}$ = 4 ksi column transmission reqt does not apply because the conc. strengths are equivalent b/w floors and columns.
ACI 318 25.7.2	Tie size and spacing: Bar size is least of 1) No. 3 enclosing No. 10 bars 2) No. 4 enclosing No. 11 bars **USE NO. 3 TIES (GRAVITY)**
ACI 318 18.7.5	Spacing: d_o is greater of 1) d_{col} = 12" - 1.5" - 3/8" - 4/16" = 9.875" 2) 1/6 l_n = (1/6)(12') = 2' = 24" ← governs 3) 18"
	s_o is least of 1) 1/4 (min col dim) = (1/4)(12") = 3" ← governs 2) 6 (diam of smallest long.) = (12")(1/8) = 6"
	s_i is least of 1) 6 (d_{long}) = (6)(1/8) = 3" ← governs 2) 6"

Reference

clear spacing = $(4/3)(d_{agg}) = 4/3 \approx \underline{1.5"}$

ACI 318 25.7.2 — max ℄ spacing is least of: 1) $16 d_{long} = 16(4/8) = 8"$ ← governs; 2) $48 d_{tie} = 48(3/8) = 18"$

Earthquake Requirements:

ACI 318 18.4.3.3 — Assume elastic capacity of gravity framing is executed during an earthquake and some non-linear behavior is req'd.

Amount of Trnsverse Req'd:

$P_u \leq 0.3 A_g f'_c$; $f'_c = 4ksi$, $P_u = 15.83k$

$15.83k \leq (0.3)(12 \times 12)(4)$

$15.83k \leq 172.8k$ ✓ ⇒ Trnsv is greater

a) $0.3\left(\frac{A_g}{A_{ch}} - 1\right)\left(\frac{f'_c}{f_y}\right) = 0.3\left(\frac{12^2}{9^2} - 1\right)\left(\frac{4}{60}\right) = \underline{0.015\ in^2}$ ← governs

ACI 318 18.7.5.4 — b) $0.09\left(\frac{f'_c}{f_y}\right) = (0.09)\left(\frac{4}{60}\right) = 0.006\ in^2$

$\frac{A_{sh}}{s_{bc}} = 0.015\ in^2$

$A_{sh} = (0.015)(3")(12" - 1.5 - 3/8" - 4/16") = 0.444375\ in^2$

$A_{Ties} = 3\text{-No } 4\text{'s} = (3)(0.20) = 0.60\ in^2$ > A_{sh} ✓

USE NO. 4 TIES @ 3" O.C. (SEISMIC)

Reference

More Checks:

ACI 318 18.7.6 §18.5.7.6 does not apply b/c not supporting reactions from discontinued stiff members, such as walls

§18.7.5.7 does not apply b/c clear spacing = 1.5" < 4"

Shear Forces - run spColumn w/ $\phi = 1.0$ & $f_y = 1.25 f_y = 75$ ksi

↳ $M_{max} = 141$ k-ft @ Balance point

$V_e = \frac{2M_{pr}}{\ell_u}$ @ full height

$= \frac{(2)(141)}{20'}$

$= 14.1$ K

$V_e = \frac{2M_{pr}}{\ell_u}$ @ mid height

$= \frac{(2)(141)}{10'}$

$= 28.2$ K

$\phi V_n = \phi V_c + \phi V_s$

$= 0 + \phi V_s$

$= 0.75 \left(\frac{A_v f_{yt} d}{s} \right)$

$= 0.75 \left(\frac{(2)(0.2)(60)(12" - 1.5 - (\frac{3}{8})(\frac{1}{2}))}{8"} \right)$

$= 92.25$ K

$\phi V_n = 92.25$ K > $V_e = 28.2$ K ✓ O.K.

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	C32 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Column group #5 (C5)	Journeyman International Organization

Reference

1. Loads

LTU

DL = 101 PSF

LL = 20 psf

ASCE §4.1

↳ ROOF level:

$A_T = (5m)(8m) = 40m^2$

$R_1 = 1.2 - 0.011 A_T$

$= 1.2 - 0.011(40m^2)$

$= 0.76$

$R_2 = 1.0$ b/c $F = 1.5 < 4$

$L_r = (20 psf)(0.76)(1.0)$

$= 15.2 psf$

2nd level

$A_T = (5m)(11m) = 55m^2$

$R_1 = 1.2 - 0.011 A_T$

$= 1.2 - 0.011(55m^2)$

$= 0.6$

$R_2 = 1.0$

$L_2 = (20psf)(0.6)(1.0)$

$= 12psf$

$DL_r = (101 psf)(1.2) = 73.2 psf$

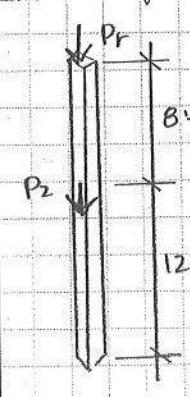
$DL_2 = (101 psf)(1.2) = 72.2 psf$

$L_r = (15.2psf)(1.6) = 24.32 psf$

$L_2 = (12psf)(1.6) = 19.2 psf$

2. Design Axial Forces

factored



$P_r = (73.2 psf + 24.32 psf)(40 m^2)(3.28 ft/m)^2$

$= 42K$

$P_2 = (73.2 psf + 19.2 psf)(55m^2)(3.28 ft/m)^2$

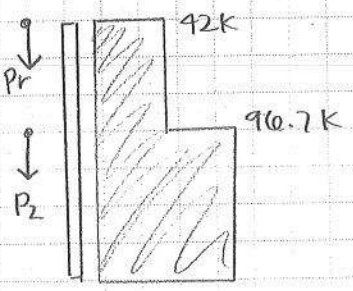
$= 54.7 K + 42K$

$= 96.7K$

ROOF CLR HT = 7'-0"

2nd level CLR HT = 11'-6"

Axial diag.



PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	C33 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: column group #5 (C5)	Journeyman International Organization

Reference

C1
10.5.2

3. Design Bending Forces

G.5
1,3G G 2,4
G2
1G
5G GA
G
3

1) Ext. face of first int. support (neg.) (girder):

$\frac{wl^2}{10} = \frac{((50\,psf)(1.2) + 32\,psf)(8m \times 3.28\,ft/m)(5m \times 3.28\,ft/m)^2}{10}$

$= 70.0\ K\text{-}ft$

2) Face of all other supports (girder):

$\frac{wl^2}{11} = \frac{((50\,psf)(1.2) + 32\,psf)(8m \times 3.28\,ft/m)(5m \times 3.28\,ft/m)^2}{11}$

$= 63.7\ K\text{-}ft$

3) Ext. face first int. support (girder):

$\frac{wl^2}{10} = \frac{((50\,psf)(1.2) + 19.2\,psf)(11m \times 3.28\,ft/m)(5m \times 3.28\,ft/m)^2}{10}$

$= 83.8\ K\text{-}ft$

4) Face of all other supports (girder):

$\frac{wl^2}{11} = \frac{((50\,psf)(1.2) + 19\,psf)(11m \times 3.28\,ft/m)(5m \times 3.28\,ft/m)^2}{11}$

$= 76\ K\text{-}ft$

5) Ext. face of first int. support (BM)

$\frac{wl^2}{9} = \frac{((41\,psf)(1.2) + 19\,psf)(5m \times 3.28\,ft/m)(6m \times 3.28\,ft/m)^2}{9}$

$= 48.1\ K\text{-}ft$

$M_{x_1} = |70\ K\text{-}ft - 63.7\ K\text{-}ft|$
$= 6.3\ K\text{-}ft$

$M_{y_1} = 0$

$M_{x_2} = |83.8\ K\text{-}ft - 76\ K\text{-}ft|$
$= 7.8\ K\text{-}ft$

$M_{y_2} = 48.1\ K\text{-}ft$

Mx:
6.3 K-ft
7.8 K-ft

My:
0 K-ft
48.1 K-ft

eference

4. Check slenderness:

12"x12" sq column

ROOF → 2nd FLOOR

10.2.5.

K = 1
lu = 7'-0" (clr ht)
r = 0.3h
= 3.6"

Braced against sidesway:

10.2.5b

$\frac{k l_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$

x-axis:

$\frac{(1)(7')(12''/1ft)}{3.6''} \leq 34 + 12\left(\frac{133.7}{159.8}\right)$

$23.3 \leq 44.04$ ✓

y-axis

$23.3 \leq 34 + 12\left(\frac{0}{48.1}\right)$

$23.3 \leq 34$ ✓

2nd FLR → FND:

K = 1
lu = 11'-6" (clr ht)
r = 0.3h
= 3.6"

Braced against sidesway

10.2.5.b

x-axis:

$\frac{(1)(11'-6'')(12'')}{3.6''} \leq 34 + 12\left(\frac{159.8}{159.8}\right)$

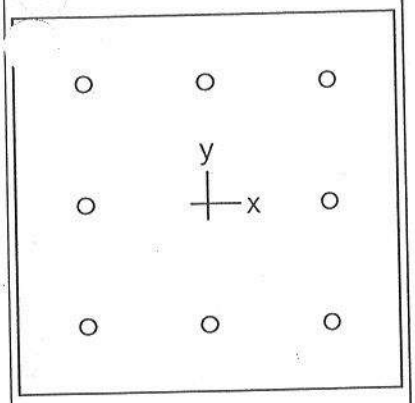
$38.3 \leq 46$ ✓

y-axis:

$38.3 \leq 34 + 12\left(\frac{48.1\ k\text{-}ft}{48.1\ k\text{-}ft}\right)$

$38.3 \leq 46$ ✓

Column Group # 5 - C5



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: Biaxial

Run option: Investigation

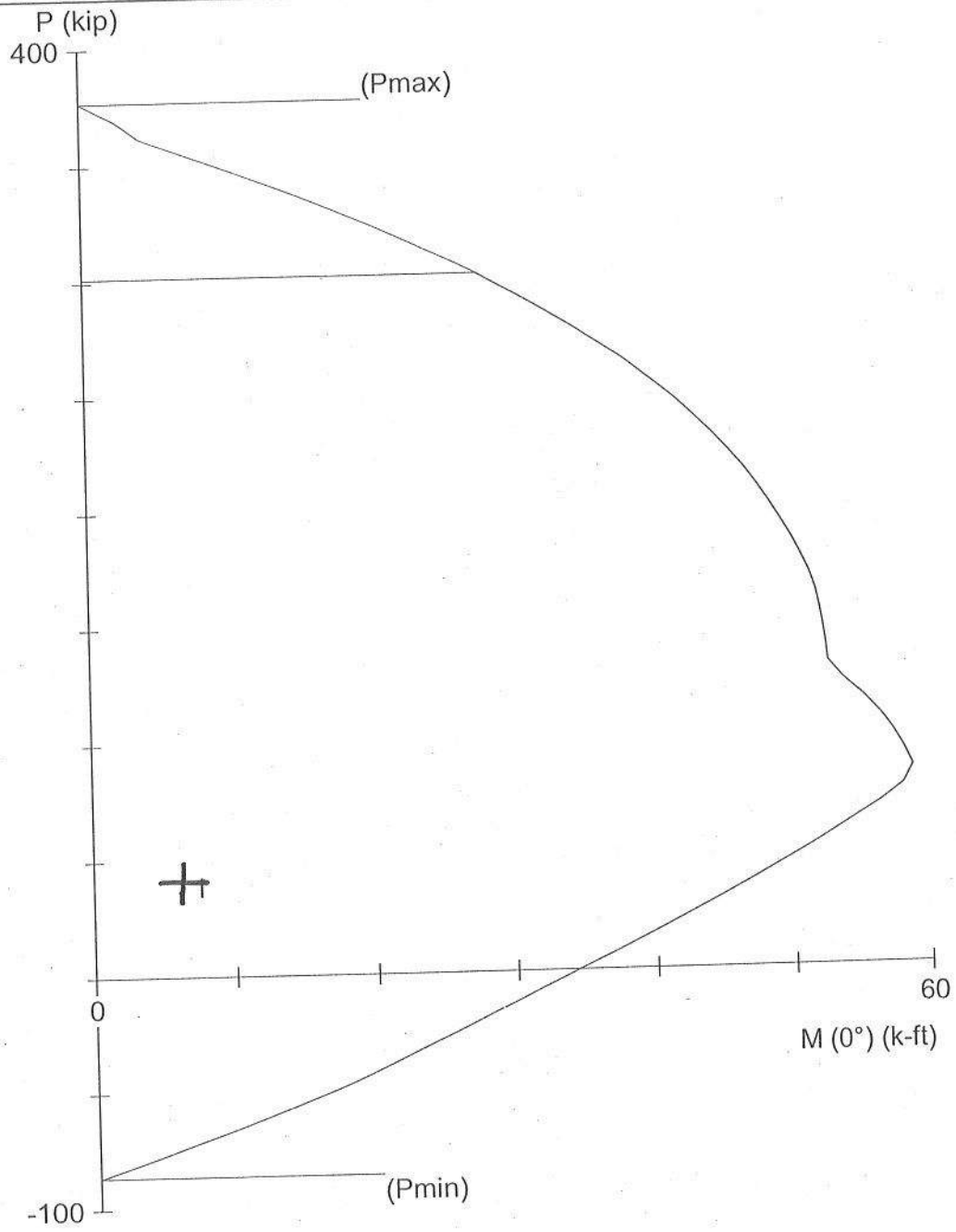
Slenderness: Not considered

Column type: Architectural

Bars: ASTM A615

Date: 06/16/17

Time: 02:10:09



File: untitled.col

Project:

Column:

Engineer:

f'c = 4 ksi

fy = 60 ksi

Ag = 144 in^2

8 #4 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 1.60 in^2

rho = 1.11%

= 3.4 ksi

e_yt = 0.00206897 in/in

Xo = 0.00 in

Ix = 1728 in^4

_u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

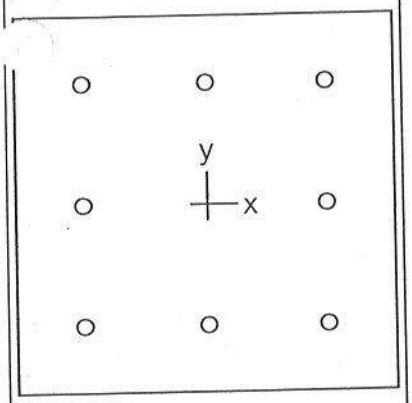
Beta1 = 0.85

Min clear spacing = 3.38 in

Clear cover = 1.88 in

Confinement: Tied

Column Group #5 – C5



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: Biaxial

Run option: Investigation

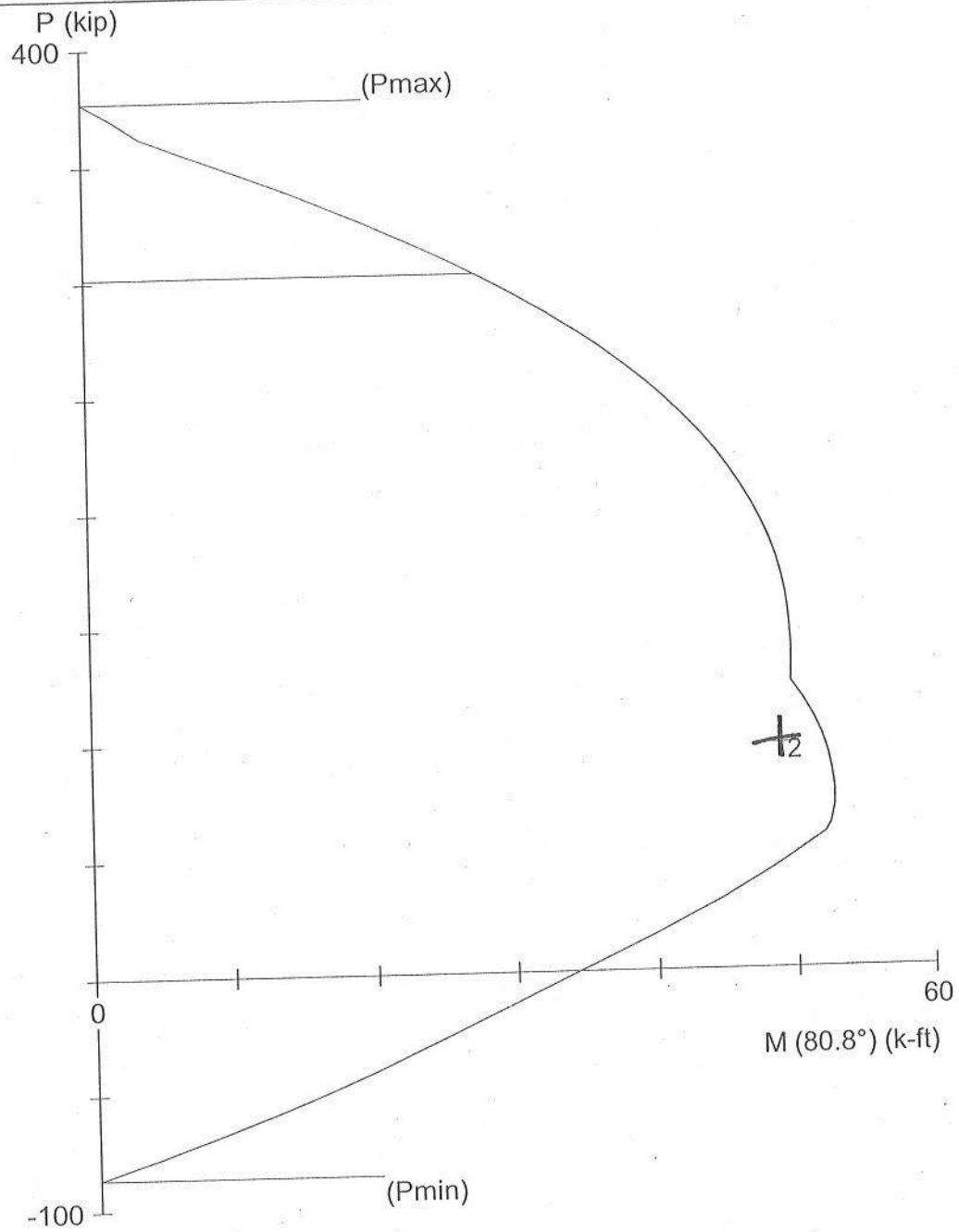
Slenderness: Not considered

Column type: Architectural

Bars: ASTM A615

Date: 06/16/17

Time: 02:10:31



File: untitled.col

Project:

Column:

Engineer:

f'c = 4 ksi

fy = 60 ksi

Ag = 144 in^2

8 #4 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 1.60 in^2

rho = 1.11%

[illegible] = 3.4 ksi

e_yt = 0.00206897 in/in

Xo = 0.00 in

Ix = 1728 in^4

e_u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

Beta1 = 0.85

Min clear spacing = 3.38 in

Clear cover = 1.88 in

Confinement: Tied

STRUCTUREPOINT - spColumn v5.11 (TM)
Licensed to: Cal Poly University. License ID: 64929-1050703-4-2356E-24F6B
untitled.col

General Information:
==========
File Name: untitled.col
Project:
Column:
Code: ACI 318-14

Engineer:
Units: English

Run Option: Investigation
Run Axis: Biaxial

Slenderness: Not considered
Column Type: Architectural

Material Properties:
==========
Concrete: Standard
f'c = 4 ksi
Ec = 3605 ksi
fc = 3.4 ksi
Eps_u = 0.003 in/in
Beta1 = 0.85

Steel: Standard
fy = 60 ksi
Es = 29000 ksi
Eps_yt = 0.00206897 in/in

Section:
==========
Rectangular: Width = 12 in

Depth = 12 in

Gross section area, Ag = 144 in^2
Ix = 1728 in^4
rx = 3.4641 in
Xo = 0 in

Iy = 1728 in^4
ry = 3.4641 in
Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 1.60 in^2 at rho = 1.11%
Minimum clear spacing = 3.38 in

8 #4 Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	Muy k-ft	PhiMnx k-ft	PhiMny k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	42.00	6.30	0.00	48.29	0.00	7.665	2.78	9.88	0.00766	0.900
2	96.70	7.80	48.10	8.35	51.49	1.071	5.76	11.62	0.00306	0.735

*** End of output ***

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	C38 OF C47
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Column Group #5 - C5	

Reference

Vertical Reinf Check:

A_S = 8 - No. 4 = $1.6\ in^2$

ACI 318 §10.6.1.1

$A_{S,min} = 0.01 A_g = (0.01)(12^2) = 1.44\ in^2 < A_S$ ✓

$A_{S,max} = 0.08 A_g = (0.08)(12^2) = 11.52\ in^2 > A_S$ ✓

USE 8 - NO. 4 LONGITUDINAL BARS IN 12" SQ COLUMN

Column Transmission Reqt:

ACI 318 § 15.3

$f'_{c,col} = 4\ ksi$, $f'_{c,floor} = 4\ ksi$

Column transmission reqt does not apply because the conc strengths are equivalent b/w floors and columns.

Tie size and spacing:

ACI 318 §25.7.2

Bar size is least of 1) No. 3 enclosing No. 10 bars
2) No. 4 enclosing No. 11 bars

USE NO. 3 TIES (GRAVITY)

ACI 318 §18.7.5

Spacing:

d_o is greatest of 1) $d_{col} = 12" - 1.5" - 3/8" - 4/16" = 9.875"$
2) $1/6\ d_n = (1/6)(12') = 2' = 24"$ ← governs
3) 18"

$s_{o,l}$ is least of 1) $1/4$ (min col dim) $= (1/4)(12") = 3"$ ← governs
2) 6 (diam of smallest long.) $= (12")(4/8) = 6"$

s_l is least of 1) 6 (d_{long}) $= (6)(4/8) = 3"$ ← governs
2) 6"

Reference

clear spacing = $(4/3)(d_{agg}) = 4/3 \approx \underline{1.5"}$

ACI 318 §25.7.2

min ℓ spacing is least of 1) $16 d_{b\,long} = 16(4/8) = \underline{8"}$ ← governs
2) $48 d_{Ltie} = 48(3/8) = 18"$

Earthquake Requirements:

ACI 318 §18.4.3.3

Assume elastic capacity of gravity framing is exceeded during an earthquake and some non-linear behavior is reqd.

Amount of Transverse Reqd:

$P_u \leq 0.3 A_g f'_c$; $f'_c = 4ksi$, $P_u = 15.83K$

$96.7\,k \leq (0.3)(12\times12)(4)$

$96.7\,k \leq 172.8\,k$ ✓ → Trans is greater

a) $0.3\left(\frac{A_g}{A_{ch}} - 1\right)\left(\frac{f'_c}{f_y}\right) = 0.3\left(\frac{12^2}{9^2} - 1\right)\left(\frac{4}{60}\right) = \underline{0.015\ in^2}$ ← governs

ACI 318 §18.7.5.4

b) $0.09\left(\frac{f'_c}{f_y}\right) = (0.09)\left(\frac{4}{60}\right) = 0.006\ in^2$

$\frac{A_{sh}}{s_{bc}} = 0.015\ in^2$

$A_{sh} = (0.015)(3")(12" - 1.5 - 3/8" - 4/16") = 0.444375\ in^2$

$A_{Ties} = 3\text{-No }4\text{'s} = (3)(0.20) = 0.60\ in^2$ > A_{sh} ✓

USE NO. 4 TIES @ 3" O.C. (SEISMIC)

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic
SHEET NO.: C 40 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu
DATE: 06/17/17
CALCULATION TOPIC: Column Group #5 - C5
Journeyman International Organization

eference

ACI 318 18.7.6

More Checks:

§18.5.7.6 does not apply b/c not supporting reactions from discontinued stiff members, such as walls

§18.7.5.7 does not apply b/c clear spacing = 1.5" < 4"

Shear Forces - run spColumn w/ $\phi = 1.0$ & $f_y = 1.25 f_y = 75$ ksi

↳ $M_{max} = 53$ kft @ Balance point

$V_e = \frac{2M_{pr}}{l_u}$ @ full height

$= \frac{(2)(53)}{20'}$

$= 5.3$k

$V_e = \frac{2M_{pr}}{l_u}$ @ mid height

$= \frac{(2)(53)}{10'}$

$= 10.6$ k

$\phi V_n = \phi V_c + \phi V_s$

$= 0 + \phi V_s$

$= 0.75 \left(\frac{A_v f_{yt} d}{s} \right)$

$= 0.75 \left(\frac{(3)(0.2)(60)(12" - 1.5 - (\frac{7}{8})(\frac{1}{2}))}{3"} \right)$

$= 92.25$k

$\phi V_n = 92.25$k $< V_e = 10.6$ k ✓ O.K.

erence

Column Design - C6

Load Combo: 1.2D + 1.6L

DL = 61 psf
LL = 20 psf

ACI 4.1

$A_T = 991\ sf / 3.28^2 ft^2/m^2 = 92.1\ m^2 \Rightarrow A_T \geq 55.85 \quad ; R_1 = 0.6$

$F_i = 1 \Rightarrow F \leq 4 \quad ; R_2 = 1$

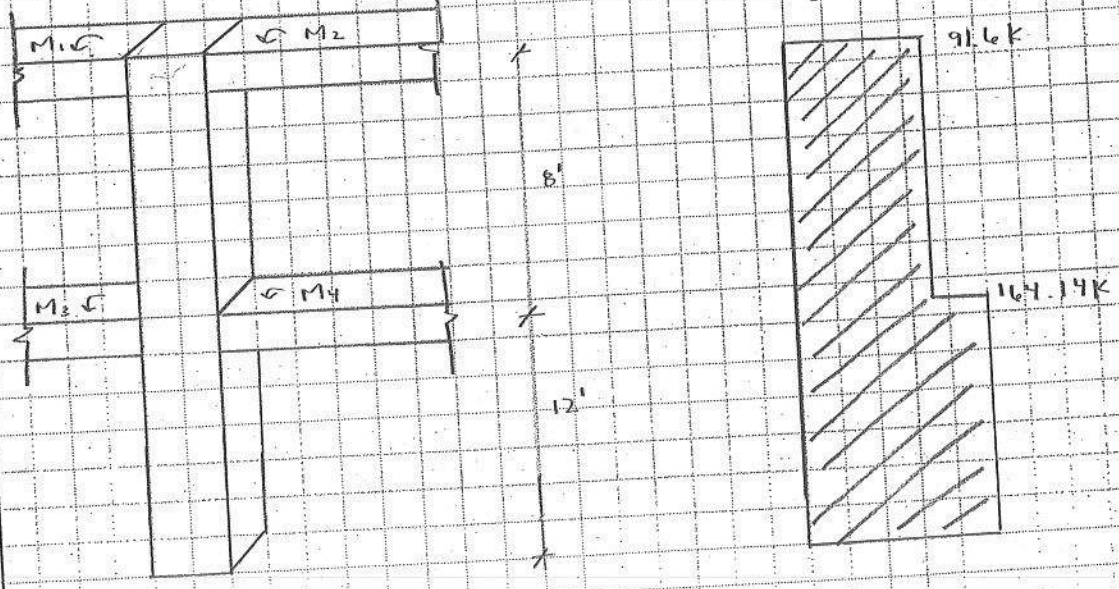
$L_r = L_o R_1 R_2 = (20)(0.6)(1) = 12\ psf$

Axial Design:

$P_{UE} = [(1.2)(61\ psf) + (1.6)(12\ psf)](991) = 91.6\ K$

$P_{UFm} = 91.6K + (1.2)(61 psf)(991) = 164.14K$

Axial Diagram:



ACI 318 F6.5.2

Flexural Design:

M_3) Exterior face of the first interior support

$M_3 = \frac{w_u l_n^2}{10} = \frac{(2.017\ kft)(12^2)}{10} = 51.63\ kft$

M_4) Face of other supports

$M_4 = \frac{w_u l_n^2}{11} = \frac{(2.017\ kft)(12^2)}{11} = 46.94\ kft$

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. C42 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Column Group #6 – C6		Journeyman International Organization

Reference

M_1) Exterior face of the first interior support

$$M_1 = \frac{w_u l_n^2}{10} = \frac{(2.804)(16^2)}{10} = 71.8 \text{ K ft}$$

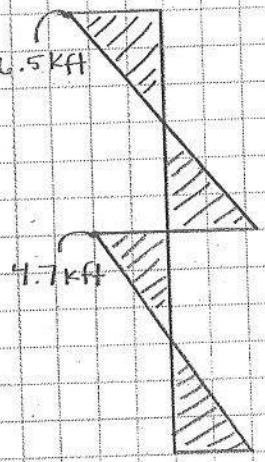
M_2) Face of other supports

$$M_2 = \frac{w_u l_n^2}{11} = \frac{(2.804)(16^2)}{11} = 65.3 \text{ K ft}$$

$M_{Roof} = |M_1 - M_2| = |71.8 - 65.3| = 6.5 \text{ K ft}$

$M_{Fr} = |M_3 - M_4| = |51.63 - 46.94| = 4.7 \text{ K ft}$

Moment Diagram:



Slenderness Check:

ACI 318 §6.2.5.1

12" SQ Column
Roof → 2nd Flr
$k = 1.0$
$l_u = 7'-0"$ (clear height)

Eqn 6.2.5b

$r = 0.3h = (0.3)(12") = 3.6"$

$$\frac{k l_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$$

$$\frac{(1)(7)(12")}{3.6} \leq 34 + 12\left(\frac{4.69}{6.5}\right)$$

$23.3 \leq 42.7$ ✓ Braced against sidesway

Reference

2nd Flr → Ground

$k = 1.0$

$l_u = 11.5'$ (clear height)

$r = 3.6"$

$$\frac{(1)(11.5)(12")}{3.6} \leq 34 + 12\left(\frac{4.67}{6.5}\right)$$

$$10.48 \leq 42.7 \quad \checkmark \text{ Braced against sidesway}$$

COLUMN IS NOT SLENDER

ACI 318 10.6.1.1

Vertical Reinf. check:

A_s = 8 - No. 4's = $1.6 in^2$

$A_{s,min} = 0.01 A_g = (0.01)(12^2) = 1.44 in^2 < A_s$ ✓

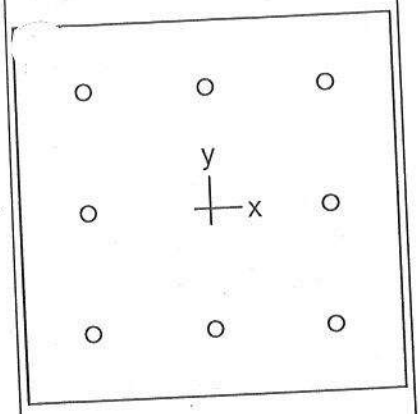
$A_{s,max} = 0.08 A_g = (0.08)(12^2) = 11.52 in^2 > A_s$ ✓

USE 8 - NO. 4 LONGITUDINAL BARS IN SQ COLUMN

Note: Reference Column design C1 or C4 for tie size and spacing calculations.

USE NO. 4 TIES @ 3" O.C (GRAVITY)

Column Group L - C6



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: About X-axis

Run option: Investigation

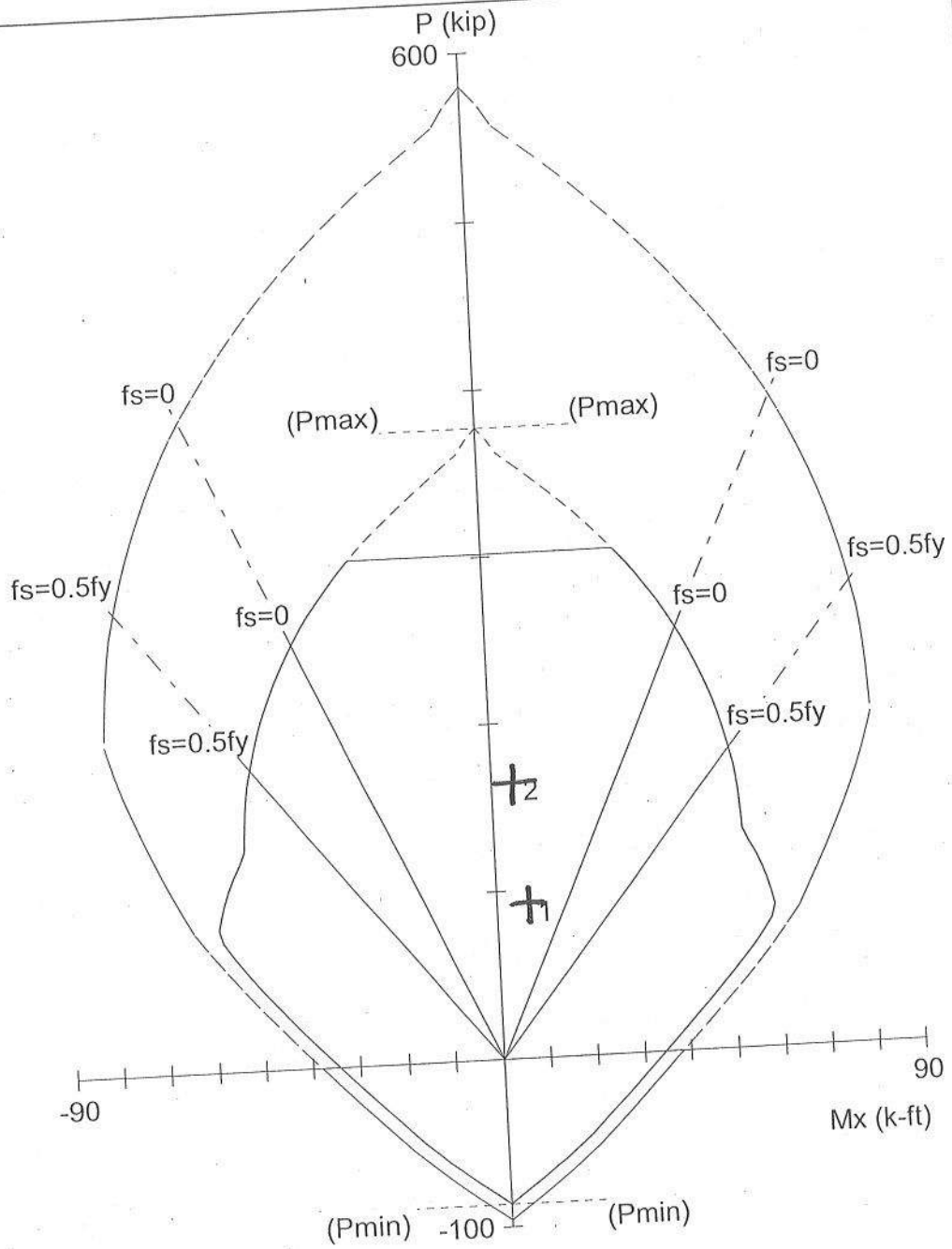
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 06/11/17

Time: 00:11:38



File: untitled.col

Project:

Column:

f'c = 4 ksi

Ec = 3605 ksi

fc = 3.4 ksi

_u = 0.003 in/in

Beta1 = 0.85

Confinement: Tied

fy = 60 ksi

Es = 29000 ksi

e_yt = 0.00206897 in/in

Engineer:

Ag = 144 in^2

As = 1.60 in^2

Xo = 0.00 in

Yo = 0.00 in

Min clear spacing = 3.38 in

8 #4 bars

rho = 1.11%

Ix = 1728 in^4

Iy = 1728 in^4

Clear cover = 1.88 in

STRUCTUREPOINT - spColumn v5.11 (TM)
Licensed to: Cal Poly University. License ID: 64929-1050703-4-2356E-200AE
untitled.col

General Information:
==========
File Name: untitled.col
Project:
Column:
Code: ACI 318-14

Engineer:
Units: English

Run Option: Investigation
Run Axis: X-axis

Slenderness: Not considered
Column Type: Structural

Material Properties:
==========
Concrete: Standard
f'c = 4 ksi
Ec = 3605 ksi
fc = 3.4 ksi
Eps_u = 0.003 in/in
Beta1 = 0.85

Steel: Standard
fy = 60 ksi
Es = 29000 ksi
Eps_yt = 0.00206897 in/in

Section:
==========
Rectangular: Width = 12 in

Depth = 12 in

Gross section area, Ag = 144 in^2
Ix = 1728 in^4
rx = 3.4641 in
Xo = 0 in

Iy = 1728 in^4
ry = 3.4641 in
Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 1.60 in^2 at rho = 1.11%
Minimum clear spacing = 3.38 in

8 #4 Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	PhiMnx k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	91.60	6.50	58.24	8.959	4.00	9.88	0.00440	0.849
2	164.14	4.70	51.72	11.004	6.85	9.88	0.00133	0.650

*** End of output ***

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: C46 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: column group #7 (C7)		Journeyman International Organization

Reference

typ TO columns - steel

Loads:

TO

DL = 11 psf

LL = 20psf

↳ $A_T = (8.5m)(3m) + (0.5m)(3m) = 27m^2$

$R_1 = 1.2 - 0.011A_T$

$= 1.2 - 0.011(27m^2)$

$= 0.903$

$R_2 = 1.0$ b/c $F = 1.5 < 4$

$L_o = (20psf)(0.903)(1.0)$

$= 18.06$ psf

$P_U = ((1.2)(11psf) + (1.6)(18.06psf))(27m^2)(3.28ft/m)^2$

$= 12.3K$

Design:

$K_x L_x = (10.5')(1.0)$

$= 10.5' \approx 11'$

used 11', be conservative

∴ Try HSS 3 × 3 × 1/8

$\phi P_n = 22.9K$

$F_y = 46ksi$

USE HSS 3 × 3 × 1/8

Checks:

AISC T B4.1a

Buckling:

$\lambda_r = b/t = 1.40\sqrt{E/F_y}$

$= 1.40\sqrt{\frac{29000ksi}{46ksi}}$

$= 35.15$ max

AISC T 1.12

$\lambda_r = 22.9 < 35.15$ ✓

Slenderness:

$\frac{kl}{r} \leq 200$

$\frac{(1.0)(10.5')(12''/1ft)}{1.17''} \leq 200$

T 1-12

$107.8 \leq 200$ ✓

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: C4 7 OF C47
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: column group #8 (C8)		Journeyman International Organization

Reference

stage steel columns:

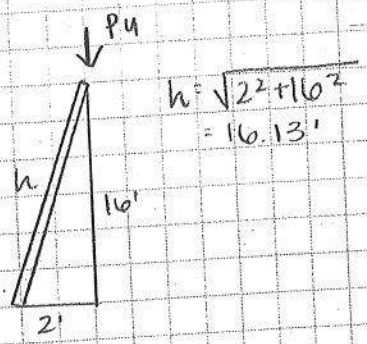
$A_T = (17')(17') = 289\ ft^2$

DL = 11 PSF

LL = 20 PSF
↳ $A_T = 289\ ft^2$
$R_1 = 1.2 - 0.001 A_T$
$= 1.2 - 0.001(289)$
$= 0.911$
$R_2 = 1.0$

$Lr = (20\ PSF)(0.911)(1.0)$
$= 18.22\ PSF$

$Pu = [(1.2)(11\ PSF) + 1.6(18.22\ PSF)](289\ ft^2)$
$= 12.24\ K$



design:

slanted column → L = 16'-0"

$KL = (1.0)(16.2')$
$= 16.2'$

⇒ use **HSS 3 x 3 x 3/16**

$\phi P_n = 15.1\ K$
$F_y = 46\ KSI$

checks:

Buckling:
$\lambda_r = b/t = 1.40\sqrt{E/F_y}$
$= 35.15$

$\lambda = 14.12 < \lambda_r$ ✓

slenderness:
$\frac{kl}{r} \leq 22$

$\frac{(1.0)(16')(12"/1')}{1.14"} \leq 200$
$168.4 \leq 200$ ✓

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	L1 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
CALCULATION TOPIC: Wind Analysis (MWFRS)	Journeyman International Organization

Reference

ASCE T27.2-1 Story height < 60' ⇒ low rise building, partially enclosed

1) Risk category: 2

2) wind loads based on Florida because it has closest wind conditions to Dominican Republic

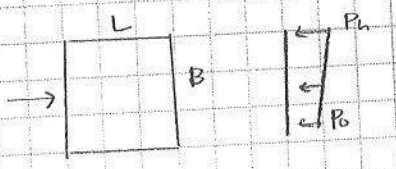
Fig 26.5-1A V = 180 mph, 80 m/s

3) wind load parameters:
- $G = 0.85$
- T26.6-1 $K_d = 0.85$
- §26.7 Exposure category: B
- §26.8.2 $K_{zt} = 1.0$
- partially enclosed (b/c DI stage)
- T26.11-1 $GC_{pi} = \pm 0.55$

4) $h_{Bldg} = z \approx 25' \approx 7.6m$ ⇒ $K_z = 0.66$
- T2 -1 $h = 22'$ (mean roof) ⇒ $K_H \approx 0.64$

EQ 27.3-1 5) $q_z = 0.00256 K_z K_{zt} K_d V^2$
$= (0.00256)(0.66)(1.0)(0.85)(180)^2$
$= 46.53$ psf

$q_h = 0.00256(0.64)(1.0)(0.85)(180)^2$
$= 45.12$ psf



6) N/S:
T27.4-1 windward → $C_p = 0.8$ use w/ q_z
$L/B = 0.7102$
leeward → $C_p = -0.5$ use w/ q_h

E/W:
windward → $C_p = 0.8$ use w/ q_z
$L/B = 1.41$
leeward → $C_p = -0.3$ use w/ q_h

7) Flexible diaphragm, Rigid Building

Eqn 27.4-1 windward:
$p = qGC_{pi} - q_z(GC_{pi})$
$= (46.53 psf)(0.85)(0.8) - (46.53 psf)(-0.55)$
$= 57.23$ psf ← worst case wind load due to windward side and full building height

$\Rightarrow (57.23 psf)(41' \times 21.62')$

USGS Design Maps Summary Report

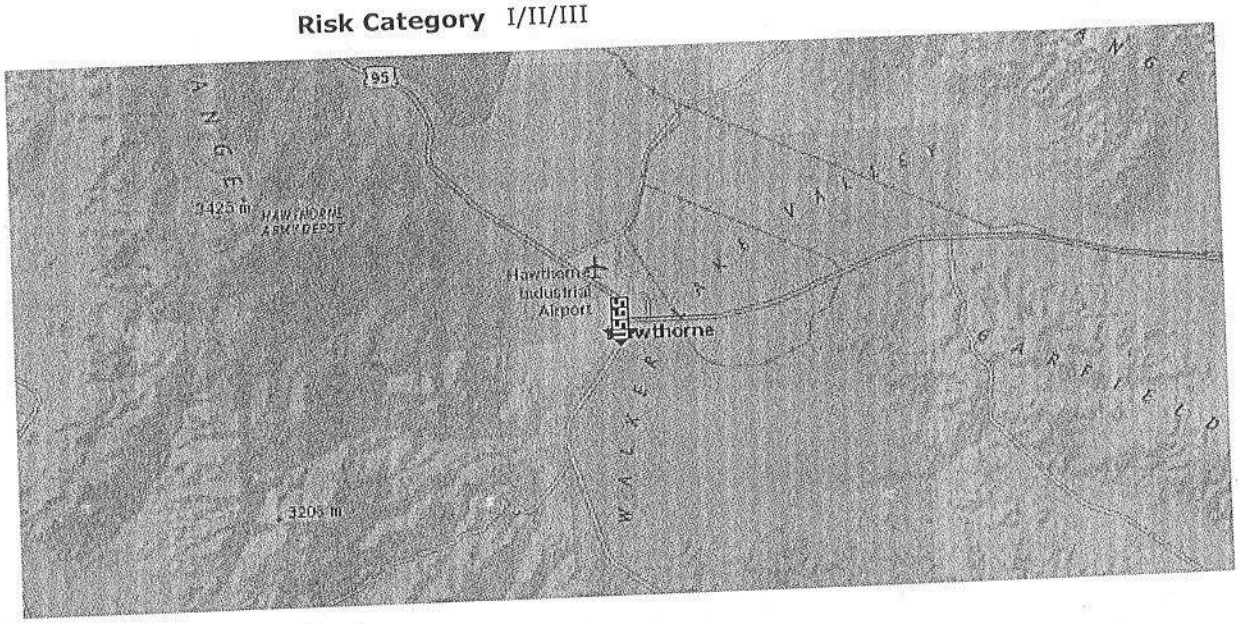
User–Specified Input

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 38.52466°N, 118.62459°W

Site Soil Classification Site Class D – "Stiff Soil"

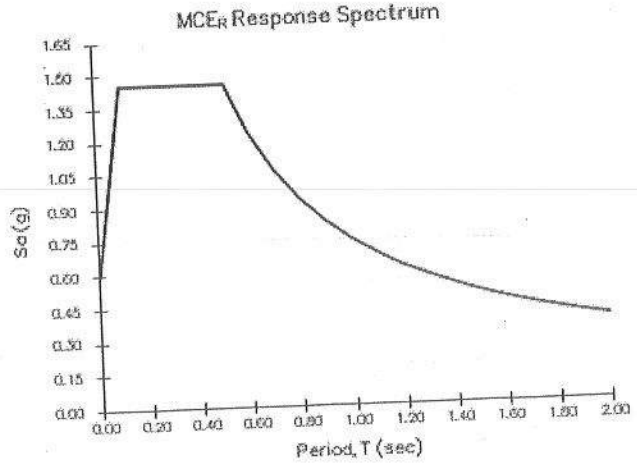
Risk Category I/II/III

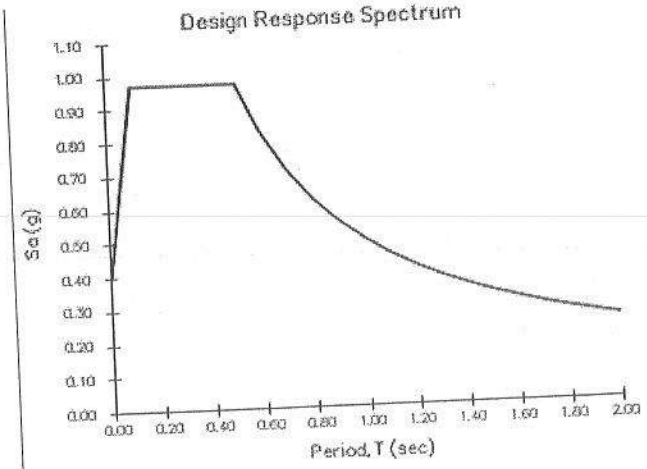


USGS–Provided Output

S_S =	1.455 g	S_{MS} =	1.455 g	S_{DS} =	0.970 g
S_1 =	0.493 g	S_{M1} =	0.743 g	S_{D1} =	0.496 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

* seismic design category is D (ASCE 7-10 Tbl 11.6.1) *

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	L3 OF L40
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Seismic Force Analysis	

Reference

Building Properties

Level	Floor Area (ft^2)	Floor Area (m^2)	Wall Perimeter (ft)	Wall Perimeter (m)	Tributary Height (ft)	Tributary Height (m)
1	-	-	-	-	-	-
2	5548.80	515.50	337.93	103.00	11.00	3.35
Roof	4305.56	400.00	269.03	82.00	5.00	1.52

Loads Per Level

	Roof	Floor	
Roof Level	262,639.16	-	#
Floor Level	-	338,476.54	#
Exterior Wall	92,815.01	256,486.59	#

Total Load

Total Weight at Roof Level	355,454.17	#
Total Weight at Floor Level	594,963.14	#
Total Building Weight	**950,417.30**	#

Mapped Spectral Acceleration:

Values gathered from USGS Design Maps Summary Report. City of Hawthorne's geographical location was chosen because it closely mirrored seismic location of Dominican Republic

Latitude:	38.52466	°N
Longitude:	118.62459	°W
Ss =	1.455	g
S1 =	0.493	g
Sms =	1.455	g
Sm1 =	0.743	g
Sds =	0.97	g
Sd1 =	0.496	g

Seismic Response Coefficient

Special Reinforced Concrete Moment Frame		
R =	8	*Response Modification Factor - ASCE Table 12.2-1*
Ie =	1.0	*Seismic Importance Factor - ASCE Table 1.5-2*
SDC =	D	*Seismic Design Category - IBC 302.1*
Risk Category =	2	*Risk Category - ASCE Table 1.5-1*

Fundamental Period			
Ct =	0.02		*ASCE Table 12.8-2*
hn =	23.28	ft	
x =	0.75		*ASCE Table 12.8-2*
T =	0.21197	sec	*Fundamental Period - ASCE eq'n 12.8-7 (T = Ct*hn^x)*

Cs =	0.12125	*ASCE Table 12.8-2 (Cs = Sds/(R/Ie))*
Cs, max =	0.29250	*ASCE Table 12.8-3 (Cs = Sd1/(T(R/Ie))*
Cs, min =	0.0427	*ASCE Table 12.8-5 (Cs = 0.044*Sds*Ie)*

Base Shear

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. L4 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Lateral Design Distribution		Journeyman International Organization

Reference

Lateral loads due to wind forces are less than lateral loads due to seismic forces. Therefore, seismic forces will govern lateral design.

Vertical Force Distribution

V =	115238	#				
k =	1					
Level	Floor Wt. (#)	Height (ft)	W*(h^k) (#-ft)	Cvx	Fx, Story Force/Shear (#)	
Roof	355,454	23.28	8,274,973	0.537	61,863	
2	594,963	12.00	7,139,558	0.463	53,375	
		Σ =	15,414,531		115,238.10	

Diaphragm Design Forces

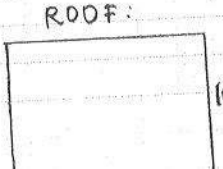
Level	Floor Wt.	Fx (#)	Fp (#)	Fp-max (#)	Fp-min (#)	Fp-design (#)	Ax (g)
Roof	355,454	61,863	2,657	137,916	68,958	68,958	0.1940
2	594,963	53,375	4,448	230,846	115,423	115,423	0.1940
ASCE 12.8 and 12.10:		*Cvx =*	*(Wx*(hx^k))/(Wt*(ht^k))*				
		Fx =	*Cvx * V*				
		Fp =	*(Sum(Fx)/Sum(Wt.))*Wt.*				
		Fp-max =	*0.4*Sds*Ie*Wt.*				
		Fp-min=	*0.2*Sds*Ie*Wt.*				
		Ax =	*Fp-design/Wt.*				

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	L5 OF L40
AUTHOR	DATE
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
inputs / checks	

Reference	
ASCE 12.3.3.1	Irregularity checks: Structures w/ SDC D can't have vertical irregularities → must check
12.3.4.2	Reduce ρ to 1.0 b/c it is SDC D w/ each story resisting more than 35% of the base shear in each direction to comply w/ T12.3-3 - lateral force-resisting element = moment frame -N/S = 5 total bays -E/W = 6 total bays ⇒ ∴ removal of one bay = 16% - 20% less strength so $\rho = 1.0$ ✓ $\rho = 1.0$
T12.3-1 ASCE 12.3.3.4	Horizontal checks: • Type 1A) $\frac{\delta max}{\delta avg} < 1.2$ ROOF: $\frac{0.000924}{0.000667} = 1.37 > 1.2$ ∴ must increase force by 25% when designing collectors & connections from diaphragm to vertical elements • Type 1B) same as Type 1A ✓ • Type 2) no reentrant corners ✓ • Type 3) no diaphragm discontinuity ✓ • Type 4) no out-of-plane offsets b/c concrete moment frame will extend to both stories ✓ • Type 5) no nonparallel system irregularity b/c building is along only major orthogonal axes ✓
T12.3-2	Vertical check • Type 1A) no stiffness soft-story irregularity b/c lateral system is the same between stories ✓ • Type 1B) same as 1A ✓ • Type 2) no weight mass irregularity b/c only technically have roof loads ✓ • Type 3) no vertical geometric irregularity b/c horizontal dimensions of seismic system is the same between stories ✓ • Type 4) doesn't apply b/c no in-plane offset of vertical seis. system ✓ • Type 5A) no discontinuity of lateral strength-weak story ✓ • Type 5B) same as 5A

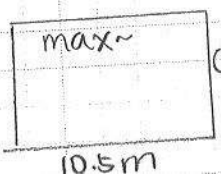
• Diaphragm ratio check:

ROOF:



$\frac{25}{16} = 1.5625 < 3$ ✓

Kitchen/restroom:



$\frac{10.5}{6} = 1.75 < 3$ ✓

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L6 OF L40
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC Inputs (etabs)	Journeyman International Organization

Reference

Load combo:

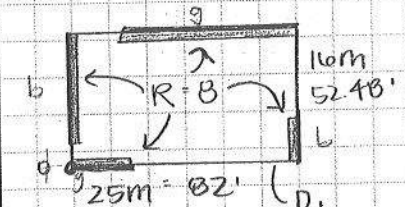
(1.2 + 0.2 S_{DS}) D + ρ Q_E + L
(1.2 + 0.2(0.97)) D + (1.0) Q_E + L
1.394 D + Q_E + L

:1.0 :see irrequia. check

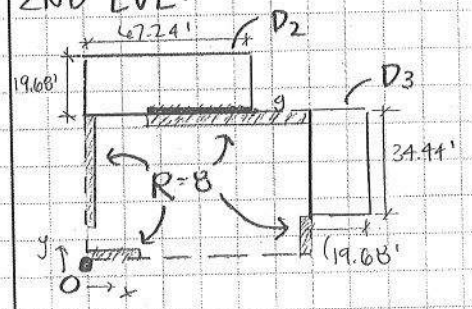
etabs inputs:

0 model etabs- ravity

ROOF:



2ND LVL:



——— : parts of MF taking gravity loads
x-axis MF = girder loads
Y-axis MF = beam loads

BM DL = (41 PSF)(41') = 1.681 KIF
BM LL = (20 PSF)(41') = 0.820 KIF

Girder DL = (56 PSF)(26.24') = 1.469 KIF
Girder LL = (20 PSF)(26.24') = 0.524 8 KIF

- only girder will take gravity load due to the location of the diaphragm

Girder DL = (56 PSF)(19.68') = 1.102 KIF
Girder LL = (20 PSF)(19.68') = 0.394 KIF

lateral: From etabs

Will analyze in both directions

ROOF: D1 — center of mass = (41', 26.24') ← apply Fx = 61,863 #

center of rigidity = where building will rotate about since load is applied @ CM

2ND LVL: D2 — CM = (33.68', 62.32') ← apply Fx = (0.66)(53,375#) = 35,228 #

2ND LVL: D3 — CM = (91.18', 33.49') ← apply Fx = (0.34)(53,375#) = 18,148 #

↳ D_2 = 1323.3 ft^2 ≈ 66% of D_{TOT}
D_3 = 677.8 ft^2 ≈ 34% of D_{TOT}
D_{TOT} = 2001.1 ft^2

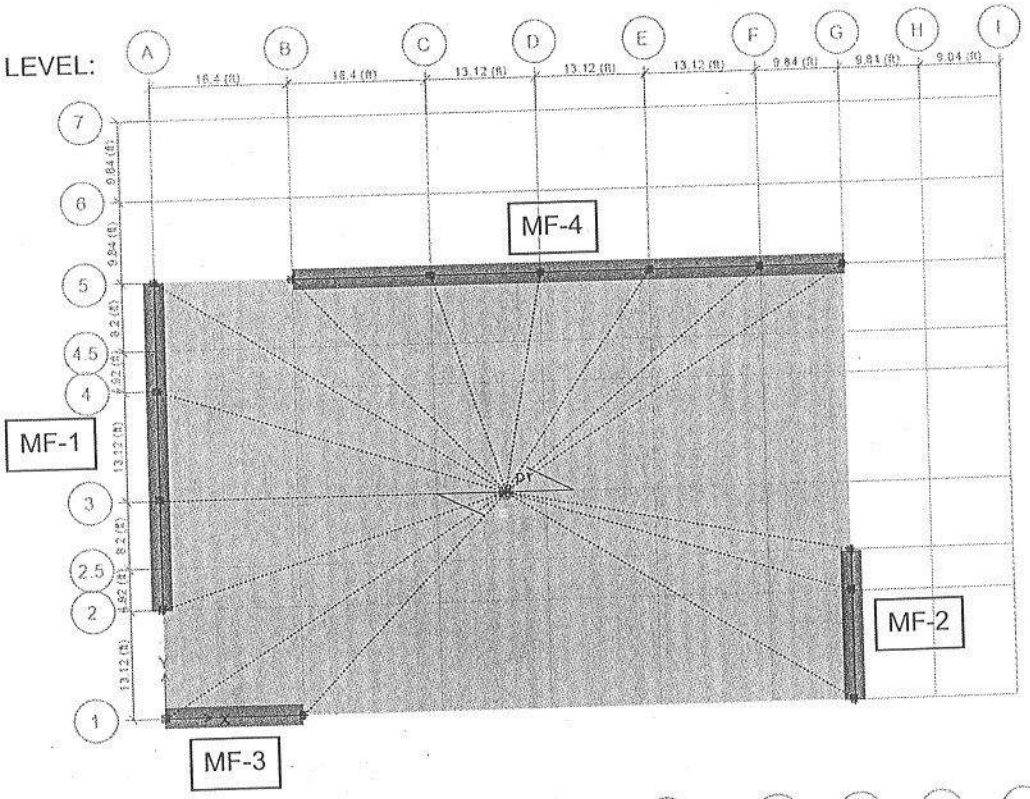
	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L7 OF L40
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC ETABS - Concrete Moment Frame	Journeyman International Organization

Reference

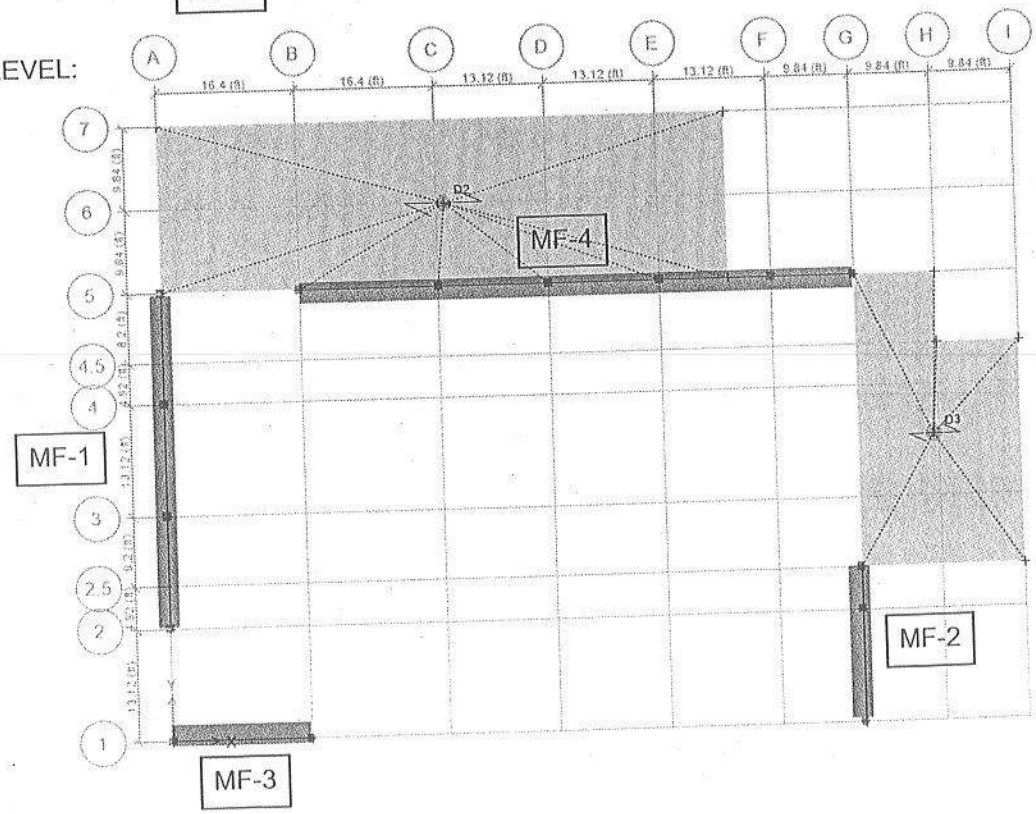
Inputs/Modeling Parameters:

See hand calculations for determination of loads applied.

ROOF LEVEL:



2ND LEVEL:



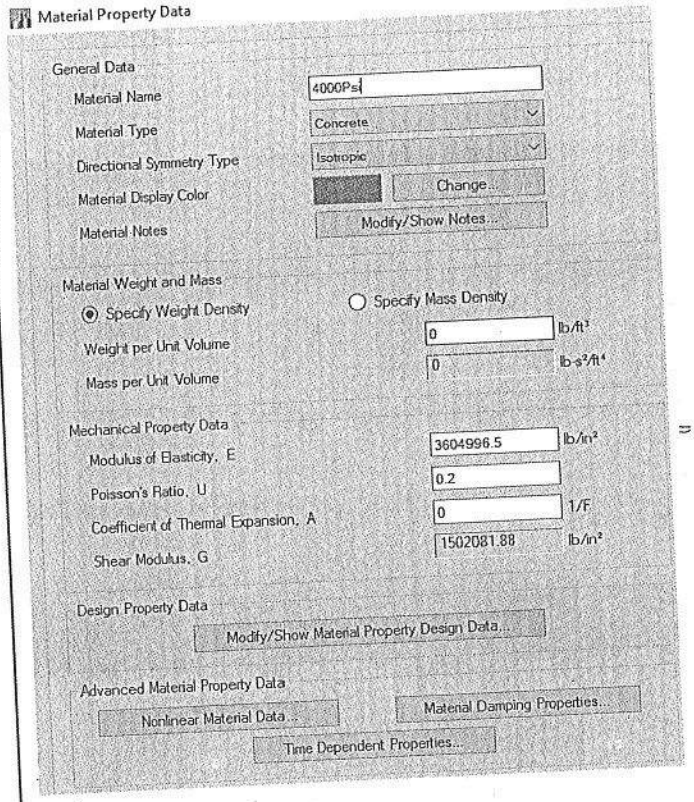
TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: L8 OF L4D
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: ETABS - Concrete Moment Frame	Journeyman International Organization

Reference

Inputs/Modeling Parameters:

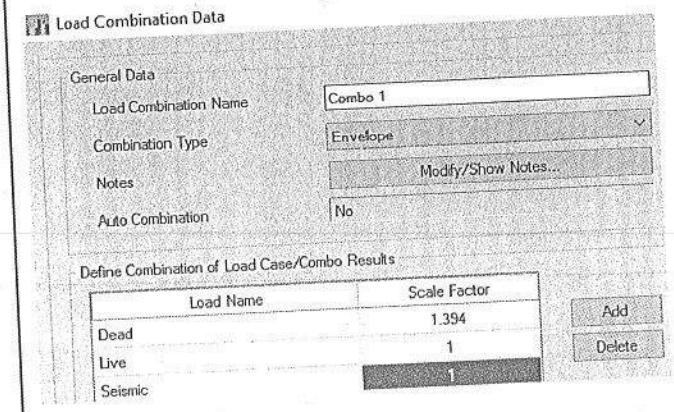
See hand calculations for determination of loads applied.

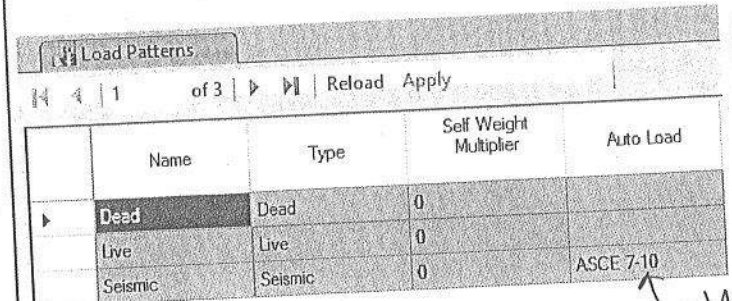
MATERIAL PROPERTIES:



= 3605 ksi

LOAD ADJUSTMENTS:





Self-weight multiplier set equal to zero because the loads applied in the ETABS model already accounts for appropriate gravity and lateral loads.

↑ use to account for eccentricity

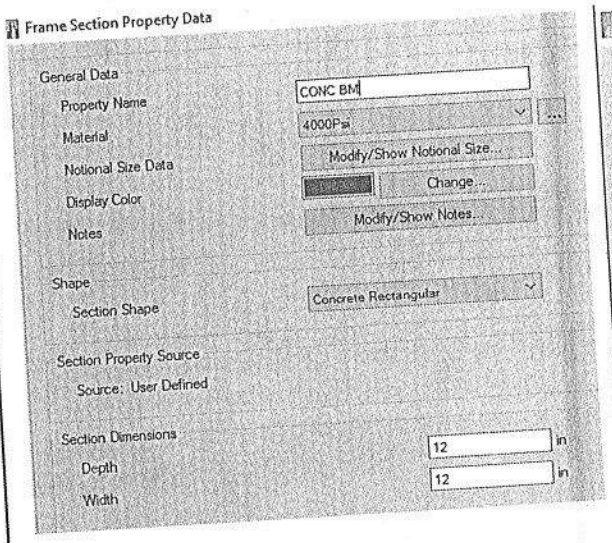
PROJECT	Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L9 OF L40
AUTHOR	Mindy Trieu and Jocelyn Lu	DATE 06/17/17
CALCULATION TOPIC	ETABS - Concrete Moment Frame	Journeyman International Organization

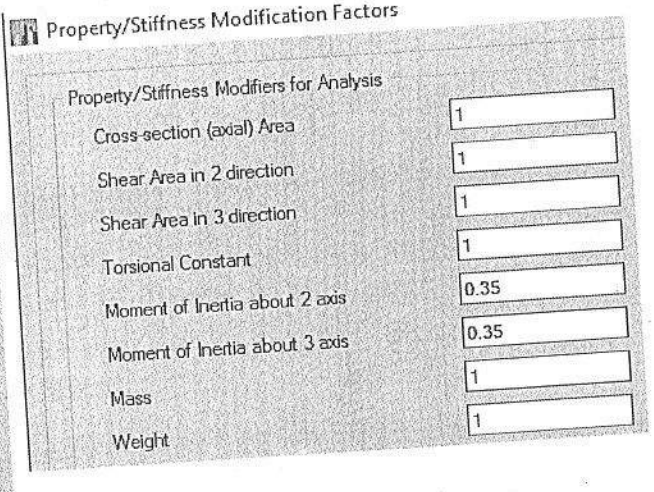
Reference

Inputs/Modeling Parameters:

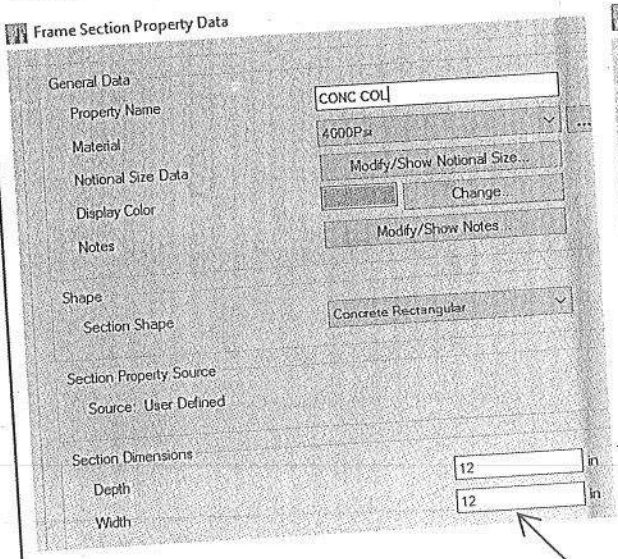
See hand calculations for determination of loads applied.

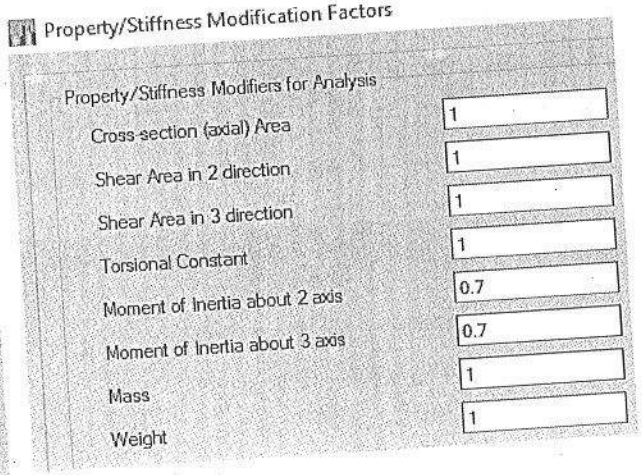
BEAM/GIRDER PROPERTIES:





COLUMN PROPERTIES:





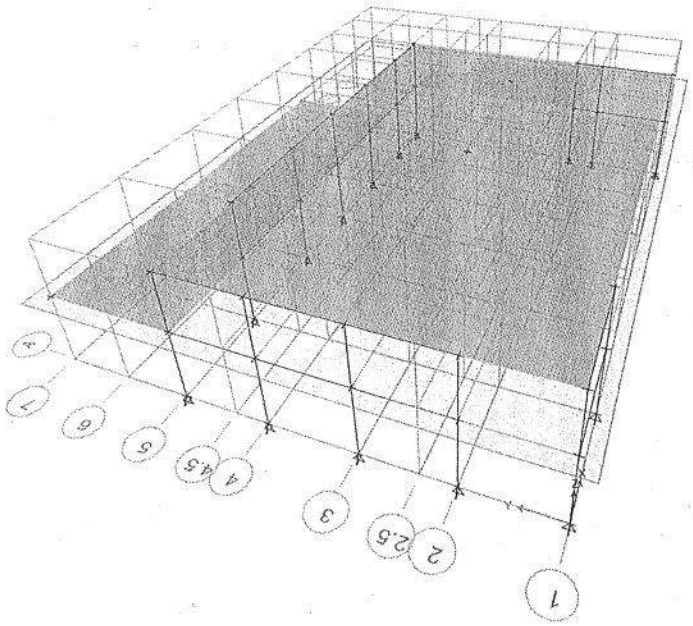
Column and beam sizes based on quick calculations and readjusting as necessary for constructability purposes

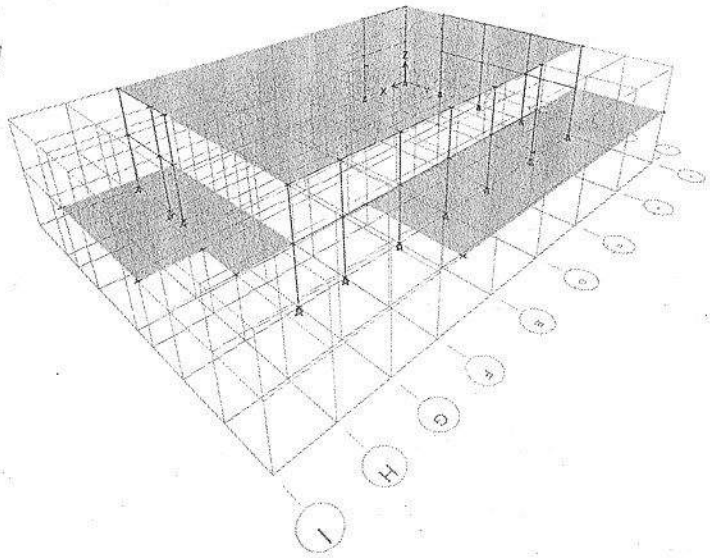
(Diaphragm modelled as semi Rigid.)

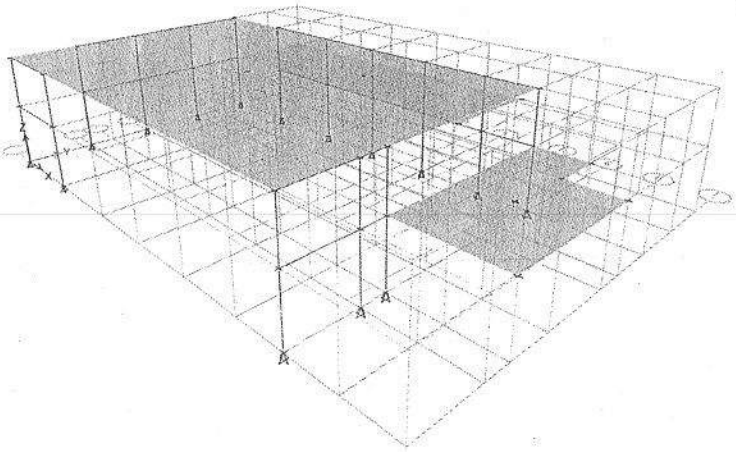
TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L10 OF L40
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC ETABS - Concrete Moment Frame	Journeyman International Organization

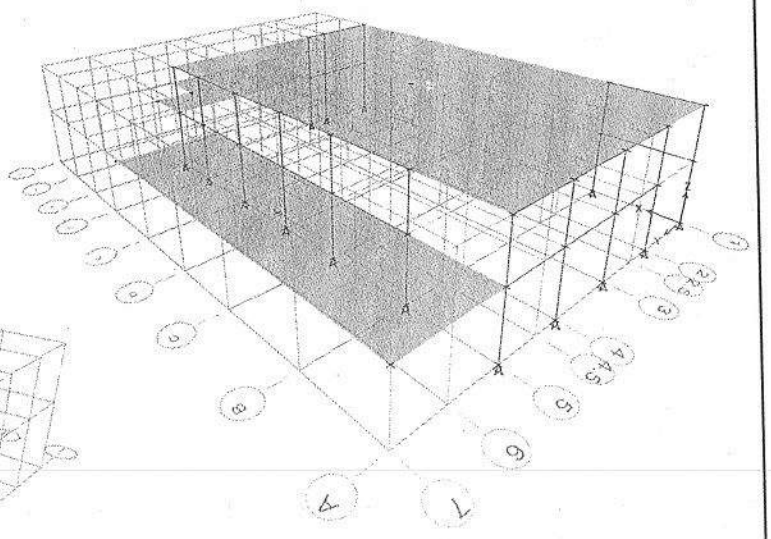
Reference

3D Model:









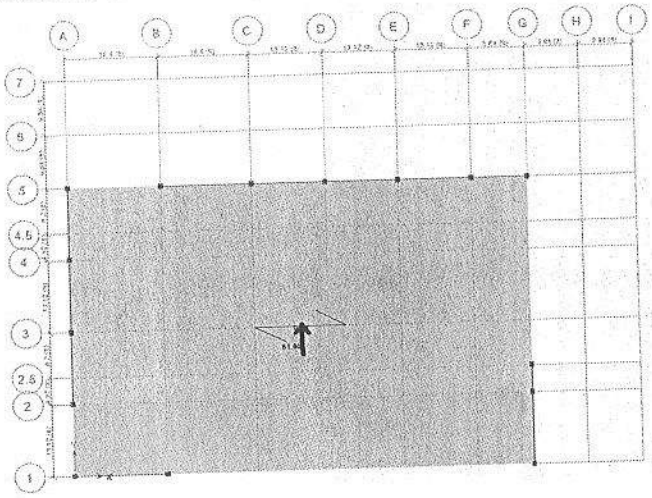
	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L11 OF L40
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC ETABS - Concrete Moment Frame	Journeyman International Organization

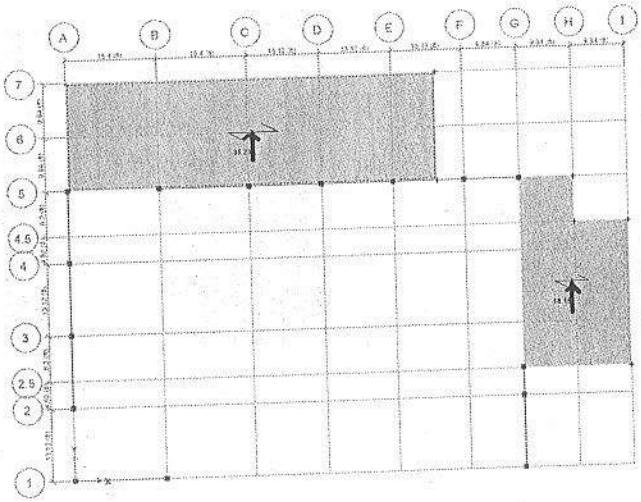
Reference

N/S Loading:

See hand calculations for determination of loads applied.

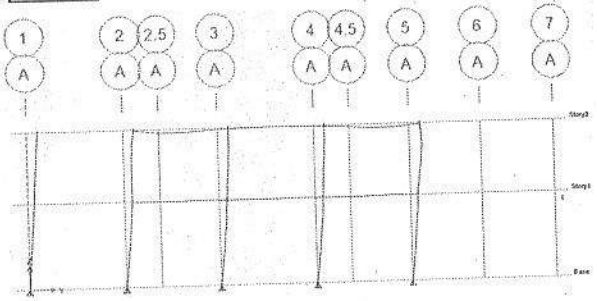
STORY FORCES:



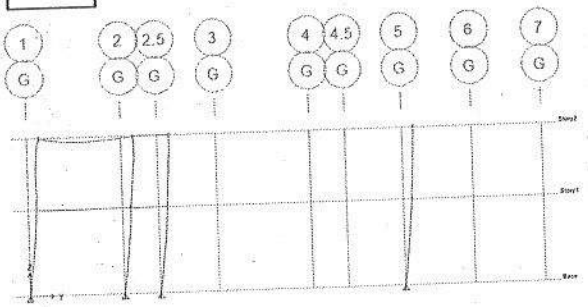


DEFLECTION:

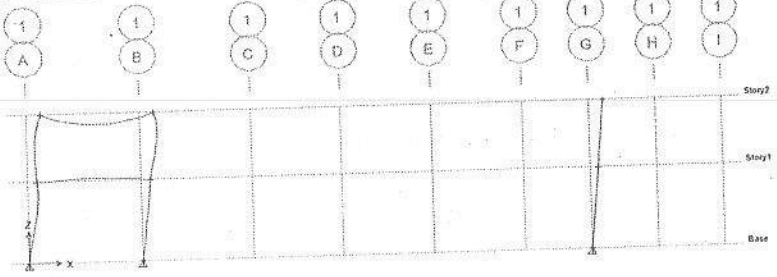
MF-1



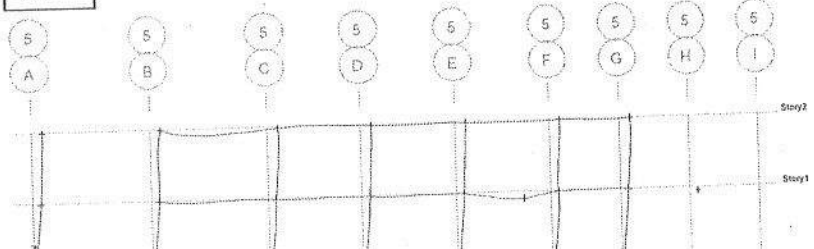
MF-2



MF-3



MF-4



	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L12 OF L40
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: ETABS - Concrete Moment Frame	Journeyman International Organization

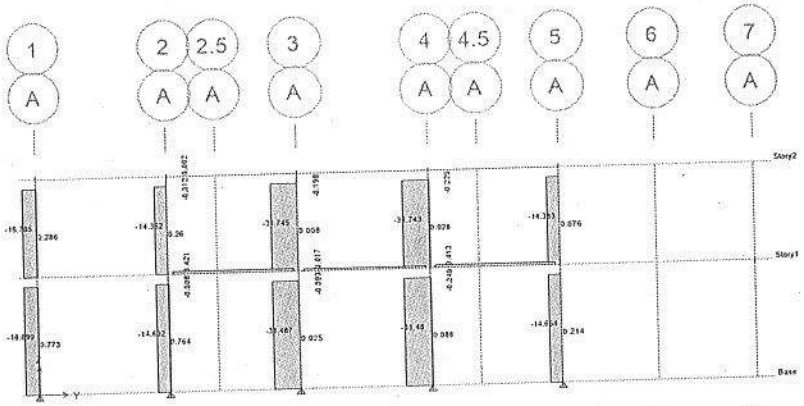
Reference

N/S Loading:

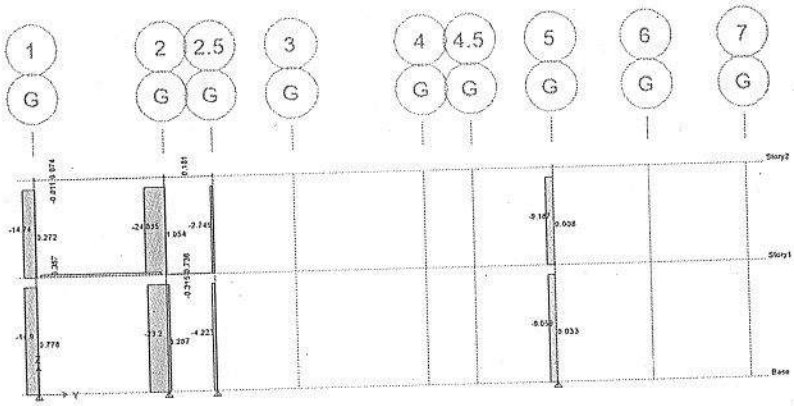
See hand calculations for determination of loads applied.

AXIAL:

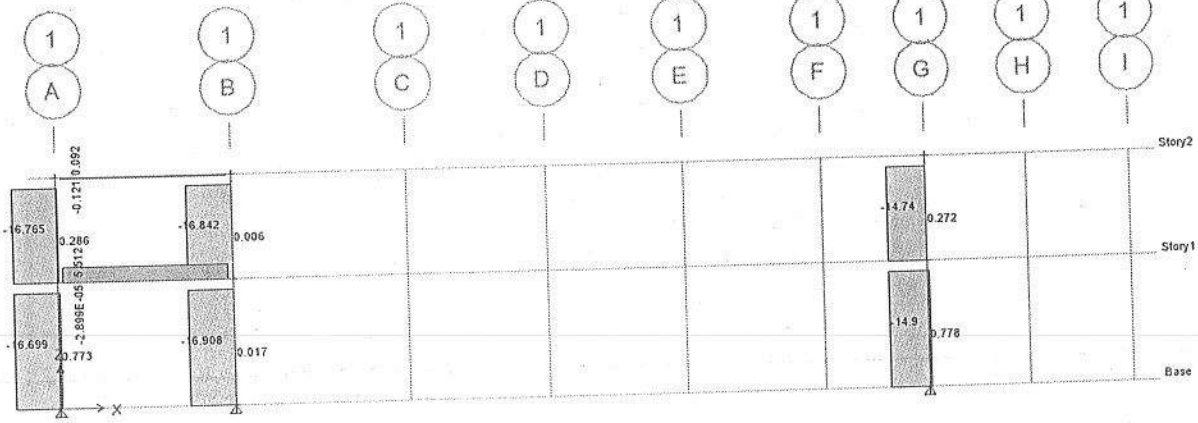
MF-1



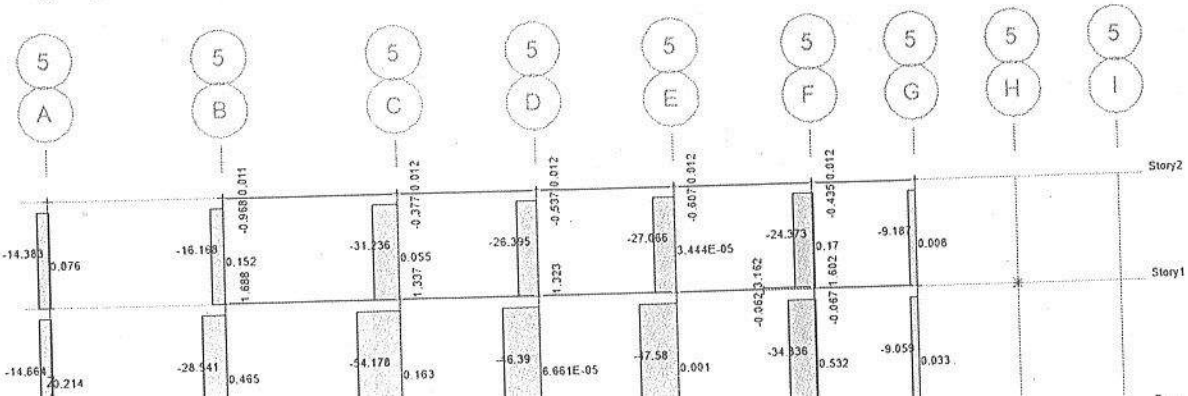
MF-2



MF-3



MF-4



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: L13 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: ETABS - Concrete Moment Frame		Journeyman International Organization

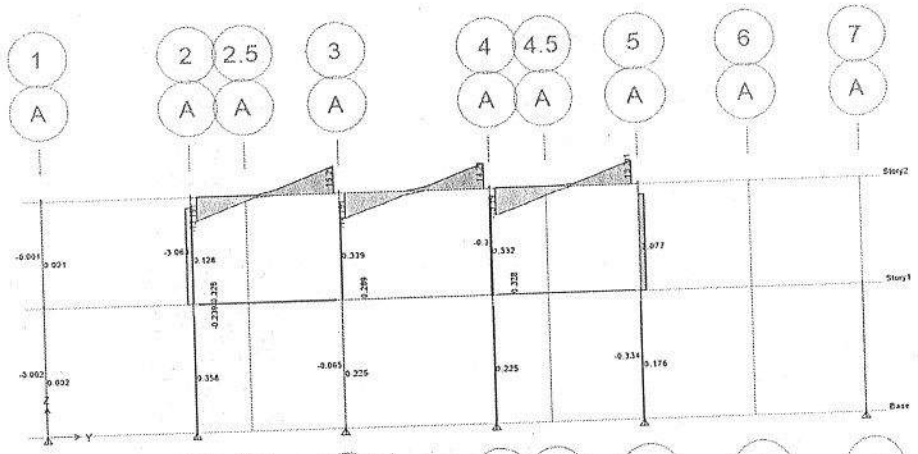
Reference

N/S Loading:

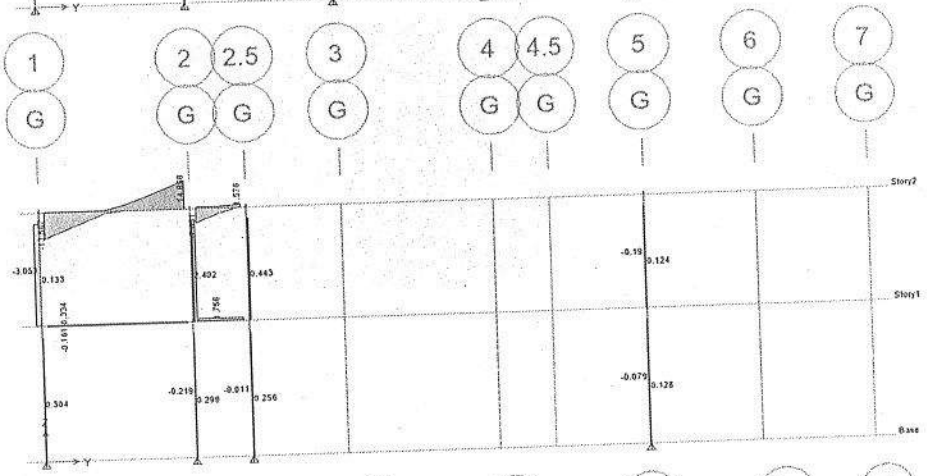
See hand calculations for determination of loads applied.

SHEAR:

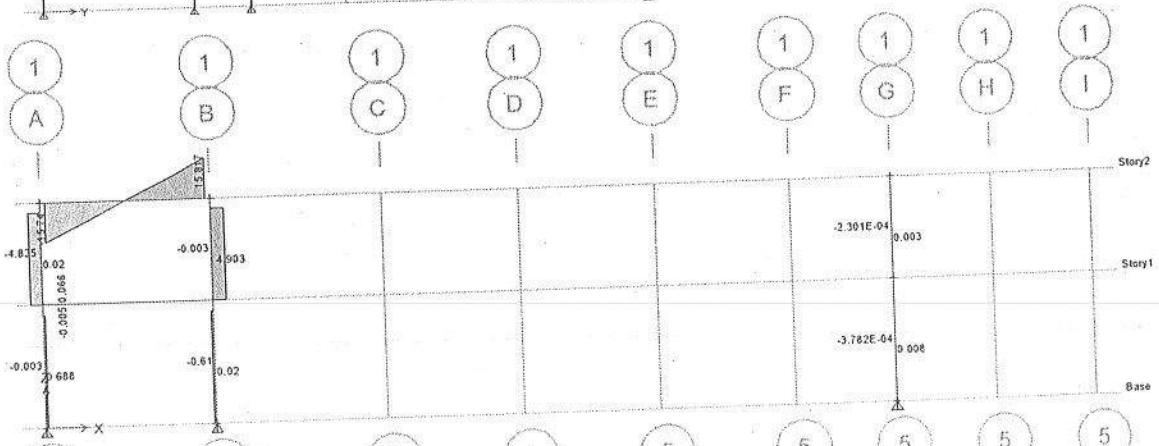
MF-1



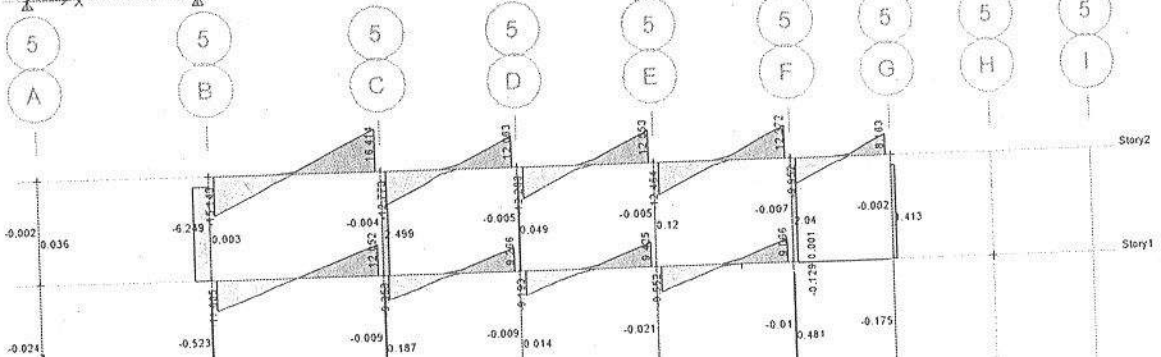
MF-2



MF-3



MF-4



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. L14 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: ETABS - Concrete Moment Frame		Journeyman International Organization

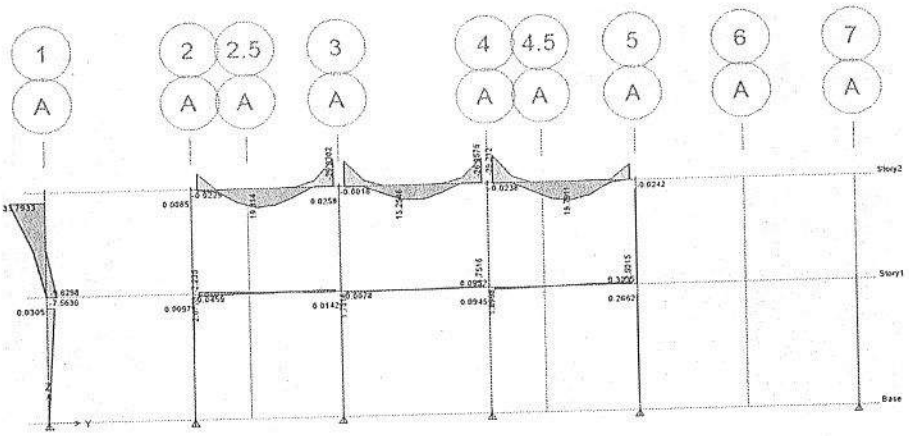
Reference

N/S Loading:

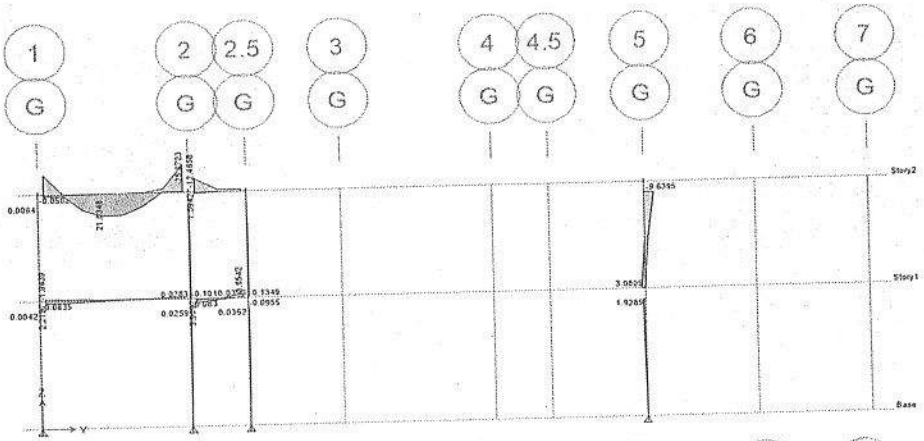
See hand calculations for determination of loads applied.

MOMENT:

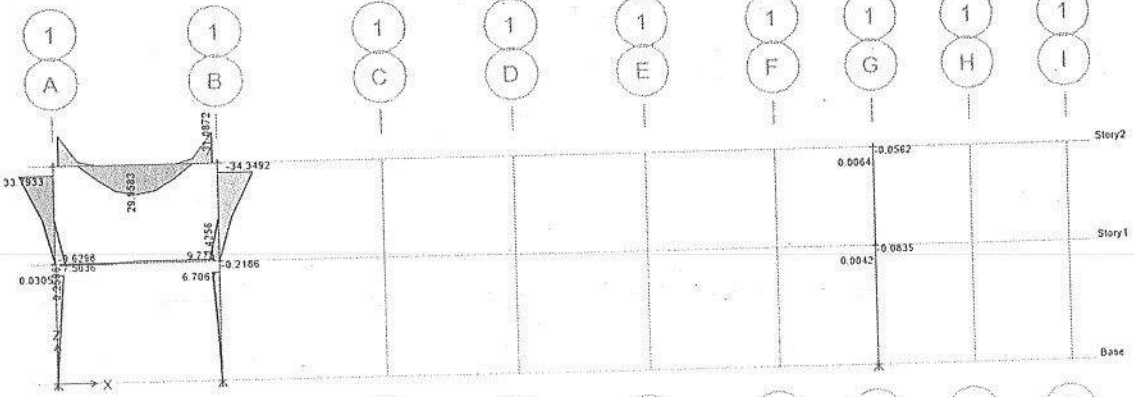
MF-1



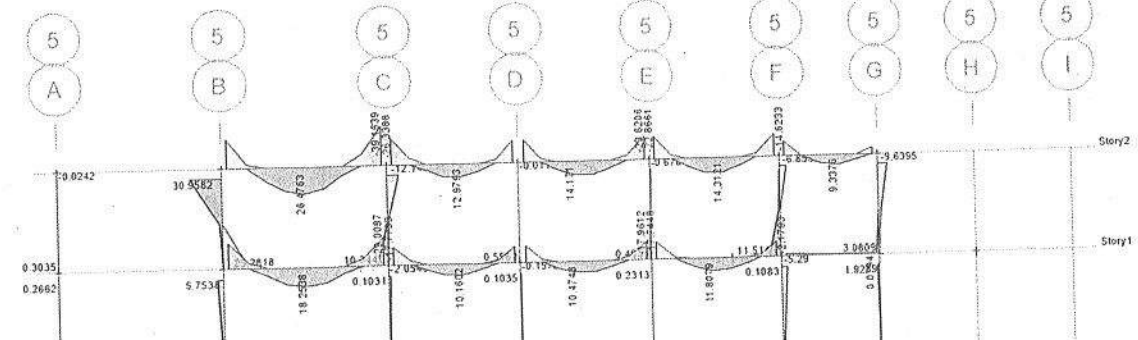
MF-2



MF-3



MF-4



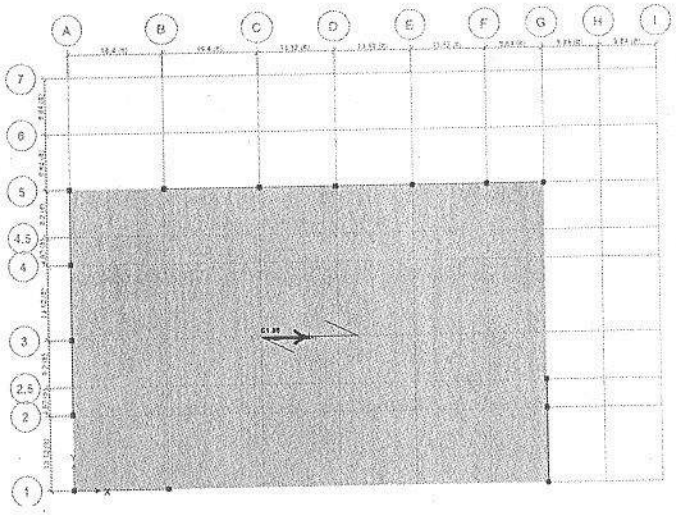
	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L15 OF L40
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC ETABS - Concrete Moment Frame	Journeyman International Organization

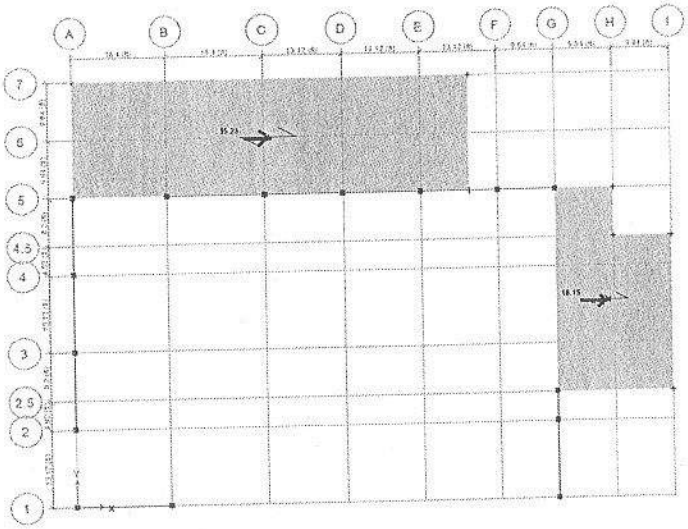
Reference

E/W Loading:

See hand calculations for determination of loads applied.

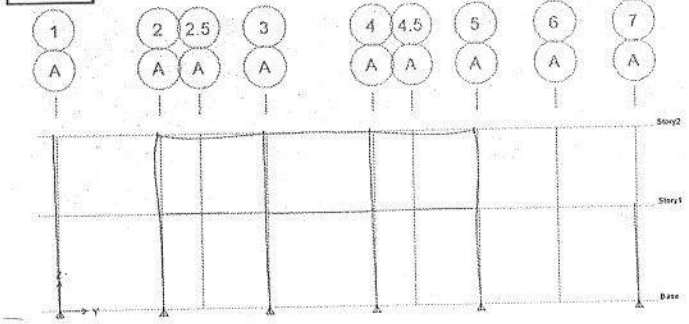
STORY FORCES:



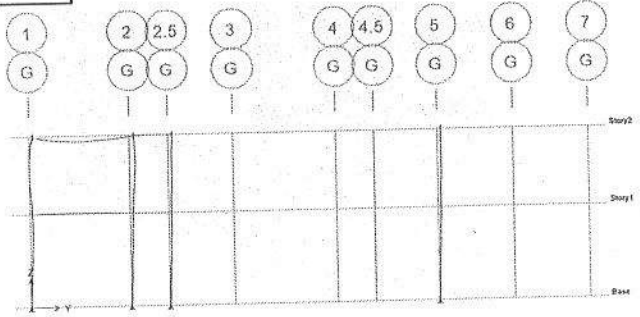


DEFLECTION:

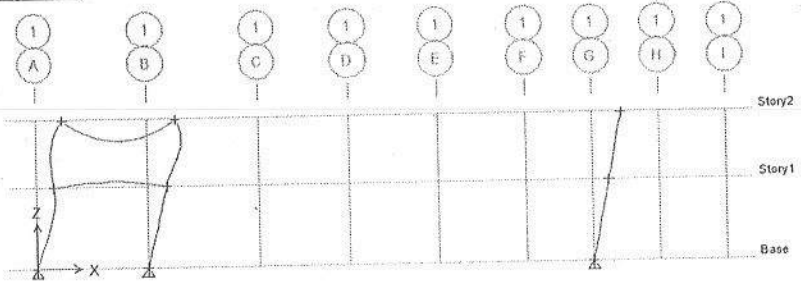
MF-1



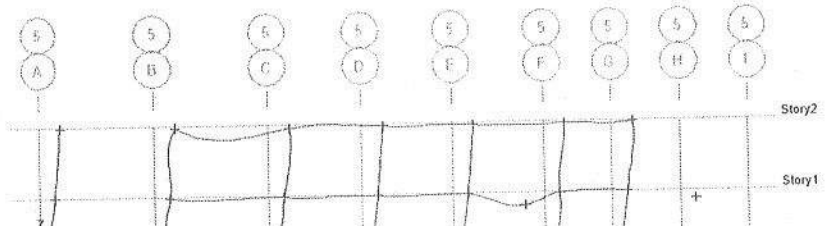
MF-2



MF-3



MF-4



	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L16 OF L40
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: ETABS - Concrete Moment Frame	Journeyman International Organization

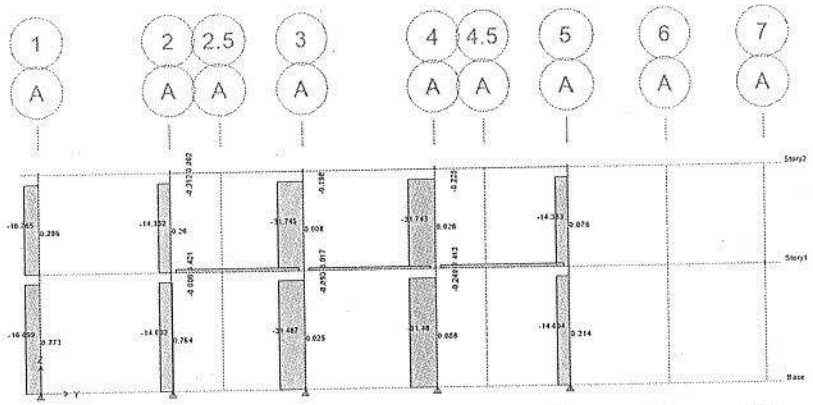
Reference

E/W Loading:

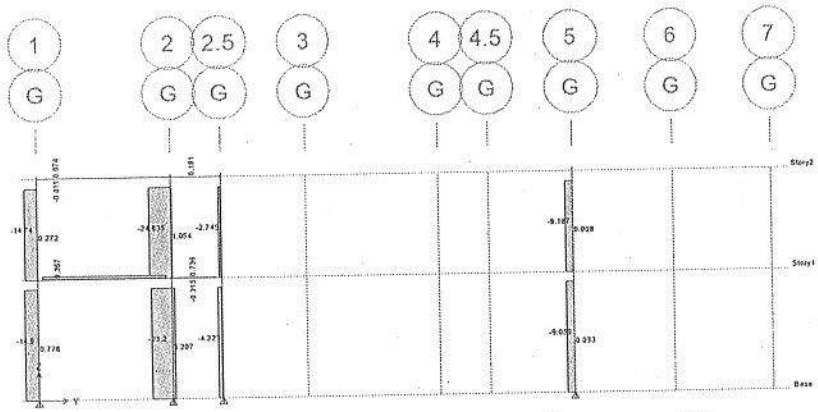
See hand calculations for determination of loads applied.

AXIAL:

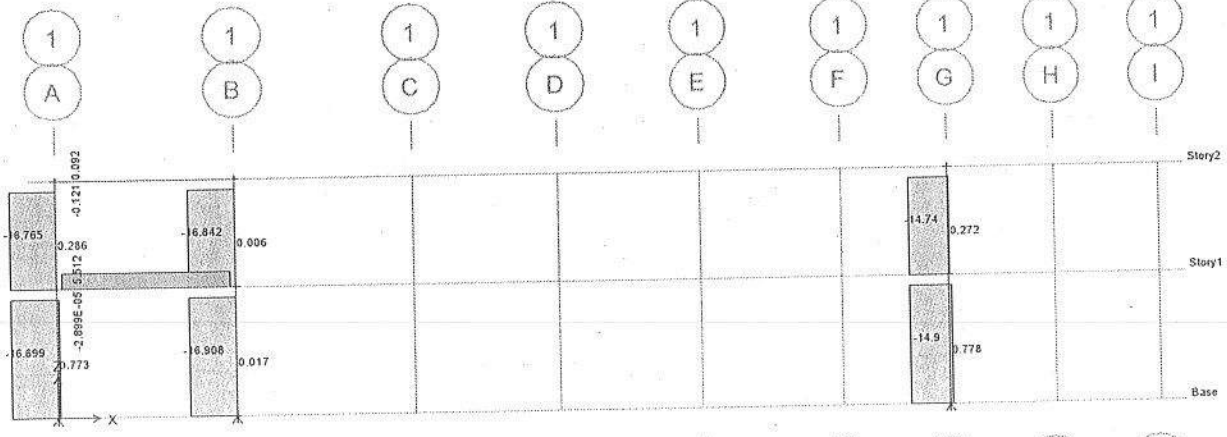
MF-1



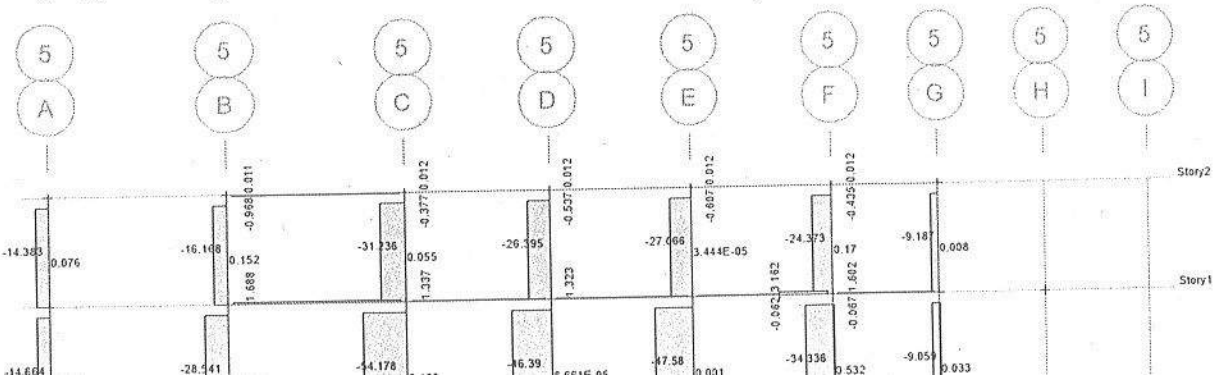
MF-2



MF-3



MF-4



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. L17 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: ETABS - Concrete Moment Frame		Journeyman International Organization

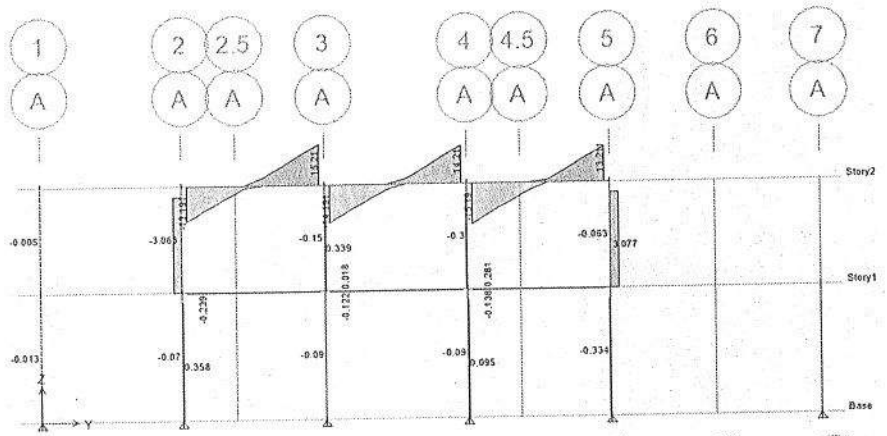
Reference

E/W Loading:

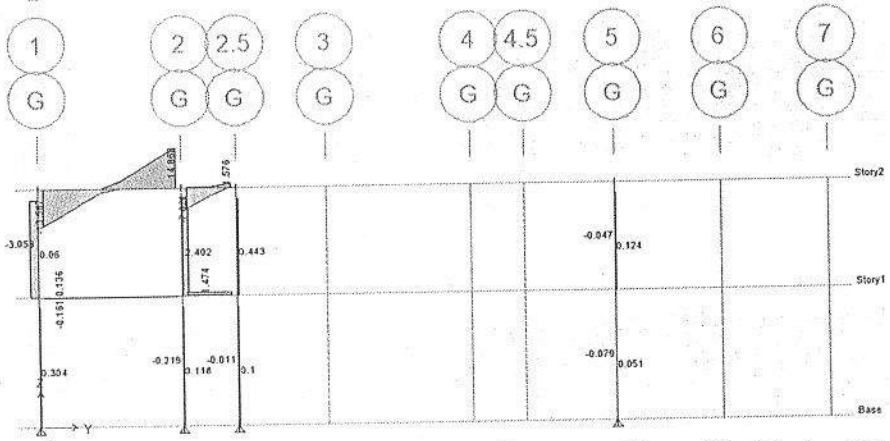
See hand calculations for determination of loads applied.

SHEAR:

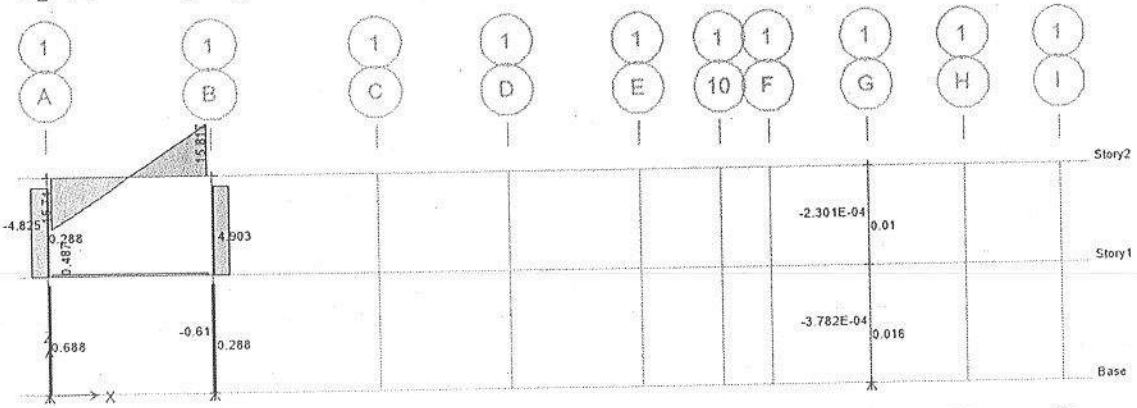
MF-1



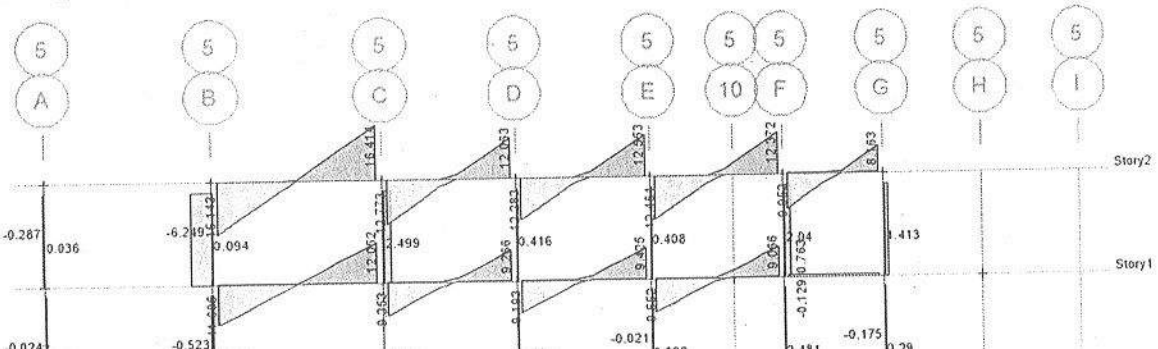
MF-2



MF-3



MF-4



PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. L18 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: ETABS - Concrete Moment Frame		Journeyman International Organization

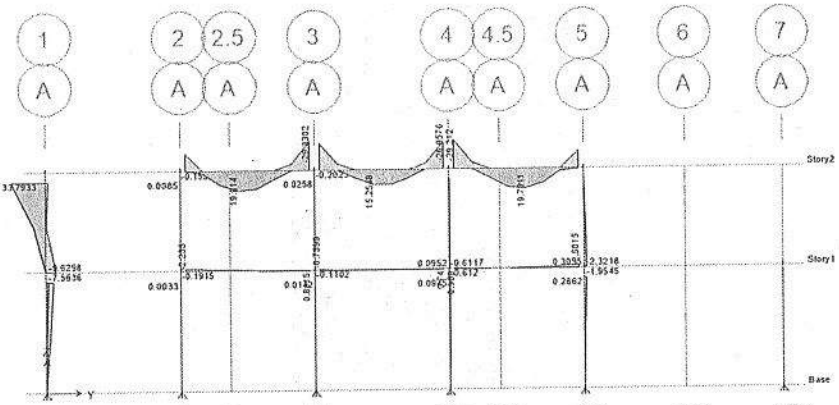
Reference

E/W Loading:

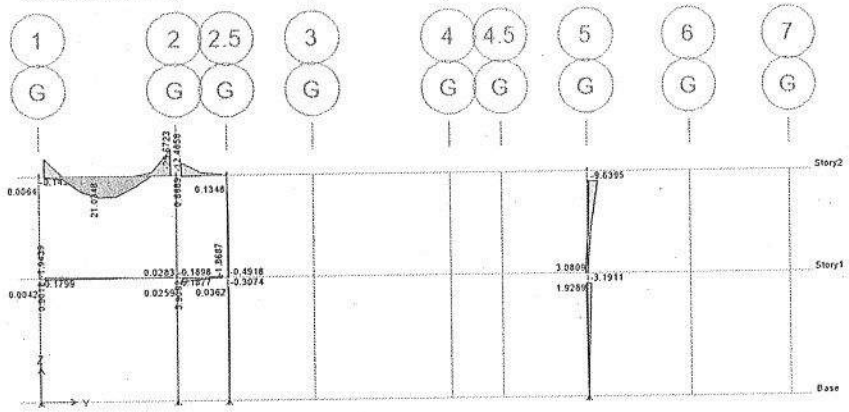
See hand calculations for determination of loads applied.

MOMENT:

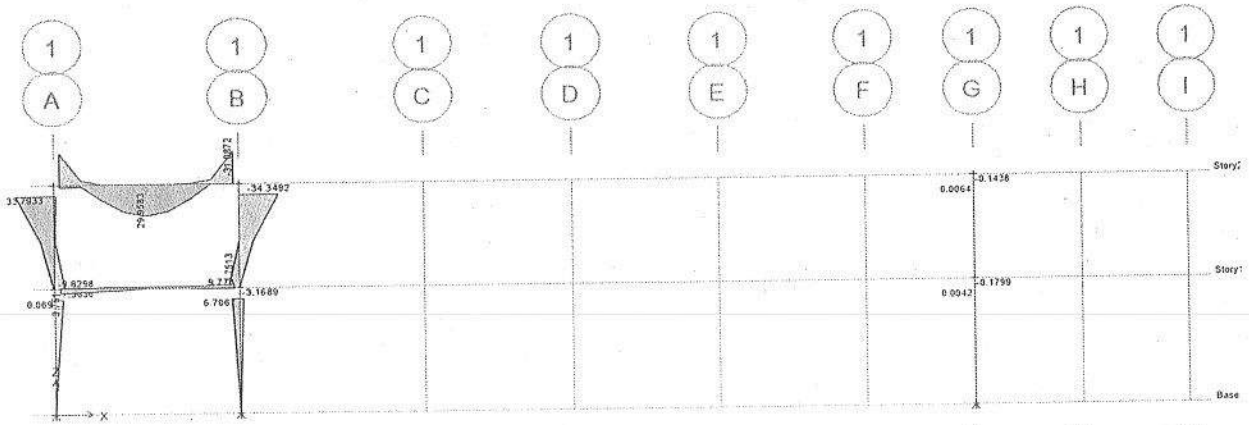
MF-1



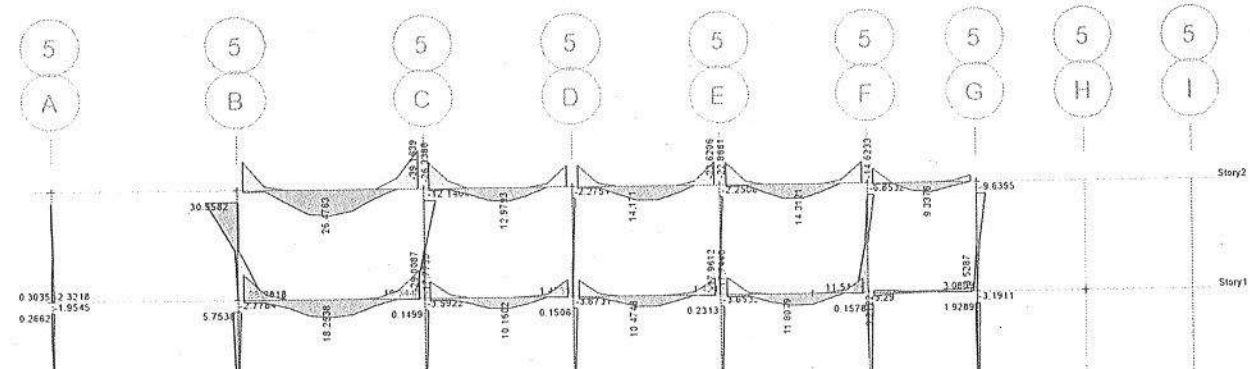
MF-2



MF-3



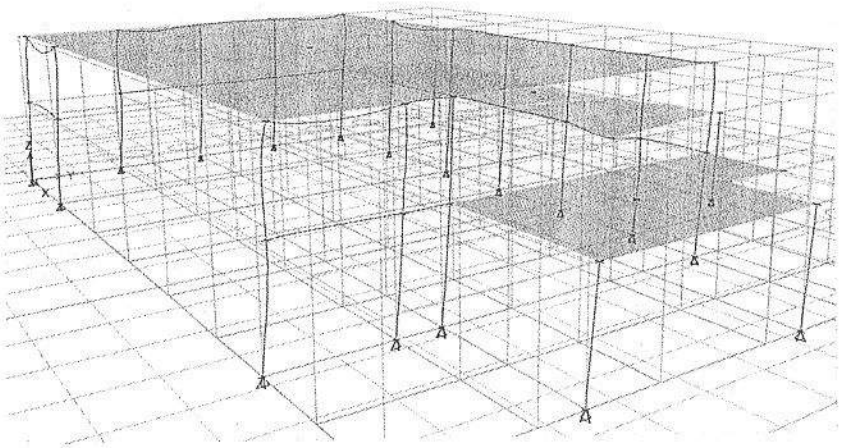
MF-4



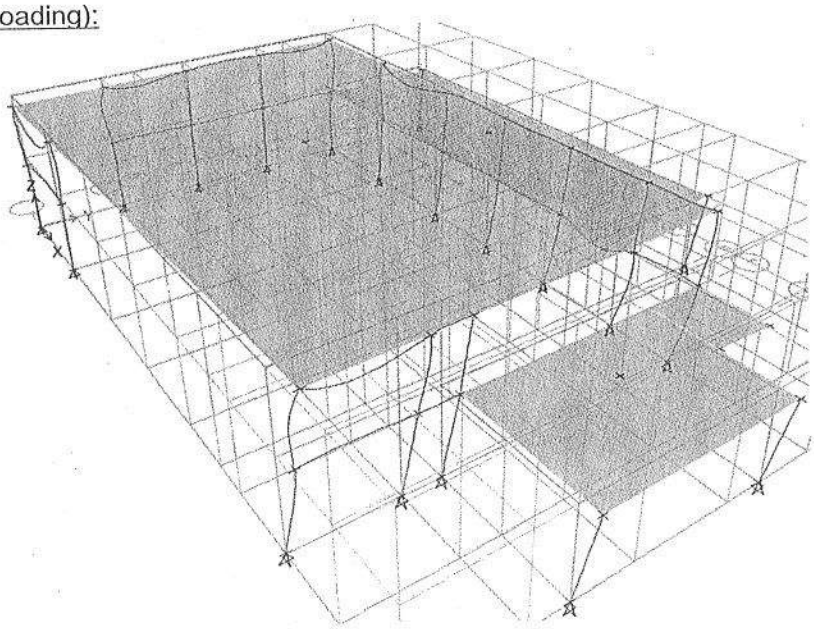
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. L19 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: ETABS - Concrete Moment Frame		Journeyman International Organization

Reference

Deflected Building (N-S Loading):



Deflected Building (~~W-W~~ E-W Loading):



Joint Deflection:

Joint Deflection (ETABS)	
N-S Force	
Level	**Max Deflection (in.)**
Roof	0.142594
2nd	0.107049
E-W Force	
Level	**Max Deflection (in.)**
Roof	0.249669
2nd	0.170547

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: L20 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: moment Frame - Drift check		Journeyman International Organization

Reference

ASCE 12.12-1

allowable: $\Delta a = 0.020 h_x$

design: $\delta_x = \frac{C_d \delta_{xe}}{I_e}$ w/ $C_d = 5.5$, $I_e = 1.0$

N-S Loading:

2nd FLOOR: $h_x = 12'-0"$

$\Delta a = 0.020(12')(12"/1ft) = 2.88"$

$\delta_x = \frac{(5.5)(0.107049")}{1.0} = 0.59"$ > $2.88"$ ✓

ROOF: $h_x = 10'-0"$

$\Delta a = 0.020(10')(12"/1ft) = 2.4"$

$\delta_x = \frac{(5.5)(0.192594" - 0.107049")}{1.0} = 0.196"$ > $2.4"$ ✓

E-W Loading:

2nd Floor: $h_x = 12'-0"$

$\Delta a = 2.88"$

$\delta_x = \frac{(5.5)(0.170547")}{1.0} = 0.94"$ > $2.88"$ ✓

ROOF: $h_x = 10'-0"$

$\Delta a = 2.4"$

$\delta_x = \frac{(5.5)(0.249669" - 0.170547")}{1.0} = 0.435"$ > $2.4"$ ✓

use story drift as grout gap between concrete framing system and masonry walls to prevent dual action lateral system

Reference

Design is based on worst case moment frame. - MF 4
One moment frame will be design for entire building.

Moment Frame Beam Design (B5)

ETABS Analysis

Demands: $M_u = 39.2$ kft (over the supports)
$M_u = 29.95$ kft (between the supports)

$V_u = 16.4$ K

Quick calcs - 12" x 12"

$f_y = 60$ ksi
$f'_c = 4$ ksi

ACI 318 Sec. 3.2.1

$M_u = \phi A_s f_y \left(d - \frac{a}{2}\right)$

↳ assume $d = h - 2.5" = 12 - 2.5" = 9.5"$
$a = \frac{d}{3} = 3.17"$

$A_{s\,req'd} = \frac{M_u}{\phi f_y \left(d - \frac{a}{2}\right)} = \frac{(39.2)(12)}{(0.9)(60)\left(9.5 - \frac{3.17}{2}\right)} = 1.1 in^2 \Rightarrow$ Try 2-No.7 s, $A_s = 1.2 in^2$

ACI 318 §9.6.1

$A_{s\,min} = \frac{200}{f_y} b_w d = \frac{(200)(12)(9.5)}{60{,}000} = 0.38 in^2 < A_s$ ✓

$A_{s\,min} = \frac{3\sqrt{f'_c}}{f_y} b_w d = \frac{3\sqrt{4000}}{60{,}000}(12)(9.5) = 0.36 in^2 < A_s$ ✓

Check:

ACI 318 T21.2.2

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.2)(60)}{(0.85)(4)(12")} = 1.76"$

$\beta = 0.85$

$c = \frac{a}{\beta} = \frac{1.76}{0.85} = 2.07"$

$d = 12" - 1.5"\ \text{cover} - 0.5"\ \text{assumed}\ (\text{No 4 stirrup}) - \left(\frac{7}{8}\right)\left(\frac{1}{2}\right) = 9.56" \approx 9.5"$

$\varepsilon_s = 0.003\left(\frac{d-c}{c}\right) = 0.003\left(\frac{9.5 - 2.07}{2.07}\right) = 0.0107 > 0.004$ ✓
∴ tens controlled, $\phi = 0.9$

$\phi M_n = \phi A_s f_y \left(d - \frac{a}{2}\right)$
$= (0.9)(1.2)(60)\left(9.5 - \frac{1.76}{2}\right)$

Reference

$\phi M_n = 46.5$ kft $> M_u = 39.2$ kft ✓ O.K.

USE 2-NO.7 LONG BARS OVER SUPPORTS

Longitudinal Steel (between the supports):

$M_u = \phi A_s f_y (d - \frac{a}{2})$

↳ same assumptions as previously stated

$A_{s\,required} = \frac{M_u}{\phi f_y (d - \frac{a}{2})}$

$= \frac{(29.95)(12")}{(0.9)(60)(7.915)}$

$A_{s\,required} = 0.84\ in^2 \Rightarrow$ Try 2 - No. 6's, $A_s = 0.88 in^2$ ✓

$A_{s\,min} = 0.38\ in^2 < A_s$ ✓

Check:

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(0.88)(60)}{(0.85)(4)(12)} = 1.29"$

$c = \frac{a}{\beta} = \frac{1.29}{0.85} = 1.52"$

$d = 12" - 1.5" - 0.5" - (\frac{6}{8})(\frac{1}{2}) = 9.625" \approx 9.5"$

$\varepsilon_s = 0.003\left(\frac{d-c}{c}\right) = 0.003\left(\frac{7.5 - 1.52}{1.52}\right) = 0.015175 > 0.004$ ✓

∴ tens controlled, $\phi = 0.9$

$\phi M_n = \phi A_s f_y (d - \frac{a}{2})$

$= (0.9)(0.88)(60)(9.5 - \frac{1.29}{2}) = 420.79$ k-in $\Rightarrow 35.1$ kft

$\phi M_n = 35.1$ kft $> M_u = 29.95$ kft ✓ O.K.

USE 2-NO.6 LONG BARS B/W SUPPORTS

Reference

Hooked Longitudinal Bars @ ends:

$M_u = 39.2$ kft

$$a = d - \sqrt{\frac{-2M_u}{\phi 0.85 f'_c b} + d^2} \quad ; d = 9.5"$$

$$= 9.5 - \sqrt{\frac{(-2)(39.2)(12)}{(0.9)(0.85)(4)(12)} + 9.5^2}$$

$a = 1.46"$

$$A_{s\,req'd} = \frac{0.85 f'_c b a}{f_y} = \frac{(0.85)(4)(12)(1.46)}{60} = 0.993\ in^2$$

$\Rightarrow$ Try 2 - No. 7's, $A_s = 1.2\ in^2$

Check:

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.2)(60)}{(0.85)(4)(12)} = 1.76"$$

$c = 2.07"$

ACI 318 §25.3.3.6

$$\varepsilon_s = 0.003\left(\frac{9.5 - 2.07}{2.07}\right) = 0.01707 > 0.004 \checkmark \quad \therefore \text{tens controlled, } \phi = 0.9$$

§18.6.4.3

§25.4.3.1

$$\phi M_n = (0.9)(1.2)(60)\left(9.5 - \frac{1.76}{2}\right) = 46.5\ \text{kft}$$

$\phi M_n = 46.5$ kft $>$ $M_u = 39.2$ kft ✓ O.K.

USE 2-NO.7 HOOKED BARS
(CLOSED BY A CROSSTIE)

Greater of:

$$l_{dh} = \frac{f_y \psi_e \psi_c \psi_r}{50 \lambda \sqrt{f'_c}}, \quad 8 d_b, \quad 6" \Rightarrow l_{dh} = 16.6"$$

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: L24 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Moment Frame - Roof Beam (B5)		Journeyman International Organization

Reference

Shear:

ACI 318 §22.5.1

$V_c = 2\sqrt{f'c}\, b_w d$

$= (2)(\sqrt{4000})(12)(9.5")$

$= 14.4k$

$\phi V_n = \phi 10 \sqrt{f'c}\, b_w d$

$= (0.75)(10)(\sqrt{4000})(12)(9.5)$

$= 54.1k$

$V_{u\,max} = 16.4k$

↳ $V_c < V_u$ ∴ need shear reinf

$\phi V_n > V_u$ ∴ don't need to inc. beam width

max spacing - $\frac{V_u}{\phi} > 6\sqrt{f'c}\, b_w d$

$\frac{16.4}{0.75} > 6\sqrt{4000}\,(12)(9.5)$

T 9.7.6.2.2

$21.9k \not> 43.3k \Rightarrow$ use $\frac{d}{2}$, not $\frac{d}{4}$

$S_{max} = \frac{d}{2} = \frac{9.5}{2} = \underline{4.75"}$

$\frac{A_{vmm}}{s}$ is greater of: 1) $\frac{0.75\sqrt{f'c}\, b_w}{f_y}$ 2) $\frac{50 b_w}{f_y}$

1) $0.75\sqrt{4000}\,(12)(1/60{,}000) = 0.0095\ in^2/in$

2) $50(12)(1/60{,}000) = \underline{0.01\ in^2/in}$ governs

$A_{vmm} = (0.01\ in^2/in)(4.75") = 0.0475\ in^2 \Rightarrow$ No. 3 stirrups

$s_{req'd} = \frac{A_v f_y d}{\frac{V_u}{\phi} - V_c} = \frac{(0.22\ in^2)(60)(9.5)}{\left(\frac{16.4}{0.75}\right) - 14.4} = 16.71" \not< S_{max}$

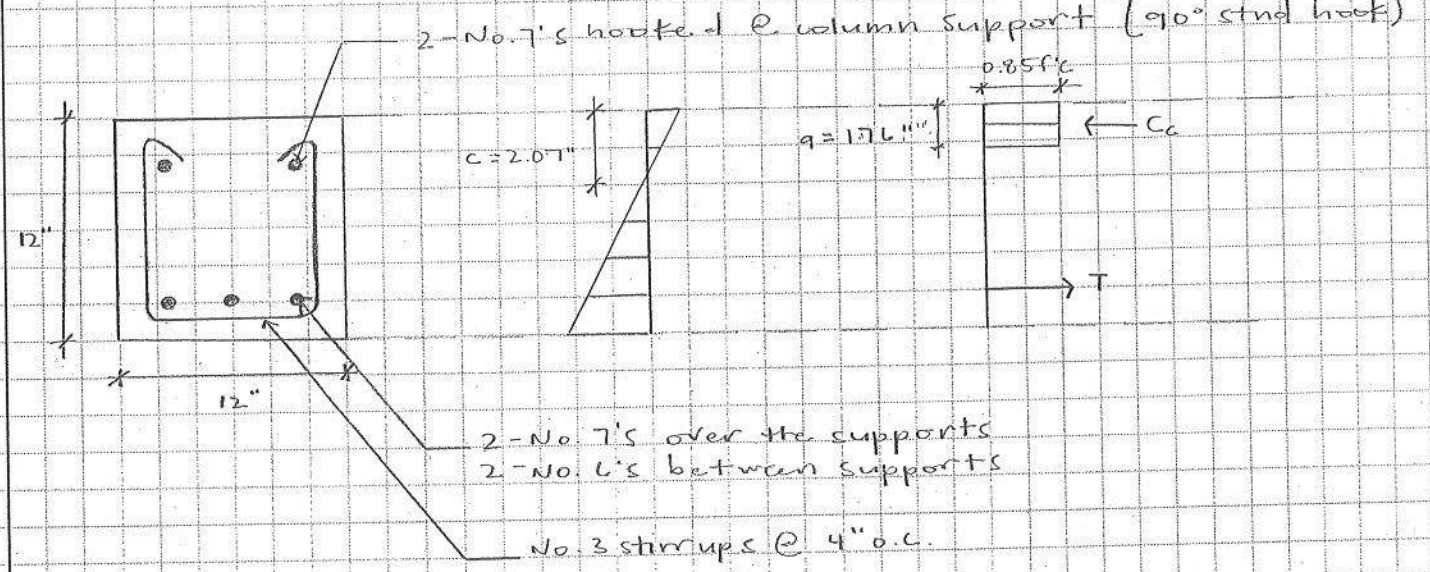
∴ use $S_{max} = 4.75" \approx 4"$

USE NO. 3 STIRRUPS @ 4" O.C. THROUGHOUT BM.

	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. L25 OF L40
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Moment Frame - Roof Beam (B5)	Journeyman International Organization

Reference

Final Beam Design (B5):



Reference

$f_y = 60ksi$, $f'_c = 4ksi$

Design is based on worst case moment frame - MF4 one moment frame will be designed for entire building.

Moment Frame Beam Design (BL):

ETABS Analysis

Demands: $M_u = 29$ kft (over the supports)
$M_u = 18$ kft (between the supports)
$V_u = 12$ kft

Quick Calcs - 12" x 12"

Longitudinal Steel (over the supports):

$M_u = \phi A_s f_y (d - \frac{a}{2})$

↳ assume $d = h - 2.5 = 9.5"$
$a = \frac{d}{3} = 3.17"$

$$A_{s\,req'd} = \frac{M_u}{\phi f_y (d - \frac{a}{2})} = \frac{(29 \times 12"/ft)}{(0.9)(60)(9.5 - \frac{3.17}{2})} = 0.814\ in^2$$

ACI 318 §m 21.3.2.1

→ Try 2 - No. 6's, $A_s = 0.88 in^2$

ACI 318 §9.6.1

$$A_{s\,min} = \frac{200}{f_y} b_w d = \frac{(200)(12)(9.5)}{60,000} = 0.38 in^2 < A_s \checkmark$$

$$A_{s\,min} = \frac{3\sqrt{f'_c}\, b_w d}{f_y} = \frac{3\sqrt{4000}\,(12)(9.5)}{60,000} = 0.36 in^2 < A_s \checkmark$$

Check:

ACI 318 -21.2.2.

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(0.88)(60)}{(0.85)(4)(12)} = 1.29"$$

β .85

$$c = \frac{a}{\beta} = \frac{1.29}{0.85} = 1.52"$$

$$d = 12" - 1.5" - 0.5" - (\tfrac{3}{8})(\tfrac{1}{2}) = 9.625 \approx 9.5"$$

$$\varepsilon_s = (0.003)\left(\frac{d - c}{c}\right) = 0.003\left(\frac{9.5 - 1.52}{1.52}\right) = 0.01575 > 0.004 \checkmark$$

tension controlled, $\phi = 0.9$

Reference

$\phi M_n = \phi A_s f_y (d - \frac{a}{2})$

$= (0.9)(0.88)(60)(9.5 - \frac{1.29}{2}) = 420.79 k\text{-}in \rightarrow 35.1 k\text{-}ft$

$\phi M_n = 35.1 k\text{-}ft > M_u = 29 k\text{-}ft$ ✓ O.K.

USE 2-NO.6 LONG. BARS OVER SUPPORTS

Longitudinal Steel (b/w Supports):

$M_u = \phi A_s f_y (d - \frac{a}{2})$

↳ same assumptions as previously stated

$A_{s\,req'd} = \dfrac{(18 k\text{-}ft \times 12 in/ft)}{(0.9)(60)(9.5 - \frac{3.17}{2})} = 0.505 in^2$

⇒ Try 2 - No. 5's, $A_s = 0.62 in^2$

$A_{s\,min} = 0.38 in^2 < A_s$ ✓

Check:

$a = \dfrac{A_s f_y}{0.85 f'_c b} = \dfrac{(0.62)(60)}{(0.85)(4)(12)} = 0.91"$

$c = 1.07"$

$d = 9.5"$

$\varepsilon_s = 0.003\left(\dfrac{9.5 - 1.07}{1.07}\right) = 0.023 > 0.004$ ✓ ∴ tens controlled, $\phi = 0.9$

$\phi M_n = \phi A_s f_y (d - \frac{a}{2}) = (0.9)(0.62)(60)(9.5 - \frac{0.91}{2}) = 302 k\text{-}in$

$\phi M_n = 25.23 k\text{-}ft > M_u = 18 k\text{-}ft$ ✓ O.K

USE 2-NO.5 LONG. BARS B/W SUPPORTS

PROJECT	SHEET NO.
Mission Twenty-Five 35 Community Center-Dominican Republic	L28 OF L40
AUTHOR	**DATE**
Mindy Trieu and Jocelyn Lu	06/17/17
CALCULATION TOPIC	Journeyman International Organization
Moment Frame - 2nd Flr Beam (BL)	

Reference

Hooked Longitudinal Bars @ Supports:

$M_u = 29 k\text{-}ft$

$$a = d - \sqrt{\frac{-2M_u}{\phi 0.85 f'_c b} + d^2} \quad ; d = 9.5"$$

$$= 9.5 - \sqrt{\frac{(-2)(29)(12)}{(0.9)(0.85)(4)(12)} + 9.5^2}$$

$a = 1.06"$

$$A_{s\,req'd} = \frac{0.85 f'_c b a}{f_y} = \frac{(0.85)(4)(12)(1.06)}{60} = 0.718\ in^2$$

$\Rightarrow$ Try 2 - No. 6's, $A_s = 0.88\ in^2$

Check:

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(0.88)(60)}{(0.85)(4)(12)} = 1.29"$$

ACI 318 §25.3.3.6

$c = 1.522"$

§18.6.4.3

$d = 9.5"$

§25.4.3.1

$$\varepsilon_s = (0.003)\left(\frac{9.5 - 1.522}{1.522}\right) = 0.015 > 0.004 \ \checkmark \ \therefore \text{tens controlled, } \phi = 0.9$$

$$\phi M_n = \phi A_s f_y \left(d - \frac{a}{2}\right)$$

$$= (0.9)(0.88)(60)\left(9.5 - \frac{1.22}{2}\right) = 420.8 k\text{-}" \Rightarrow 35.1 k\text{-}ft$$

$\phi M_n = 35.1 k\text{-}ft > M_u = 29 k\text{-}ft \ \checkmark$ O.K.

USE 2- NO. 6 HOOKED BARS
(CLOSED BY A CROSSTIE)

$l_{dh} = 14.23"$, $l_{ext} = 9"$

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: L29 OF L40
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Moment Frame - 2nd Flr Bm (B6)	Journeyman International Organization

Reference

Shear:

ACI 318 §22.5.1

$V_c = 2\sqrt{f'c}\, b_w d$

$= (2)(\sqrt{4000})(12)(9.5)$

$= 14.4k$

$\phi V_n = 10\sqrt{f'c}\, b_w d$

$= 10\sqrt{4000}\,(12)(9.5)$

$= 54.1k$

$V_{u\,max} = 12 k\text{-ft}$

↳ $V_c \nless V_u$ ∴ do not need shear reinf

$\phi V_n > V_u$ ∴ do not need to inc. bm width

Max spacing – $\frac{V_u}{\phi} > 6\sqrt{f'c}\, b_w d$

T9.7.6.22 $\frac{12}{0.75} > 6\sqrt{4000}\,(12)(9.5)$

$16k \ngtr 433k \Rightarrow$ use $\frac{d}{2}$, not $\frac{d}{4}$

$S_{max} = \frac{d}{2} = \frac{9.5}{2} = \underline{4.75"} \approx 4"$

$A_{v\,min}$ is greater of: 1) $\frac{0.75\sqrt{f'c}\, b_w}{f_y}$ 2) $\frac{50 b_w}{f_y}$

1) $0.75\sqrt{4000}\,(12)(1/60{,}000) = 0.0095\ in^2/in$

2) $50(12)(1/60{,}000) = 0.01\ in^2/in$ ← governs

$A_{v\,min} = (0.01)(4.75) = 0.0475\ in^2 \Rightarrow$ No. 3 stirrups, $A_v = 0.22\ in^2$

$S_{req'd} = \frac{A_v f_y d}{\frac{V_u}{\phi} - V_c} = \frac{(0.22)(60)(9.5)}{\left(\frac{12}{0.75}\right) - 14.4} = 78.34 \nless S_{max}$

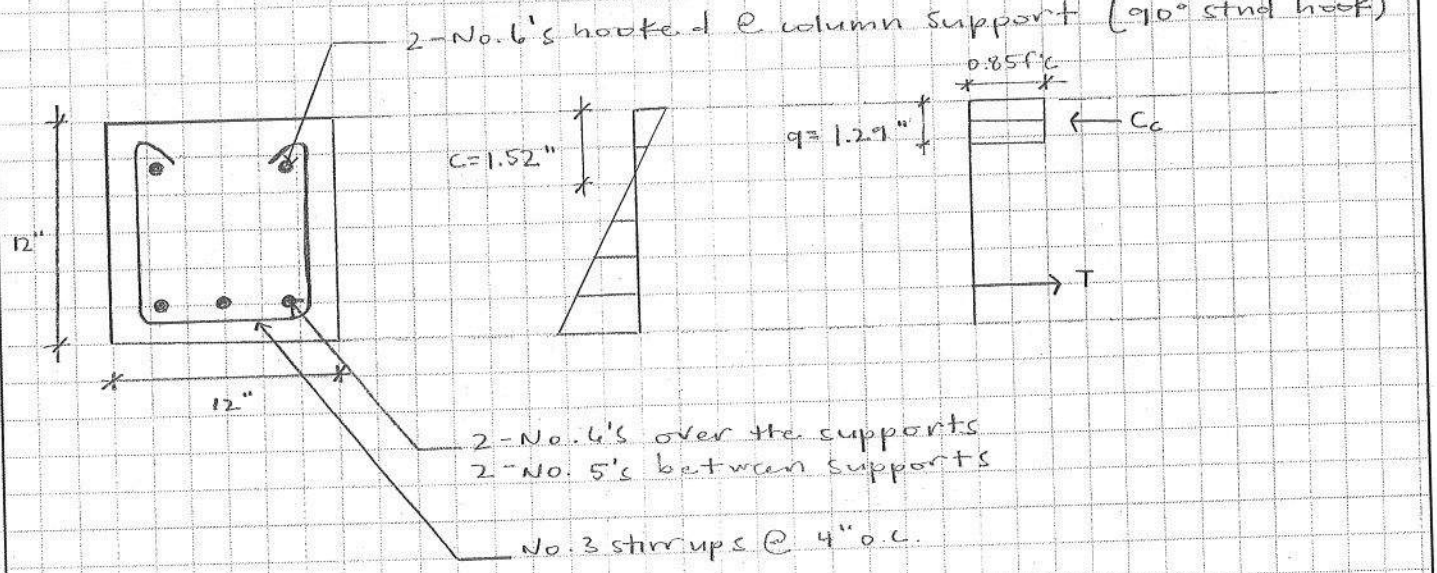
∴ use $S_{max} = 4"$

USE NO. 3 STIRRUPS @ 4" O.C. THROUGHOUT BM.

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. L30 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Moment Frame – 2nd Flr Beam (B6)		Journeyman International Organization

Reference

Final Beam Design (B6):



Reference

Design is based on worst case moment frame - MF4
one moment frame will be designed for entire building.

Moment Frame Column Design (C1):

ETABS analysis

Demands: $P_{uR} = 31.24\ k$
$P_{uF} = 54.2\ k$

$M_{uR} = 12.14\ k\text{-}ft$
$M_{uF} = 2.05\ k\text{-}ft$

Slenderness Check:

ACI 318 §6.2.5.1

12" SQ Column
Roof → 2nd Flr
$k = 1.0$
$l = 8' \rightarrow l_u = 7'\text{-}0"$ (clear height)
$r = 0.3h = 0.3(12) = 3.6"$

$$\frac{k l_u}{r} \leq 34 + 12\left(\frac{M_1}{M_2}\right)$$

Quick calcs - 12"x12"

$$\frac{(1)(7)(12)}{3.6} \leq 34 + 12\left(\frac{2.05}{12.14}\right)$$

$23.33 \leq 36.03$ ✓ Braced against sidesway

2nd Flr → Ground
$k = 1.0$
$l_u = 11'\text{-}6"$
$r = 3.6"$

$$\frac{k l_u}{r} \leq 34 + 12\left(\frac{2.05}{12.14}\right)$$

$$\frac{(1)(11.5)(12)}{3.6} \leq 36.03$$

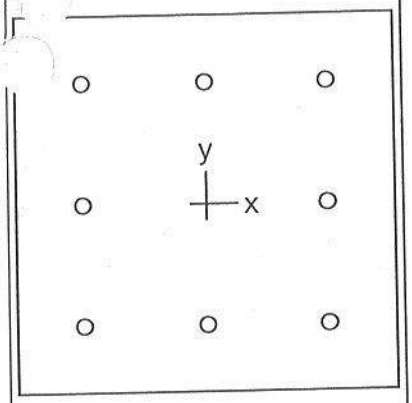
$38.33 \not\leq 36.03$ ✗ Not braced against sidesway

* Must use moment magnification

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: L32 OF L40
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Moment Frame Column - (C1)	Journeyman International Organization

Reference	
ACI 318 §6.6.4.5	$C_m = 1.0$; for columns w/ transverse loads b/w supports
	$P_u = 54.2\ k$
Eqn 6.6.4.4.2	$P_c = \frac{\pi^2 EI_{eff}}{(k\ell_u)^2} = \frac{(\pi^2)(1.17\times10^6)}{(1)(11.5\times12'')^2} = 609.14$
6.6.4.4.5	$EI_{eff} = \frac{(0.2E_c I_g)}{1+\beta_{dns}} = \frac{(0.2)(3605)(12^4/12)}{1+0.6} = 1.17\times10^6$
	$\delta = \frac{C_m}{1-\frac{P_u}{0.75P_c}} \geq 1.0$
	$= \frac{(1.0)}{1-\left(\frac{54.2}{0.75\times609.14}\right)} = 1.13 \geq 1.0$ ✓
	$M_c = \delta M_2 = (1.13)(2.05) = \underline{2.33\ k\text{-}ft}$
	check if: $M_2 < 1.4M_1$
	$12.14 < (1.4)(2.33)$
	$12.14 < 3.25$ ✓ Design for $M_{u\,floor} = 2.33 k\text{-}ft$

Moment Frame Column - C1



12 x 12 in

Code: ACI 318-14

Units: English

Run axis: About X-axis

n option: Investigation

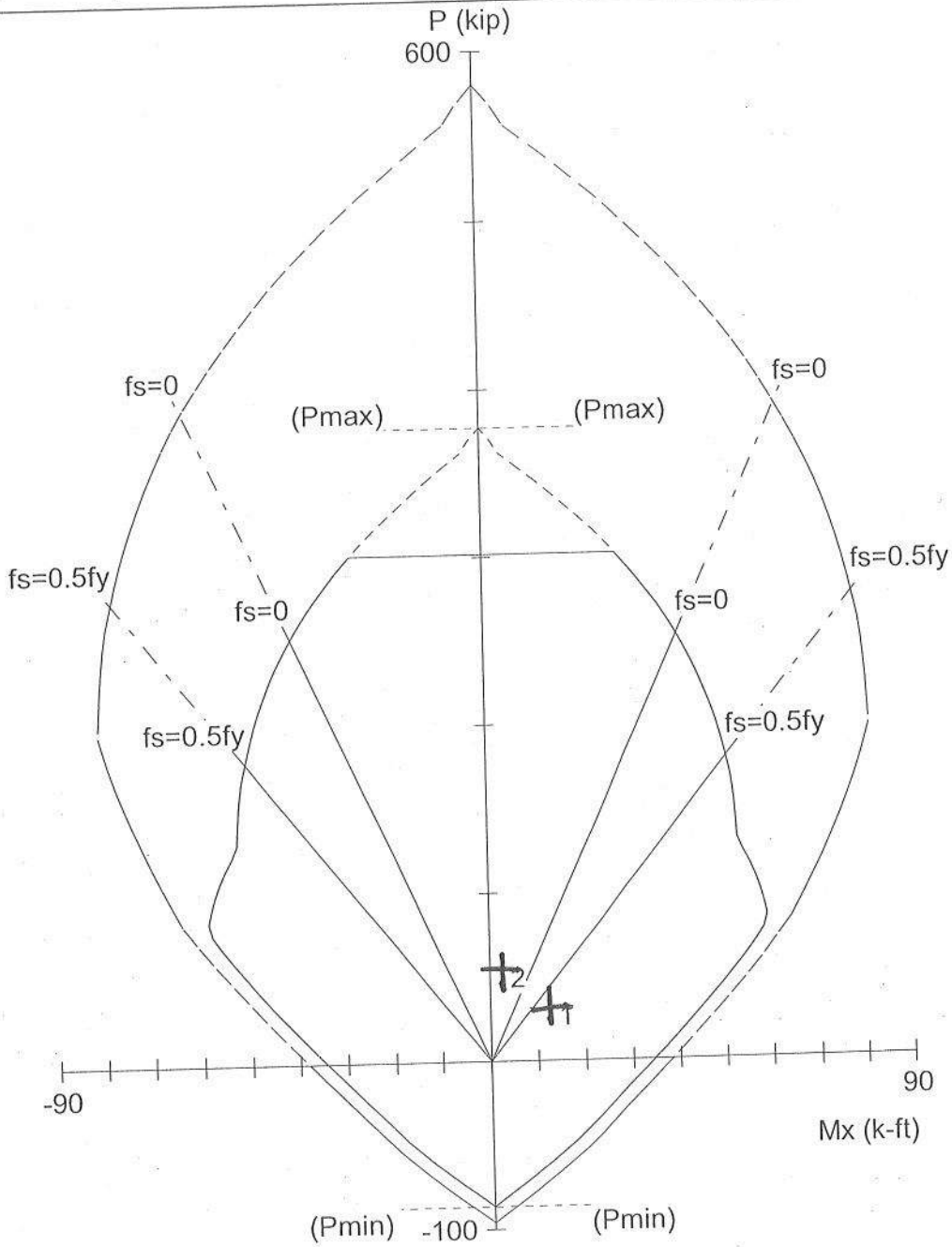
enderness: Not considered

Column type: Architectural

Bars: ASTM A615

Date: 06/16/17

Time: 01:32:18



File: untitled.col

Project:

Column:

Engineer:

f'c = 4 ksi

fy = 60 ksi

Ag = 144 in^2

8 #4 bars

Ec = 3605 ksi

Es = 29000 ksi

As = 1.60 in^2

rho = 1.11%

= 3.4 ksi

e_yt = 0.00206897 in/in

Xo = 0.00 in

Ix = 1728 in^4

_u = 0.003 in/in

Yo = 0.00 in

Iy = 1728 in^4

Beta1 = 0.85

Min clear spacing = 3.38 in

Clear cover = 1.88 in

Confinement: Tied

phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

L34

STRUCTUREPOINT - spColumn v5.11 (TM)
Licensed to: Cal Poly University. License ID: 64929-1050703-4-2356E-24F6B
untitled.col

General Information:
==========
File Name: untitled.col
Project:
Column:
Code: ACI 318-14

Engineer:
Units: English

Run Option: Investigation
Run Axis: X-axis

Slenderness: Not considered
Column Type: Architectural

Material Properties:
==========
Concrete: Standard
f'c = 4 ksi
Ec = 3605 ksi
fc = 3.4 ksi
Eps_u = 0.003 in/in
Beta1 = 0.85

Steel: Standard
fy = 60 ksi
Es = 29000 ksi
Eps_yt = 0.00206897 in/in

Section:
========
Rectangular: Width = 12 in

Depth = 12 in

Gross section area, Ag = 144 in^2
Ix = 1728 in^4
rx = 3.4641 in
Xo = 0 in

Iy = 1728 in^4
ry = 3.4641 in
Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 1.60 in^2 at rho = 1.11%
Minimum clear spacing = 3.38 in

8 #4 Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	PhiMnx k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	31.24	12.14	44.91	3.699	2.54	9.88	0.00865	0.900
2	54.20	2.33	51.97	22.303	3.06	9.88	0.00667	0.900

*** End of output ***

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: L35 OF L40
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Moment Frame Column - C1	Journeyman International Organization

Reference

- From spColumn, the moment frame column will require 8 - No. 4's
- See column group #1 for vertical reinf check calculations.
- See column group #1 for tie size/spacing calculations and shear force checks ($M_{pr} = 59 kft < M_{pr} = 81 kft$)

Earthquake Requirements:

ACI 318 §18.4.3.3 Assume elastic capacity of gravity framing is exceeded during an earthquake and some non-linear behavior is required.

Amount of Transverse Reqd:

$P_u \leq 0.3 A_g f'_c$

$54.2 \leq (0.3)(12" \times 12")(4ksi)$

$54.2 \leq 172.8K$ ✓ → Transverse is greater of a) or b)

a) $0.3\left(\frac{A_g}{A_{ch}} - 1\right)\left(\frac{f'_c}{f_y}\right) = 0.3\left(\frac{12^2}{9^2} - 1\right)\left(\frac{4}{60}\right) = \underline{\underline{0.015\ in^2}}$ ← governs

b) $0.09\left(\frac{f'_c}{f_y}\right) = 0.09\left(\frac{4}{60}\right) = 0.006\ in^2$

$\frac{A_{sh}}{s_{bc}} = 0.015$

s_{bc} = 3" from column group #1 calcs

$A_{sh} = (0.015)(3")(12" - 1.5 - 3/8 - 4/16) = 0.444375\ in^2$

$A_{TIES} = (3)(No.4) = (3)(0.20) = 0.60\ in^2 > A_{sh}$ ✓

USE NO.4 TIES @ 3" O.C (SEISMIC)

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: L36 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Moment Frame Checks		Journeyman International Organization

Reference

Beam Check

ACI 318 § 18.6

Dimensional limits:

(a) clear span l_n shall be at least $4d$

§18.6.2.1

$l_n = 4m = 13.12'$

$4d = 4(13.5")' = 54" = 4.5'$ ← largest d of all beams

$l_n = 13.12' > 4d = 4.5'$ ✓ O.K.

(b) width b_w shall be at least the lesser of $0.3h$ and 10".

b_w of all beams = 12"

h (largest beam) = 20"

$0.3h = (0.3)(20) = 6" < 10"$ ← governs

12" > 10" ✓ O.K.

(c) projection of beam width beyond the width of the supporting column on each side shall not exceed the lesser of c_2 and $0.75c_1$

beam width (s) = 12"

$c_2 = 12"$

$0.75c_1 = (0.75)(12") = 9"$ ← governs

projection width = 0"

0" < 9" ✓ O.K.

§18.6.3.1 Longitudinal Reinf:

Beams shall have at least 2 continuous bars @ both top and bottom faces. The amount of reinforcement shall be at least that required by § 9.6.1.2 and the reinforcement ratio ρ shall not exceed 0.025.

* Reference calculations B1-B4, G1-G2 for § 9.6.1.2 req't.

All beams have at least 2 cont. bars @ top and bottom ✓ O.K.

Reference

§18.6.3.3

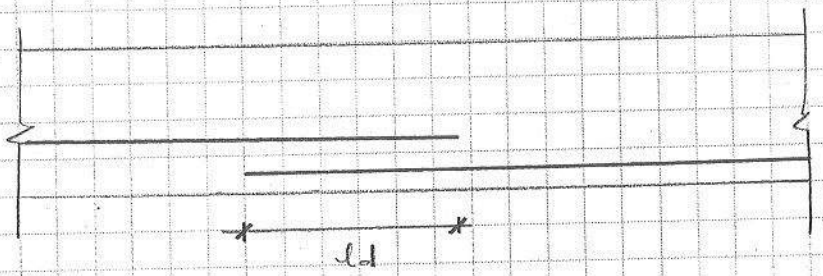
Lap splices should not be used in locations -

(a) within the joints

(b) within the distance of twice the beam depth from the face of the joint.

(c) within a distance of twice the beam depth from critical sections where flexural yielding is likely to occur as a result of lateral displacements beyond the elastic range of behavior

§1 25.5.2.1



ld for straight bars:

No. 3 - ld = 3"

No. 4 - ld = 3"

No. 5 - ld = 3"

No. 6 - ld = 9"

No. 7 - ld = 10.5"

No. 8 - ld = 12"

No. 9 - ld = 3"

No. 10 - ld = 3"

No. 11 - ld = 3.75"

No. 14 - ld = 4.5"

No. 18 - ld = 5.25"

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: L38 OF L40
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CALCULATION TOPIC: Moment Frame Checks		Journeyman International Organization

Reference

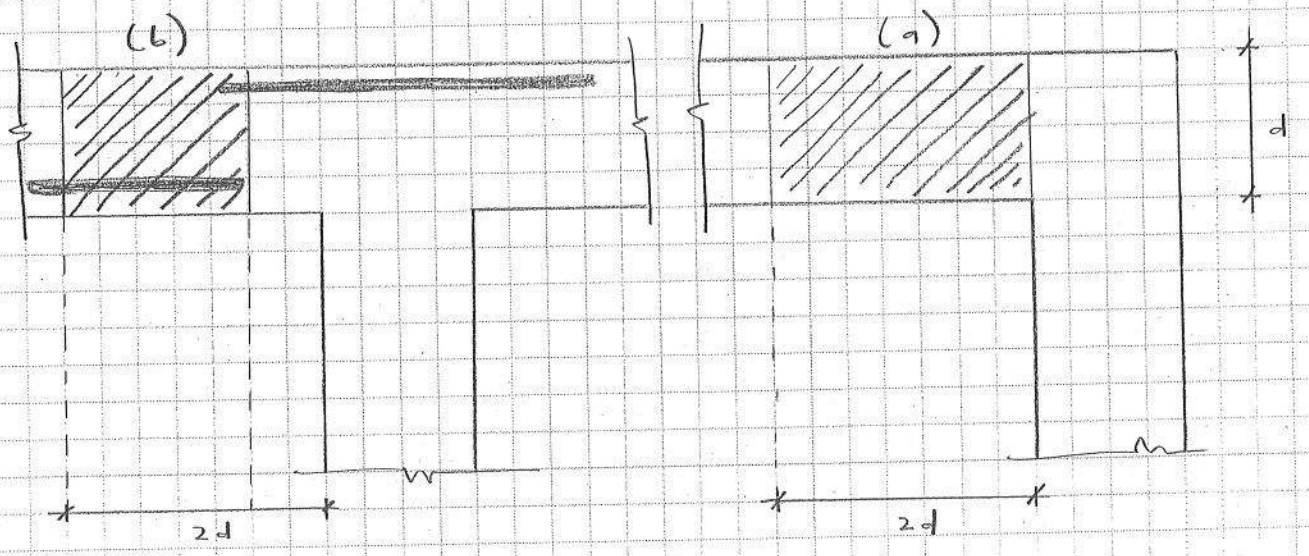
§18.6.4.1

Transverse Reinf:

Hoops shall be provided in the following regions -

(a) over a length equal to twice the beam depth measured from the face of the supporting column toward mid span @ both ends of the beam

(b) over lengths equal to twice the beam depth on both sides of a section where flexural yielding is likely to occur as a result of lateral displacement beyond the elastic range behavior



Hoop spacing shall not exceed -

§18.6.4.4

(a) $\frac{d}{4}$

d (B3, B4, G2) = 9.5"/4 = 2.375" ≈ 2"

d (G1) = 17.5"/4 = 4.375" ≈ 4"

2" governs

(b) $6 d_{long}$ ← smallest primary flexural reinf. bar

(6)(No.6) = (6)(6/8) = 4.5"

(c) 6"

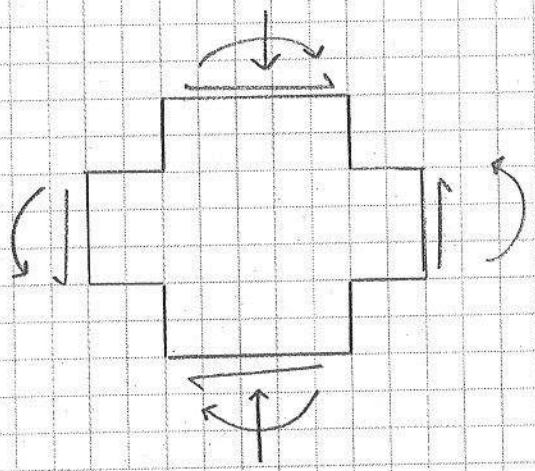
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. L39 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Moment Frame Checks		Journeyman International Organization

Reference

Column Check

All columns were calculated in accordance to §18.7 - columns of special moment frames

Joints of special moment frames



§18.8.2.4 Depth h of the joint shall not be less than ½ h_{beam} framing into the joint system

Beams B3, B4 and Girder G2 - 12" × 12"

Girder G1 - 12" × 20"

$h = (\frac{1}{2})(12) = 6" < 12"$ ✓ O.K

$h = (\frac{1}{2})(20") = 10" < 12"$ ✓ O.K.

18.8.4.3 Effective joint width shall not exceed the lesser of -

(a) Beam width plus joint depth

j = 12" × 12"

Beam width = 12"
Joint Depth = 12"
} 24"

Effective joint width = 12" < 24" ✓ O.K.

(b) 2x's the smaller perpendicular dist. from the longitudinal axis of beam to column side = 12"

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: L40 OF L40
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Moment Frame Checks		Journeyman International Organization

Reference

§18.8.5.1

Developement length of hooks:

l_{dh} shall be at least the greater of -

(a) $8 d_b$

$8(No.6) = 8\left(\frac{6}{8}\right) = 6"$

(b) 6"

(c) $l_{dh} = \frac{f_y d_b}{65 \lambda \sqrt{f'_c}}$

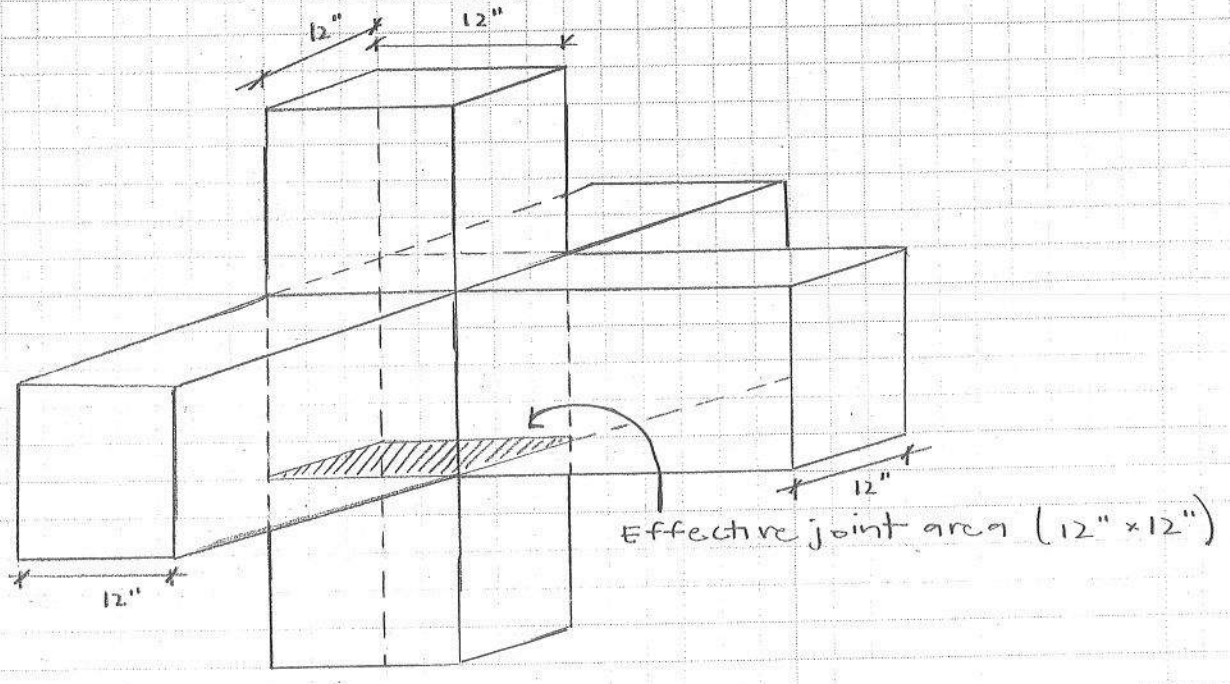
$\lambda = 1.0$ for normal weight concr.

$= \frac{(60000)(\frac{6}{8}")}{(65)(1)(\sqrt{4000})}$

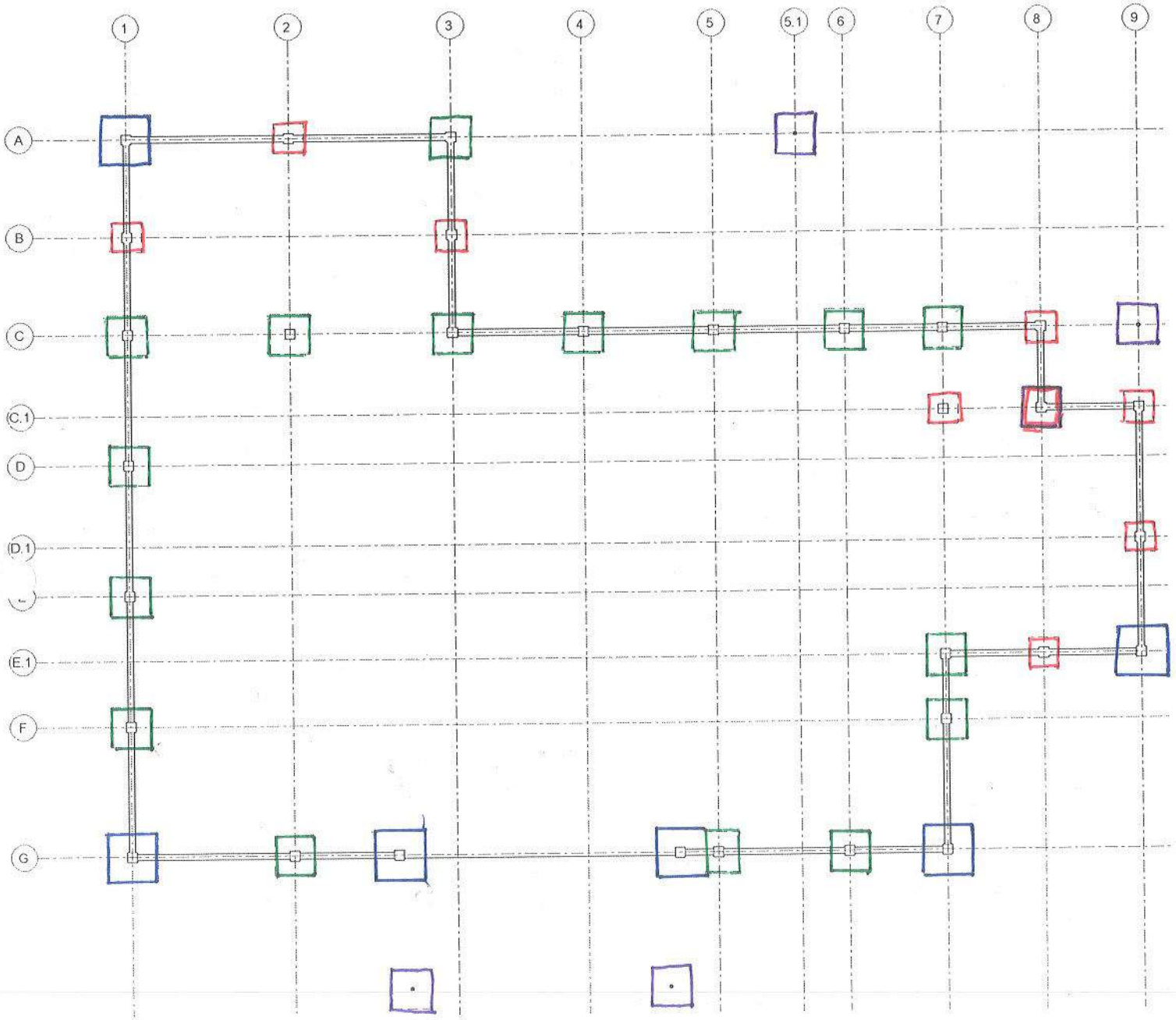
$= 10.94" \approx \underline{11"}$

governs

Note: The hook shall be located within the confined core of a column, with the hook bent into the joint.



	PROJECT Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO. F1 OF F7
	AUTHOR Mindy Trieu and Jocelyn Lu	DATE 06/17/17
	CALCULATION TOPIC Foundation Key Plan	Journeyman International Organization



□ - F1

□ - F2

□ - F3

□ - F4

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. F2 OF F7
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Foundation Design		Journeyman International Organization

Reference

ETABS axial analysis

Load Combo: 1.394D + QE + L

Values are obtained from ETABS model
Column design is based on worst case loading.

Footing 1 - F1

Based on column group #6 - C6 (12" × 12")
A_T = 991 sf

$P_{u\,Roof}$ = 16.6K

$P_{u\,Flr}$ = 16.9K

$P_{u\,T} = P_{u\,design}$ = 33.55K

Footing 2 - F2

Based on column group #2 - C2 (12" × 12")

$P_{u\,Roof}$ = 24.8K

$P_{u\,Flr}$ = 23.2K

$P_{u\,T}$ = 48K

Footing 3 - F3

Based on column group #3 - C3 (12" × 12")
ETABS values < Gravity Design values. Gravity values govern.

$P_{u\,LRFD}$ = (81 psf)(161.4 sf) = 13.1K

$P_{u\,LRFD}$ = [(1.2)(.61) + (1.6)(.20)](161.4) = 16.9K

Footing 4 - F4

Based on column group #8 - C8 (HSS 3 × 3 × 3/16)

A_T = 290 sf

$P_{u\,ASD}$ = (81 psf)(290 sf) = 23.5K

$P_{u\,LRFD}$ = [(1.2)(.61) + (1.6)(.20)](290 sf) = 30.5K

Reference

To simplify column schedule, columns with same reinforcements will be grouped:

C_1, C_4, C_5, C_6, & MF COL - F1

C_2 - F2

C_3 - F3

C_7, C_8 - F4

After further analysis, all moment frame columns will also be grouped under C_1 denoted above

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F4 OF F7
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Footing 1 - F1		Journeyman International Organization

Reference

COLUMN PROPERTIES		
DL	61	psf
LL	20	psf
f'c	4	ksi
fy	60	ksi
qu	2	ksf
M (k-ft)	0	(concentric)
Pu	33.5	kips
Pu	33.5	kips
d_{col}	12	inches

ECCENTRICITY		
e = M/ P	0	ft
L/6	0.6821127	ft
q min	2.09375	ksf
q max	2.09375	ksf

FOOTPRINT OF FTG		
A FTG	16.75	ft^2
L = W	4.09	ft
TRY 4'-0" SQ FTG		
L = W	4	ft
quActual	2.09	ksf

ONE-WAY BEAM SHEAR		
d_{min}	2.39	inches
Vu	2.72	kips
ϕ	0.75	
ϕVc	2.72	kips
h	6.39	> 6" minimum
	12	(increments of 3")
TRY H = 12"		
cover	3	inches
d = h - (3" cover + 1")	8	inches
ϕVc	9.11	kips
Vu	1.74	kips
CHECK: Vu < ϕVc		

TWO-WAY (PUNCHING) SHEAR		
β	1	(square column)
Vu	27.68	kips
b_o	80	inches
ϕVc 1	182.15	kips
α_s	30	(exterior column)
ϕVc 2	151.79	(kips)
ϕVc 3	121.43	(kips)
SMALLEST Vc GOVERNS		
CHECK: Vu < ϕVc		

FLEXURAL DESIGN		
Mu	2.36	k-ft/ft
If (d-a/2) = 0.9d	7.2	inches
Assume ϕ = 0.9	0.9	
As_{min}	0.14	in^2/ft
As	0.07	in^2/ft
REQUIRED REINFORCEMENT		
As = 0.14 in2/ft		

REINFORCEMENT		
As	0.2	in^2/ft
#4 @ 12" C.C. EACH WAY		
Checks:		
1) a < $a_{assumed}$		
$a_{assumed}$	1.6	inches
a	0.0735294	inches
As is O.K.		
2.) εs	0.021	
c = a	0.0735294	inches
εs > 0.005, TENSION CONTROLLED		
ϕ = 0.9		

4' SQ FTG W/ #4 @ 12" C.C. EACH WAY

H=18" min

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F5 OF F7
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Footing 2 - F2		Journeyman International Organization

Reference

COLUMN PROPERTIES		
DL	61	psf
LL	20	psf
f'c	4	ksi
fy	60	ksi
qu	2	ksf
M (k-ft)	0	(concentric)
Pu	48	kips
Pu	48	kips
d_{col}	12	inches

ECCENTRICITY		
e = M/ P	0	ft
L/6	0.8164966	ft
q min	1.92	ksf
q max	1.92	ksf

FOOTPRINT OF FTG		
A FTG	24	ft^2
L = W	4.90	ft
TRY 5'-0" SQ FTG		
(MIN. FND WIDTH IS 12")		
L = W	5	ft
quActual	1.92	ksf

ONE-WAY BEAM SHEAR		
d_{min}	2.96	inches
Vu	3.37	kips
ϕ	0.75	
ϕVc	3.37	kips
h	6.96	> 6" minimum
	12	(increments of 3")
TRY H = 12"		
cover	3	inches
d = h - (3" cover + 1")	8	inches
ϕVc	9.11	kips
Vu	2.56	kips
CHECK: Vu < ϕVc		

TWO-WAY (PUNCHING) SHEAR		
β	1	(square column)
Vu	42.67	kips
b_o	80	inches
ϕVc 1	182.15	kips
α_s	30	(exterior column)
ϕVc 2	151.79	(kips)
ϕVc 3	121.43	(kips)
SMALLEST Vc GOVERNS		
CHECK: Vu < ϕVc		

FLEXURAL DESIGN		
Mu	3.84	k-ft/ft
If (d-a/2) = 0.9d	7.2	inches
Assume ϕ = 0.9	0.9	
As_{min}	0.15	in^2/ft
As	0.12	in^2/ft
REQUIRED REINFORCEMENT		
As = 0.15 in2/ft		

REINFORCEMENT		
As	0.2	in^2/ft
#4 @ 12" C.C. EACH WAY		
Checks:		
1) a < $a_{assumed}$		
$a_{assumed}$	1.6	inches
a	0.0588235	inches
As is O.K.		
2.) εs	0.021	
c = a	0.0588235	inches
εs > 0.005, TENSION CONTROLLED		
ϕ = 0.9		

5' SQ FTG W/ #4 @ 12" C.C. EACH WAY

H=18" Min

	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: F6 OF F7
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Footing 3 - F3	Journeyman International Organization

Reference

COLUMN PROPERTIES		
DL	61	psf
LL	20	psf
f'c	4	ksi
fy	60	ksi
qu	2	ksf
M (k-ft)	0	(concentric)
P (ASD)	13.1	kips
P (LRFD)	16.9	kips
d_{col}	12	inches

ECCENTRICITY		
e = M/ P	0	ft
L/6	0.4265495	ft
q min	1.4555556	ksf
q max	1.4555556	ksf

FOOTPRINT OF FTG		
A FTG	6.55	ft^2
L = W	2.56	ft
TRY 3'-0" SQ FTG		
L = W	3	ft
quActual	1.88	ksf

ONE-WAY BEAM SHEAR		
d_{min}	1.45	inches
Vu	1.65	kips
ϕ	0.75	
ϕVc	1.65	kips
h	5.45	> 6" minimum
	12	(increments of 3")
TRY H = 12"		
cover	3	inches
d = h - (3" cover + 1")	8	inches
ϕVc	9.11	kips
Vu	0.63	kips
CHECK: Vu < ϕVc		

TWO-WAY (PUNCHING) SHEAR		
β	1	(square column)
Vu	11.68	kips
b_o	80	inches
ϕVc 1	182.15	kips
α_s	30	(exterior column)
ϕVc 2	151.79	(kips)
ϕVc 3	121.43	(kips)
SMALLEST Vc GOVERNS		
CHECK: Vu < ϕVc		

FLEXURAL DESIGN		
Mu	0.94	k-ft/ft
If (d-a/2) = 0.9d	7.2	inches
Assume ϕ = 0.9	0.9	
As_{min}	0.12	in^2/ft
As	0.03	in^2/ft
REQUIRED REINFORCEMENT		
As = 0.12 in2/ft		

REINFORCEMENT		
As	0.2	in^2/ft
#4 @ 12" C.C. EACH WAY		
Checks:		
1) a < $a_{assumed}$		
$a_{assumed}$	1.6	inches
a	0.0980392	inches
As is O.K.		
2.) εs	0.021	
c = a	0.0980392	inches
εs > 0.005, TENSION CONTROLLED		
ϕ = 0.9		

3' SQ FTG W/ #4 @ 12" C.C. EACH WAY

H=18" min

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: F7 OF F7
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Footing 4 - F4		Journeyman International Organization

Reference

COLUMN PROPERTIES		
DL	61	psf
LL	20	psf
f'c	4	ksi
fy	60	ksi
qu	2	ksf
M (k-ft)	0	(concentric)
P (ASD)	23.5	kips
P (LRFD)	30.5	kips
d_{col}	12	inches

ECCENTRICITY		
e = M/ P	0	ft
L/6	0.5713046	ft
q min	1.46875	ksf
q max	1.46875	ksf

FOOTPRINT OF FTG		
A FTG	11.75	ft^2
L = W	3.43	ft
TRY 4'-0" SQ FTG		
L = W	4	ft
quActual	1.91	ksf

ONE-WAY BEAM SHEAR		
d_{min}	2.20	inches
Vu	2.51	kips
ϕ	0.75	
ϕVc	2.51	kips
h	6.20	> 6" minimum
	12	(increments of 3")
TRY H = 12"		
cover	3	inches
d = h - (3" cover + 1")	8	inches
ϕVc	9.11	kips
Vu	1.59	kips
CHECK: Vu < ϕVc		

TWO-WAY (PUNCHING) SHEAR		
β	1	(square column)
Vu	25.20	kips
b_o	80	inches
ϕVc 1	182.15	kips
α_s	30	(exterior column)
ϕVc 2	151.79	(kips)
ϕVc 3	121.43	(kips)
SMALLEST Vc GOVERNS		
CHECK: Vu < ϕVc		

FLEXURAL DESIGN		
Mu	2.14	k-ft/ft
If (d-a/2) = 0.9d	7.2	inches
Assume ϕ = 0.9	0.9	
As_{min}	0.13	in^2/ft
As	0.07	in^2/ft
REQUIRED REINFORCEMENT		
As = 0.13 in2/ft		

REINFORCEMENT		
As	0.2	in^2/ft
#4 @ 12" C.C. EACH WAY		
Checks:		
1) a < $a_{assumed}$		
$a_{assumed}$	1.6	inches
a	0.0735294	inches
As is O.K.		
2.) εs	0.021	
c = a	0.0735294	inches
εs > 0.005, TENSION CONTROLLED		
ϕ = 0.9		

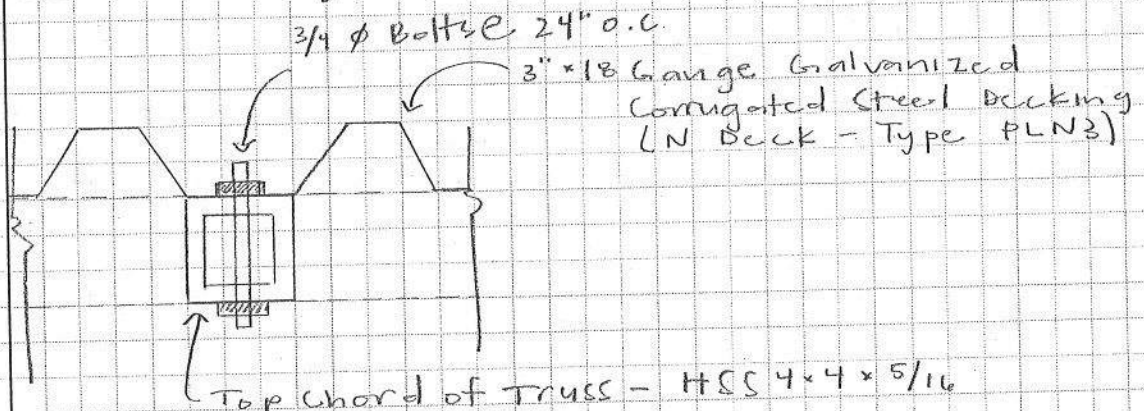
4' SQ FTG W/ #4 @ 12" C.C. EACH WAY

H = 18" min

TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: P1 OF P6
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: Steel Deck to Connection: Steel Truss	Journeyman International Organization

Reference

Steel Decking to Steel Truss:



Lateral loading st.

$V = 61,863\# = 61.9\ K$

$L = 25\ m \times 3.28\ ft/m = 82\ ft$

$w = \frac{61.9\ K}{82\ ft} = 0.754\ K/f$

Trib width $= 5m \times 3.28\ ft/m = 16.4'$

Shear per bolt $= (0.754\ K/f)(16.4') = \underline{12.36\ K}$

↳ Try 3/4" diam bolts.
Available shear = 17.9 K

AISC T17-1

$\phi V_n = 17.9\ K > V_u = 12.36\ K$ ✓ O.K.

USE 3/4" DIAM. BOLTS TO CONNECT DECKING TO TRUSS

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: P2 OF D6
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Connection: Steel Decking to HSS Beams (2nd Flr)		Journeyman International Organization

Reference

Steel Decking to HSS beam:

Reference "Steel Decking to Steel Truss" for configuration.

ETABS Analysis

$V = 35,228\# = 35.2K$

$L = 67.24ft$

$v = \frac{35.2K}{67.24ft} = 0.523 k/ft$

Trib width = 8.33'

AISC T47-1

Shear per bolt = $(0.523)(8.33) = 4.36K$

↳ Try 5/8" diam bolts @ 24" o.c.
Available shear = 12.4K

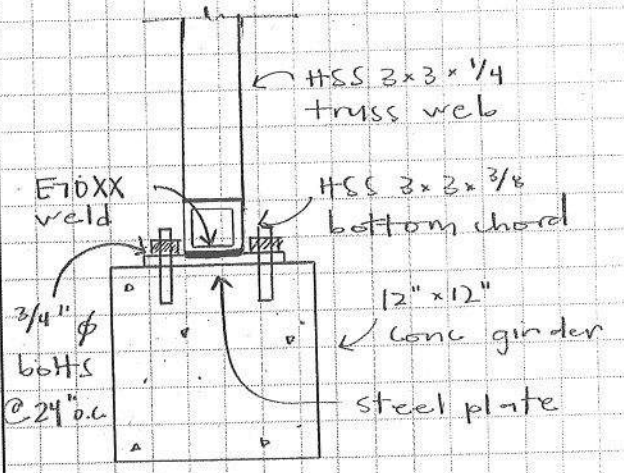
$\phi V_n = 12.4K > V_u = 4.36K$ ✓

USE 5/8" DIAM BOLTS TO CONNECT STEEL DECKING HSS BEAMS.

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO. P3 OF D6
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Connection : Truss to concrete beam		Journeyman International Organization

Reference

Steel Truss to Concrete Beam:



$V = 61,863\ \# = 61.9k$

$L = 82ft$

$w = \frac{61.9k}{82ft} = 0.754\ k/ft$

AISC TL17-1

Trib width = 16.4'

shear per bolt = $(0.754)(16.4) = \underline{12.36k}$

↳ Try 3/4" diam bolts
available shear = 17.9k

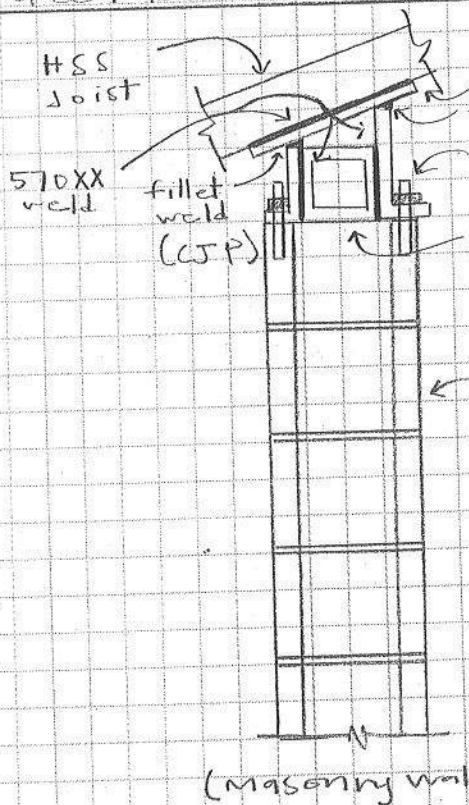
$\phi V_n = 17.9k \geq V_u = 12.36k$ ✓ O.K

USE 3/4" DIAM. BOLTS TO CONNECT STEEL TRUSS TO CONCRETE BM.

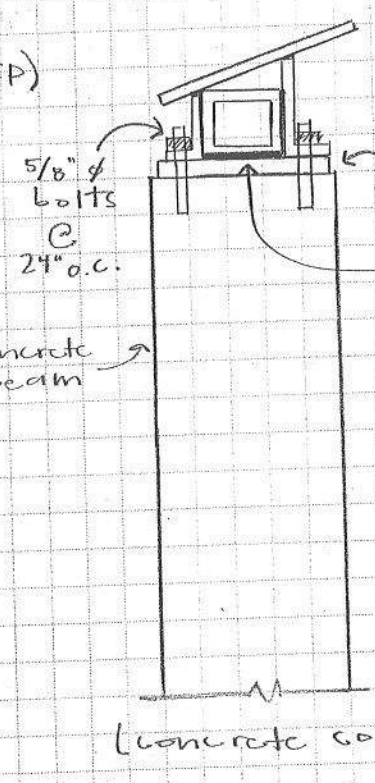
PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: D4 OF D6
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Connection: Steel Beam to Masonry wall / Concrete column		Journeyman International Organization

Reference

Steel Beam to Masonry wall / Concrete Column:



same configuration as the left image



[drawing configuration changed on actual drawings]

Lateral Load Combo

ETABS Analysis

$V = 35,228\# = 35.2\,K$

$L = 67.24\,ft$

$v = \frac{35.2K}{67.24\,ft} = 0.523\,k/f$

Trib width = 8.33'

AISC Tbl 7-1

Shear per bolt = $(0.523)(8.33) = 4.36\,K$

↳ Try 5/8" diam bolts
Available shear = 12.4K

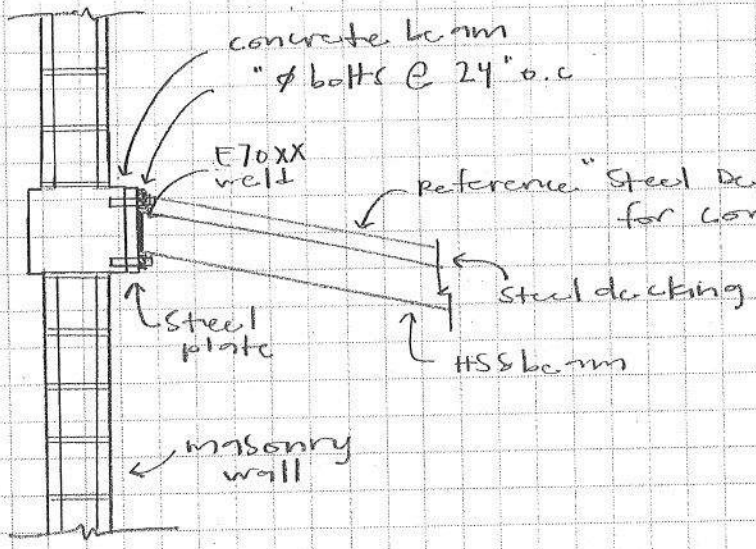
$\phi V_n = 12.4K > V_u = 4.36\,K$ ✓ O.K

USE 5/8" DIAM. BOLTS TO CONNECT ANGLES TO MASONRY WALL

PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic		SHEET NO.: D5 OF D6
AUTHOR: Mindy Trieu and Jocelyn Lu		DATE: 06/17/17
CALCULATION TOPIC: Connection: Steel Decking/HSS to Concrete Beam		Journeyman International Organization

Reference

Steel Decking / HSS Beams to Concrete Beam:



(Elevation View)

ETABS Analysis

V = 35.2k

L = 67.24 ft

A-ISC T6|7-1

$v = \frac{35.2k}{67.24ft} = 0.523 k/ft$

Trib width = 8.33'

Shear per bolt = (8.33' x 0.523 k/ft) = 4.36k

↳ Try 5/8" diam bolts
Available shear = 12.4k

$\phi V_n = 12.4k \geq V_u = 4.36k$ ✓ O.K

USE 5/8" DIAM BOLTS TO CONNECT HSS BEAM / STEEL DECKING TO FACE OF CONCRETE BEAM.

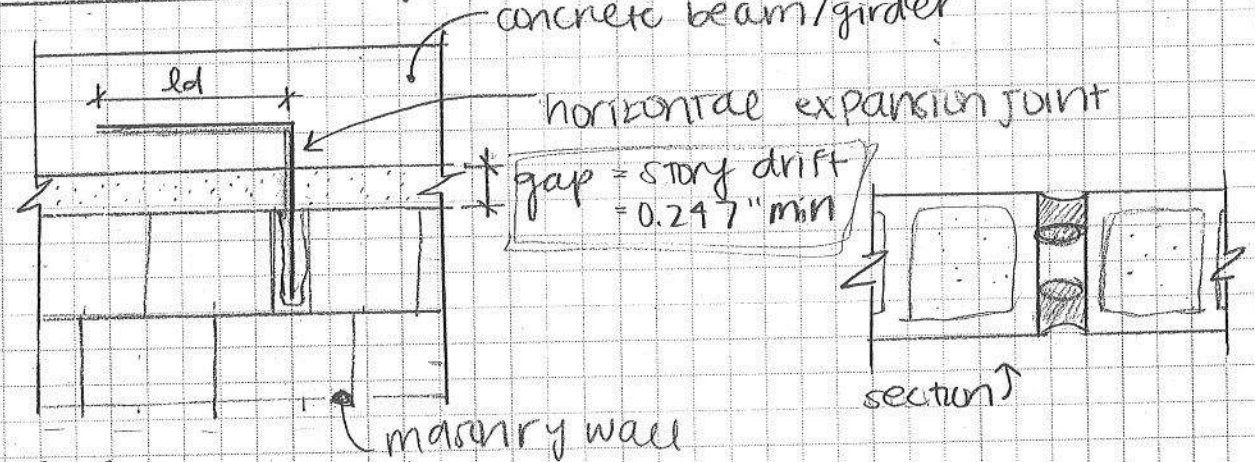
TWENTYFIVE35 DOMINICAN REPUBLIC	PROJECT: Mission Twenty-Five 35 Community Center-Dominican Republic	SHEET NO.: D6 OF D6
	AUTHOR: Mindy Trieu and Jocelyn Lu	DATE: 06/17/17
	CALCULATION TOPIC: connection: concrete frame to masonry wall	Journeyman International Organization

Reference

NTS

worst case story drift

conc. Bm to masonry wall:



AS3700 max. joint movement = 10mm
max. joint spacing = 3m

∴ Expansion joint: #4 hooks to match beam shear tie size
spacing = every 8' o.c.
↳ to follow code & have even spacing within CMU blocks

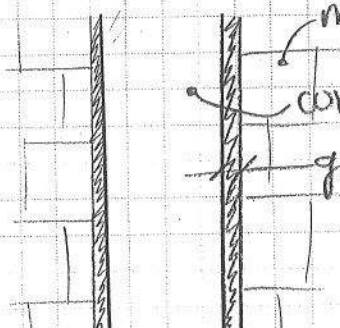
ACI T.25.4.2.2 $l_d = \left(\frac{f_y \psi_t \psi_e}{25\lambda\sqrt{f'c}}\right) d_b$

$= \frac{(60\ ksi)(1.0)(1.0)}{25(1.0)\sqrt{1000\ psi}} (3/8")$

$l_d = 18.8"$

⇒ #4 hooks in horizontal expansion joint
s = 8' o.c.
l_d = 18.8"

conc column to masonry wall:



- gap is filled solely w/ sealant as a connection between the two elements so the masonry wall won't affect the moment frame (lateral system)
- gap: story drift max

g = 0.247" min

GENERAL NOTES

1. ALL NEW CONSTRUCTION SHALL COMPLY WITH THE CONTRACT DOCUMENTS AND THE CURRENT EDITION OF THE 2015 IBC.

2. THESE GENERAL NOTES SUPERSEDE THE REQUIREMENTS OF THE PROJECT SPECIFICATIONS. IN CASE OF CONFLICT BETWEEN THE PLANS AND SPECIFICATIONS, CONTACT THE OWNER'S REPRESENTATIVE.

3. REFERENCE TO CODES, RULES, REGULATIONS, STANDARDS, MANUFACTURER'S INSTRUCTIONS OR REQUIREMENTS OF REGULATORY AGENCIES IS TO THE LATEST PRINTED EDITION OF EACH IN EFFECT AT THE DATE OF SUBMISSION OF BID UNLESS THE DOCUMENT DATE IS SHOWN.

4. TYPICAL DETAILS AND GENERAL NOTES APPLY TO ALL PARTS OF THE WORK EXCEPT WHERE SPECIFICALLY DETAILED OR UNLESS NOTED OTHERWISE (U.N.O.)

5. THE STRUCTURAL DRAWINGS ILLUSTRATE THE NEW STRUCTURAL MEMBERS. REFER TO ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS FOR NON-STRUCTURAL ITEMS WHICH REQUIRE SPECIAL PROVISIONS DURING THE CONSTRUCTION OF THE STRUCTURAL MEMBERS.

6. REFER TO ARCHITECTURAL DRAWINGS FOR FLOOR DEPRESSIONS, EDGE OF SLAB, OPENINGS, SLOPES, DRAINS, CURBS, PADS, EMBEDDED ITEMS, NON-BEARING PARTITIONS, ETC. REFER TO MECHANICAL AND ELECTRICAL DRAWINGS FOR SLEEVES, OPENINGS, AND HANGERS FOR PIPES, DUCTS AND EQUIPMENT.

7. THE CONTRACTOR SHALL VERIFY AND BE RESPONSIBLE FOR COORDINATING THE WORK OF ALL TRADES AND SHALL VERIFY ALL DIMENSIONS AND CONDITIONS WHICH IMPACT THE WORK. FIELD VERIFY SIZES, ELEVATIONS, HOLE LOCATIONS, ETC. PRIOR TO FABRICATION.

8. DRAWING DIMENSIONS ARE TO FACE OF FINISH, JOINT CENTERLINE OR COLUMN GRID CENTERLINE UNLESS NOTED OTHERWISE. DO NOT SCALE THE DRAWINGS.

9. CONTRACTOR SHALL CAREFULLY REVIEW THE DRAWINGS TO IDENTIFY THE SCOPE OF WORK REQUIRED, VISIT THE SITE TO RELATE THE SCOPE OF WORK TO EXISTING CONDITIONS, AND DETERMINE THE EXTENT TO WHICH THOSE CONDITIONS AND PHYSICAL SURROUNDINGS WILL IMPACT THE WORK.

10. EXISTING CONDITIONS AS SHOWN ON THESE PLANS ARE FOR REFERENCE ONLY. CONTRACTOR IS REQUIRED TO FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION. CONTRACTOR SHALL REPORT CONDITIONS THAT CONFLICT WITH THE CONTRACT DOCUMENTS TO THE OWNER'S REPRESENTATIVE. DO NOT DEVIATE FROM THE CONTRACT DOCUMENTS WITHOUT WRITTEN DIRECTION FROM THE OWNER'S REPRESENTATIVE.

11. THE CONTRACTOR SHALL RESOLVE ANY CONFLICTS ON THE DRAWINGS OR IN THE SPECIFICATIONS WITH THE OWNER'S REPRESENTATIVE BEFORE PROCEEDING WITH THE WORK.

12. ANY DEVIATION, MODIFICATION, AND SUBSTITUTION FROM THE APPROVED SET OF STRUCTURAL DRAWINGS SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE FOR REVIEW/APPROVAL PRIOR TO ITS USE OR INCLUSION ON THE SHOP DRAWINGS & PRIOR TO PROCEEDING WITH THE WORK.

13. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY SHORES, BRACES, AND GUIDES REQUIRED TO SUPPORT ALL LOADS TO WHICH THE BUILDING STRUCTURE AND COMPONENTS, SOILS, OTHER STRUCTURES AND UTILITIES MAY BE SUBJECTED DURING CONSTRUCTION. SHORING SYSTEMS SHALL BE DESIGNED AND STAMPED BY A CIVIL ENGINEER LICENSED IN THE STATE OF CALIFORNIA. VISITS TO THE SITE BY THE OWNER'S REPRESENTATIVE WILL NOT INCLUDE OBSERVATION OF THE ABOVE NOTED ITEMS.

14. THE CONTRACTOR SHALL PROVIDE MEANS, METHOD, TECHNIQUES, SEQUENCE, AND PROCEDURE OF CONSTRUCTION AS REQUIRED. SITE VISITS PERFORMED BY THE OWNER'S REPRESENTATIVE DO NOT INCLUDE INSPECTIONS OF MEANS AND METHODS OF CONSTRUCTION PERFORMED BY CONTRACTOR.

15. THE CONTRACTOR SHALL PROTECT ALL WORK, MATERIALS, AND EQUIPMENT FROM DAMAGE AND SHALL PROVIDE PROPER STORAGE FACILITIES FOR MATERIALS AND EQUIPMENT DURING CONSTRUCTION.

16. STRUCTURAL OBSERVATIONS PERFORMED BY ENGINEER DURING CONSTRUCTION ARE NOT THE CONTINUOUS AND SPECIAL INSPECTION SERVICES AND DO NOT WAIVE THE RESPONSIBILITY FOR THE INSPECTIONS REQUIRED OF THE BUILDING INSPECTOR OR THE DEPUTY INSPECTOR. OBSERVATIONS ALSO DO NOT GUARANTEE CONTRACTOR'S PERFORMANCE AND SHALL NOT BE CONSIDERED AS SUPERVISION OF CONSTRUCTION.

17. CONTRACTORS SHALL REVIEW SHOP DRAWINGS FOR COMPLETENESS AND COMPLIANCE WITH CONTRACT DOCUMENTS. CONTRACTOR SHALL STAMP SHOP DRAWINGS PRIOR TO SUBMISSION TO OWNER'S REPRESENTATIVE.

18. REVIEW OF THE SHOP DRAWINGS SHALL NOT BE CONSTRUED AS AN AUTHORIZATION TO DEVIATE FROM CONTRACT DOCUMENTS.

19. SHOP DRAWINGS WILL NOT BE PROCESSED DUE TO INCOMPLETENESS, LACK OF CO-ORDINATION WITH RELEVANT PORTION OF CONTRACT DOCUMENTS, LACK OF CALCULATIONS IF REQUIRED AND WHERE DEVIATIONS, MODIFICATIONS AND SUBSTITUTIONS ARE INDICATED WITHOUT PRIOR WRITTEN APPROVAL FROM OWNER'S REPRESENTATIVE.

20. ALLOW FOURTEEN WORKING DAYS FOR PROCESSING SHOP DRAWINGS AFTER RECEIPT.

CONCRETE

1. CONCRETE IS REINFORCED AND CAST-IN-PLACE UNLESS OTHERWISE NOTED. WHERE REINFORCING IS NOT SPECIFICALLY SHOWN OR WHERE DETAILS ARE NOT GIVEN, PROVIDE REINFORCING SIMILAR TO THAT SHOWN FOR SIMILAR CONDITIONS, SUBJECT TO REVIEW BY THE OWNER'S REPRESENTATIVE.

2. ALL STRUCTURAL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS AS FOLLOWS:

SLAB	4000 PSI NORMAL WEIGHT
ALL OTHER CONCRETE	4000 PSI NORMAL WEIGHT

3. ALL STRUCTURAL CONCRETE MIXES SHALL BE TYPE II CEMENT AND SHALL BE DESIGNED BY AN APPROVED LABORATORY.

4. NORMAL WEIGHT CONCRETE AGGREGATES SHALL CONFORM TO ASTM C-33.

5. NO MORE THAN ONE GRADE OF CONCRETE SHALL BE ON THE JOB SITE AT ANY ONE TIME.

6. THOROUGHLY CLEAN AND ROUGHEN ALL HARDENED CONCRETE AND MASONRY SURFACES TO RECEIVE NEW CONCRETE. INTERFACE SHALL BE ROUGHENED TO A FULL AMPLITUDE OF 1/4" UNLESS NOTED OTHERWISE.

7. KEY AND DOWEL POUR JOINTS AS SHOWN ON THE PLANS. ANY DEVIATION FROM POUR JOINTS SHOWN ON THE PLANS MUST BE APPROVED BY THE OWNER'S REPRESENTATIVE.

8. DEFECTIVE CONCRETE (VOIDS, ROCK POCKETS, HONEYCOMBS, CRACKING, ETC.) SHALL BE REMOVED AND REPLACED AS DIRECTED BY THE OWNER'S REPRESENTATIVE.

REINFORCEMENT

1. REINFORCING TO CONFORM TO THE FOLLOWING, UNLESS OTHERWISE NOTED:

LOCATION	TYPE
REINFORCING STEEL U.N.O.	ASTM A706, 60 KSI
REINFORCING STEEL TO BE WELDED AND IN CONCRETE SHEAR WALL BOUNDARY ELEMENTS	ASTM A706, 60 KSI
SMOOTH DOWELS IN SLAB ON GRADE	ASTM A36, 36 KSI

2. REINFORCING BARS SHALL HAVE THE FOLLOWING MINIMUM COVERAGE. PLACE BARS AS NEAR TO THE CONCRETE SURFACE AS THESE MINIMUMS PERMIT WHEREVER POSSIBLE UNLESS NOTED OTHERWISE:

	MIN. CONCRETE COVER
CONCRETE POURED AGAINST EARTH	3"
FORMED CONCRETE IN CONTACT WITH EARTH	1 1/2"
EXPOSED TO WEATHER (#6 AND LARGER)	2"
EXPOSED TO WEATHER (#5 AND SMALLER)	1 1/2"
SLABS & WALLS NOT EXPOSED TO WEATHER	1"

3. #5 AND LARGER REINFORCING BARS SHALL NOT BE SPLICED EXCEPT AS LOCATED AND DETAILED ON THE DRAWINGS. #4 AND SMALLER BARS WITH LENGTH NOT SHOWN SHALL BE CONTINUOUS, LAPPING 1'-6" MINIMUM IN CONCRETE (SEE TYPICAL DETAILS). HORIZONTAL WALL SPLICES SHALL BE STAGGERED. VERTICAL BARS SHALL NOT BE SPLICED EXCEPT AT HORIZONTAL SUPPORT, SUCH AS FLOOR OR ROOF, UNLESS DETAILED OTHERWISE. ALL BARS ENDING AT THE FACE OF A WALL, COLUMN, OR BEAM SHALL EXTEND TO WITHIN 2" OF THE FAR FACE AND HAVE A 90 DEGREE HOOK UNLESS OTHERWISE SHOWN.

4. BARS SHALL BE FIRMLY SUPPORTED AND ACCURATELY PLACED AS REQUIRED BY THE A.C.I. STANDARDS, USING TIE AND SUPPORT BARS IN ADDITION TO REINFORCEMENT SHOWN WHERE NECESSARY FOR FIRM AND ACCURATE PLACING. ALL DOWELS SHALL BE ACCURATELY SET IN PLACE BEFORE PLACING CONCRETE.

5. DRAWINGS SHOW TYPICAL REINFORCING CONDITIONS. CONTRACTOR SHALL PREPARE DETAILED PLACEMENT DRAWINGS OF ALL CONDITIONS SHOWING QUANTITY, SPACING, SIZE, CLEARANCES, LAPS, INTERSECTIONS AND COVERAGE REQUIRED BY STRUCTURAL DETAILS, APPLICABLE CODE AND TRADE STANDARDS. CONTRACTOR SHALL NOTIFY REINFORCING INSPECTOR OF ANY ADJUSTMENTS FROM TYPICAL CONDITIONS THAT ARE PROPOSED IN PLACEMENT DRAWINGS TO FACILITATE FIELD PLACEMENT OF REINFORCING STEEL AND CONCRETE.

6. NO WELDING OF REINFORCEMENT (INCLUDING TACK WELDING) SHALL BE DONE UNLESS SHOWN ON THE DRAWINGS. WHERE SHOWN ON THE DRAWINGS, WELDING OF REINFORCING STEEL SHALL BE PERFORMED BY WELDERS SPECIFICALLY CERTIFIED FOR REINFORCING STEEL. USE E90XX ELECTRODES.

FOUNDATIONS

1. THE DESIGN OF THE FOUNDATION SYSTEM IS BASED UPON THE CRITERIA AND RECOMMENDATIONS CONTAINED IN THE GEOTECHNICAL INVESTIGATION REPORT ENTITLED GS-101 BY QUICKSAND TECHNOLOGIES, DATED 12-10-2016 AND SUPPLEMENTAL REPORT ENTITLED GS-102, DATED 12-10-2016.

2. THE GEOTECHNICAL INVESTIGATION REPORT AND ITS RECOMMENDATIONS SHALL BE FOLLOWED AND SHALL BE CONSIDERED MINIMUM REQUIREMENTS UNLESS MORE STRIGENT REQUIREMENTS ARE PRESENTED IN THE SPECIFICATIONS OR ON THE DRAWINGS.

3. PER GEOTECHNICAL INVESTIGATION REPORT, THE ALLOWABLE SOIL BEARING PRESSURES ARE AS FOLLOWS:

A. SPREAD FOOTINGS: 4000 POUNDS PER SQUARE FOOT

B. ALLOWABLE BEARING VALUES MAY BE INCREASED BY 33 PERCENT FOR SHORT TERM LOADING.

4. REMOVE LOOSE SOIL AND STANDING WATER FROM FOUNDATION EXCAVATIONS PRIOR TO PLACING CONCRETE. THE GEOTECHNICAL ENGINEER SHALL INSPECT AND APPROVE ALL EXCAVATIONS, SOIL COMPACTION WORK PRIOR TO PLACEMENT OF ANY REBAR OR CONCRETE, SHORING INSTALLATIONS, BAKFILL MATERIALS AND BACK FILLING PROCEDURES.

5. LOCATE AND PROTECT EXISTING UTILITIES TO REMAIN DURING AND/OR AFTER CONSTRUCTION.

6. REMOVE ABANDONED FOOTINGS, UTILITIES, ETC. WHICH INTERFERE WITH NEW CONSTRUCTION, UNLESS OTHERWISE INDICATED.

7. NOTIFY THE OWNER'S REPRESENTATIVE IF ANY BURIED STRUCTURES NOT INDICATED, SUCH AS CESSPOOLS, CISTERNS, FOUNDATIONS, ETC., ARE FOUND.

8. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR EXCAVATION PROCEDURES INCLUDING LAGGING, SHORING, UNDERPINNING AND PROTECTION OF EXISTING CONSTRUCTION.

9. PLACE BACKFILL BEHIND RETAINING WALLS AFTER CONCRETE OR MASONRY HAS ATTAINED FULL DESIGN STRENGTH. BRACE BUILDING AND PIT WALLS BELOW GRADE FROM LATERAL LOADS UNTIL ATTACHED FLOORS AND SLABS ON GRADE ARE COMPLETE AND HAVE ATTAINED FULL DESIGN STRENGTH.

FORMWORK

1. BEFORE STARTING CONSTRUCTION, THE CONTRACTOR SHALL DEVELOP A PROCEDURE AND SCHEDULE FOR REMOVAL OF CONCRETE FORMS AND SHORES. CONCRETE FORMS AND SHORES SHALL BE REMOVED IN SUCH A MANNER AS TO NOT IMPAIR THE SAFETY AND SERVICEABILITY OF THE STRUCTURE. IN ADDITION TO THE ABOVE REQUIREMENTS, REMOVAL OF FORMS SHALL BE NO SOONER THAN THE FOLLOWING:

LOCATION	REMOVE FORMS NO SOONER THAN
BOTTOM FORMS AND SHORES FOR MILDLY REINFORCED SLABS, BEAMS, AND GIRDERS	7 DAYS, AND F'C = 3500 PSI MINIMUM
SIDE FORMS FOR BEAMS AND GIRDERS	72 HOURS
COLUMNS AND WALLS	72 HOURS
FOOTINGS, PILE CAPS, AND GRADE BEAMS	48 HOURS

2. PROVIDE CURING WHERE FORMS ARE REMOVED IN LESS THAN 7 DAYS, INCLUDING BUT NOT LIMITED TO WALLS, COLUMNS, AND UNDERSIDE OF ELEVATED SLABS.

Must be checked by licensed engineer before construction

Journeyman International

Engineers

Jocelyn Lu
Mindy Trieu

Client

MissionTwenty-Five35

Revisions

No.	Desc.	Date

Project

Community Center and Stage

Sheet Name

GENERAL NOTES

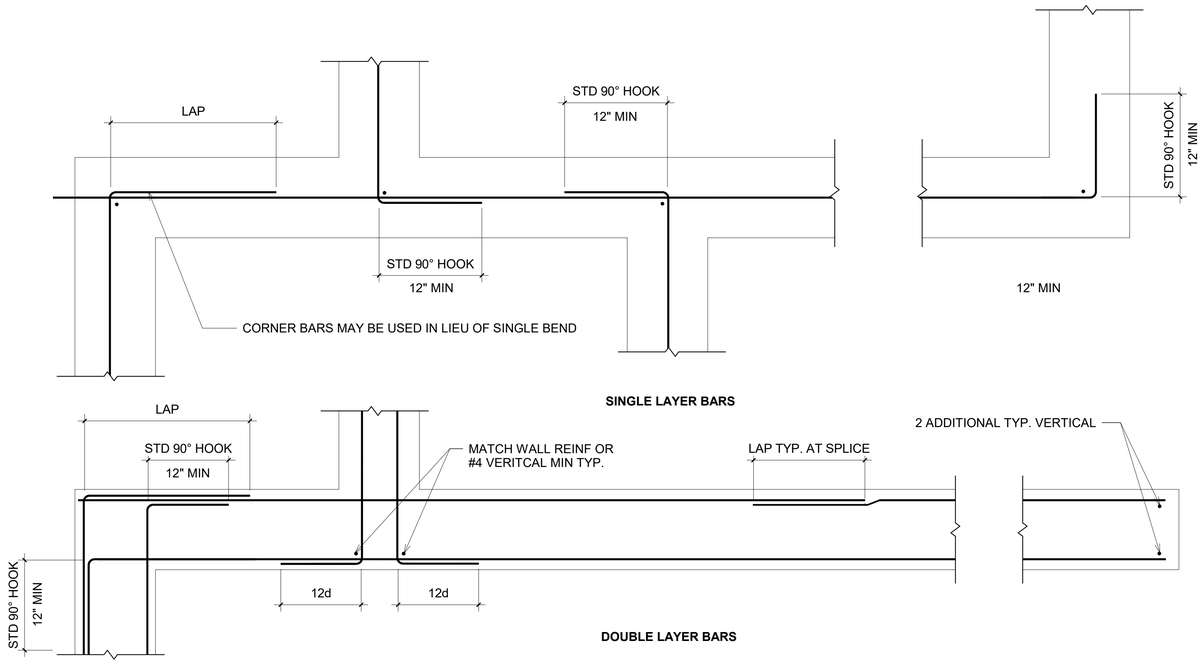
Plot date

6/19/2017
7:16:22 PM

Scale

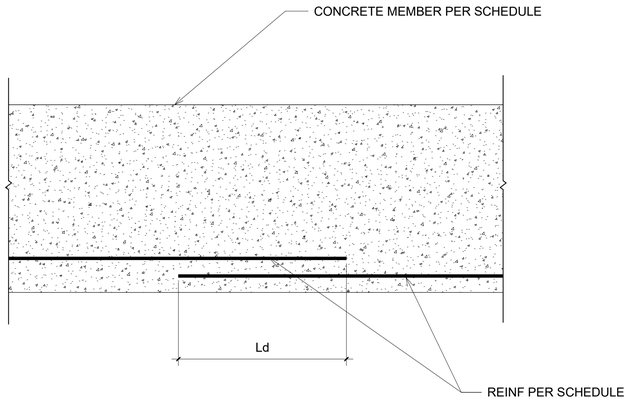
Sheet No.

S0.1



CORNER REINFORCING AT CONCRETE WALLS AND FOOTINGS

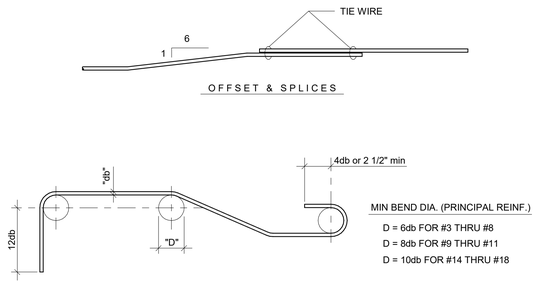
1 CORNER REINFORCING AT CONCRETE WALL AND FOOTINGS
3/4" = 1'-0"



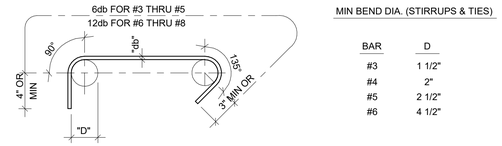
NOTES: 1. Ld (TOP) NOT SHOWN FOR CLARITY
2. Ld PER 4 / S 1.1

3 TYPICAL SPLICE AND SCHEDULE
1/2" = 1'-0"

Must be checked by licensed engineer before construction



STANDARD HOOK DETAILS FOR PRINCIPAL REINFORCEMENT



MIN BEND DIA. (STIRRUPS & TIES)

BAR	D
#3	1 1/2"
#4	2"
#5	2 1/2"
#6	4 1/2"

STANDARD HOOK DETAILS FOR STIRRUPS & TIES

2 TYPICAL REINFORCEMENT DETAILS
1" = 1'-0"

4 / S 1.1 Development Length for Tension Bars ($f'c$ = 4,000 psi ; f_y = 60,000 psi)

Bar Size	d_b (in)	A_b (in^2)	L_d (in)
3	0.375	1.5	3.0
4	0.50	2.0	3.0
5	0.625	2.5	3.0
6	0.75	4.5	9.0
7	0.875	5.25	10.5
8	1.0	6.0	12.0
9	1.128	1.5	3.0
10	1.27	2.0	3.0
11	1.41	2.5	3.75
14	1.693	4.5	4.5
18	2.257	5.25	5.25

5 / S 1.1 Standard Hooks for Tension Bars

Hook Type	Bar Size	d_b (in)	Min. Bend Diam. (in)	Straight Extension (in)
90°	3	0.375	2.25	4.5
90°	4	0.50	3.0	6.0
90°	5	0.625	3.75	7.5
90°	6	0.75	4.5	9.0
90°	7	0.875	5.25	10.5
90°	8	1.0	6.0	12.0
90°	9	1.128	9.0	13.5
90°	10	1.27	10.25	15.25
90°	11	1.41	11.25	17.0
90°	14	1.693	17.0	20.5
90°	18	2.257	22.5	27.0
180°	3	0.375	2.25	4.5
180°	4	0.50	3.0	6.0
180°	5	0.625	3.75	7.5
180°	6	0.75	4.5	9.0
180°	7	0.875	5.25	10.5
180°	8	1.0	6.0	12.0
180°	9	1.128	9.0	13.5
180°	10	1.27	10.25	15.25
180°	11	1.41	11.25	17.0
180°	14	1.693	17.0	20.5
180°	18	2.257	22.5	27.0

6 / S 1.1 Standard Hooks for Stirrups, Ties, & Hoops

Hook Type	Bar Size	d_b (in)	Min. Bend Diam. (in)	Straight Extension (in)
90°	3	0.375	1.5	3.0
90°	4	0.50	2.0	3.0
90°	5	0.625	2.5	3.0
90°	6	0.75	4.5	9.0
90°	7	0.875	5.25	10.5
90°	8	1.0	6.0	12.0
135°	3	0.375	1.5	3.0
135°	4	0.50	2.0	3.0
135°	5	0.625	2.5	3.75
135°	6	0.75	4.5	4.5
135°	7	0.875	5.25	5.25
135°	8	1.0	6.0	6.0
180°	3	0.375	1.5	2.5
180°	4	0.50	2.0	2.5
180°	5	0.625	2.5	2.5
180°	6	0.75	4.5	3.0
180°	7	0.875	5.25	3.5
180°	8	1.0	6.0	4.0

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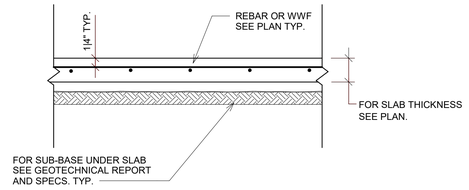
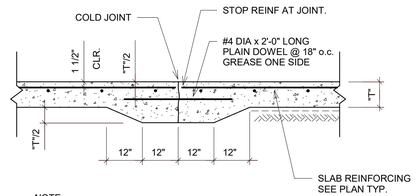


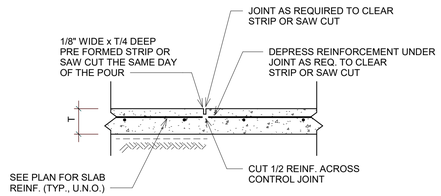
1 TYPICAL SLAB ON GRADE
1" = 1'-0"



NOTE:

1. CONTROL JOINTS TO LOCATED AT COLUMN CENTER LINES AND AT 20'-0" O.C. MAX. AND EVERY 400 SQUARE FEET.
2. IF SAW-CUT CONTROL JOINT TO BE USED, SAW-CUT WITHIN 24 HOURS OF POUR.

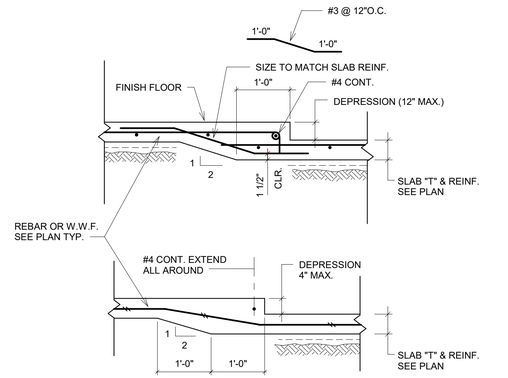
2 TYPICAL SLAB ON GRADE CONSTRUCTION JOINT
1" = 1'-0"



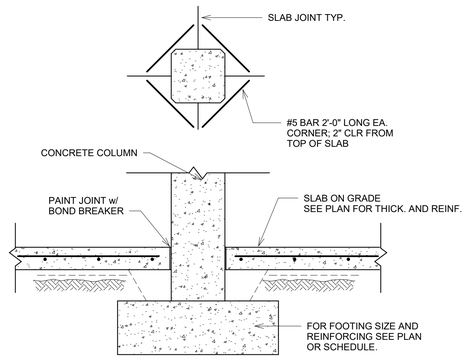
NOTES:

1. CONTROL JOINTS TO LOCATED AT COLUMN CENTER LINES AND AT 20'-0" O.C. MAX. AND EVERY 400 SQUARE FEET.
2. IF SAW-CUT CONTROL JOINT TO BE USED, SAW-CUT WITHIN 24 HOURS OF POUR.
3. SEE PLAN FOR "T".

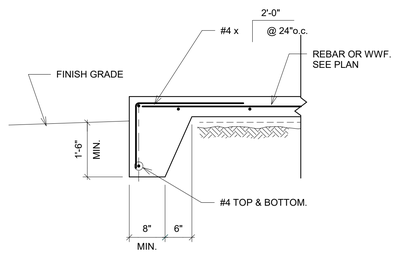
3 TYPICAL SLAB ON GRADE CONTROL JOINT
1" = 1'-0"



4 TYPICAL SLAB ON GRADE DEPRESSION DETAIL
1" = 1'-0"



5 TYPICAL SLAB ON GRADE JOINTING AT CONCRETE COLUMN
1" = 1'-0"



6 TYPICAL SLAB ON GRADE EDGE DETAILS
1" = 1'-0"

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SLAB ON GRADE DETAILS

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1" = 1'-0"

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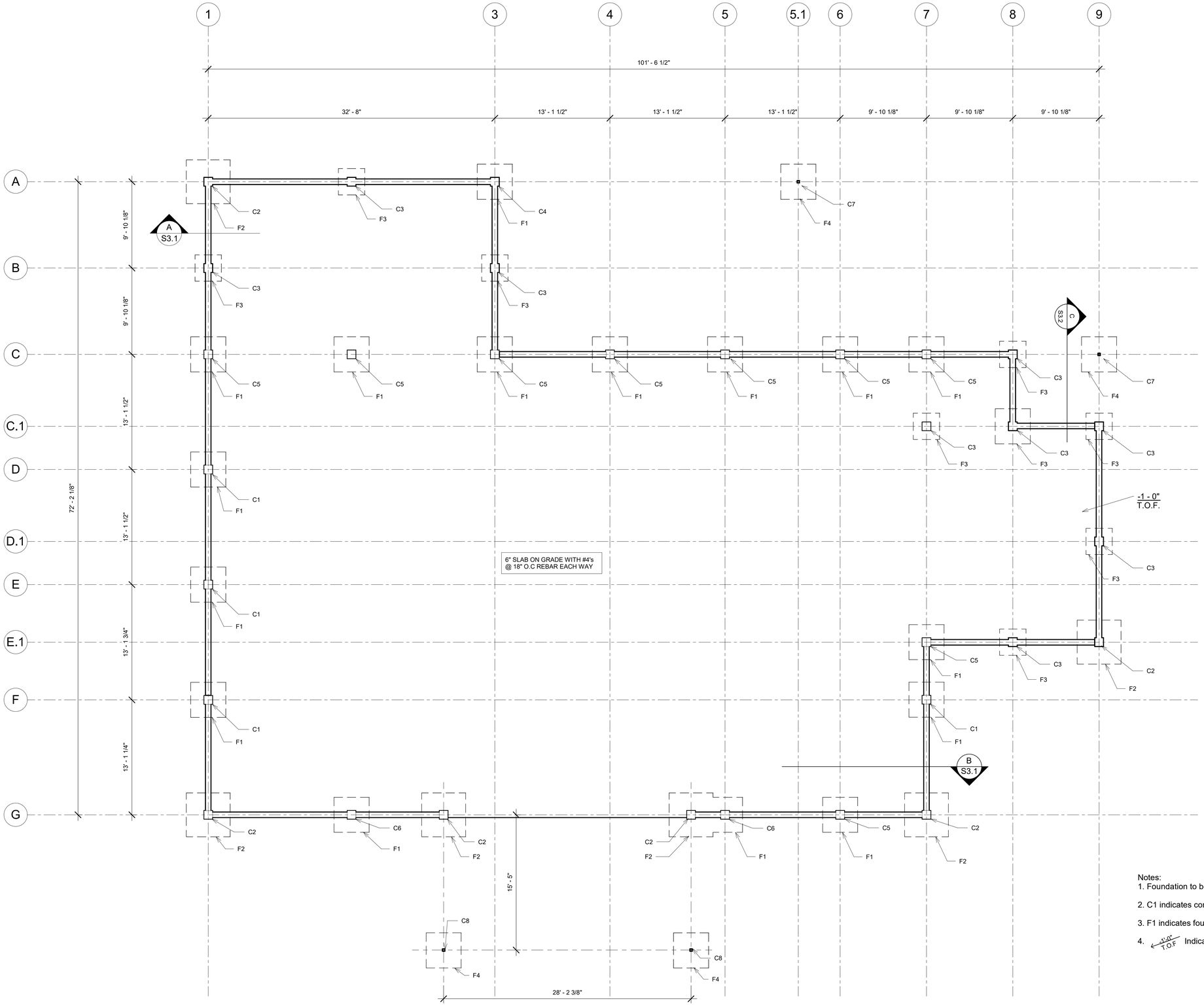

1 FOUNDATION PLAN
3/16" = 1'-0"

NORTH

Must be checked by licensed engineer before construction

Notes:
1. Foundation to be prepared in accordance to geotechnical report.
2. C1 indicates concrete column, see ⊖ for size and reinforcement.
3. F1 indicates foundation, see ⊖ for size and reinforcement.
4. -1'-0" T.O.F. Indicates top of foundation (reference finished floor (0'-0")).

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FOUNDATION PLAN

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3/16" = 1'-0"

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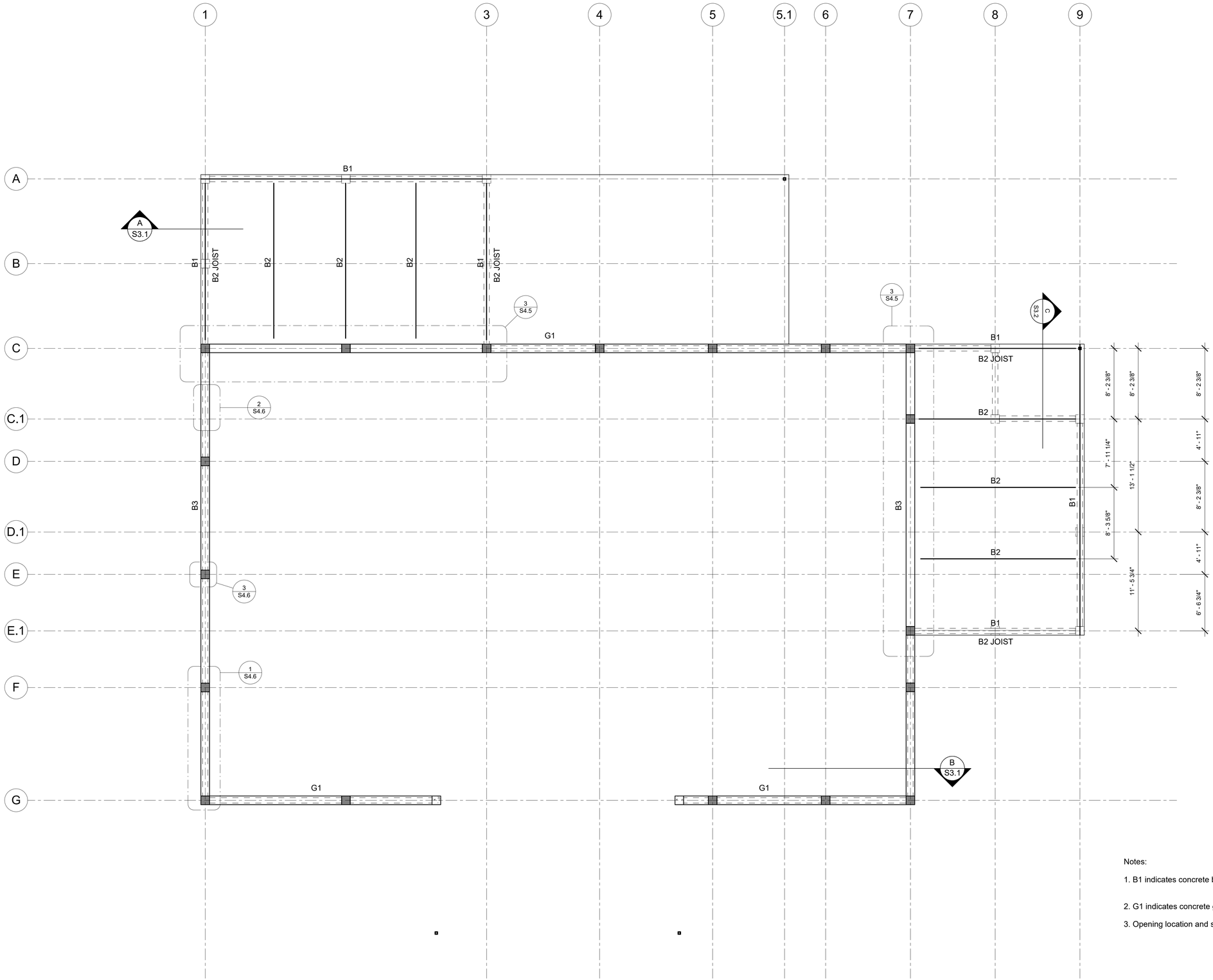
S2.1



1 2nd FLOOR PLAN
3/16" = 1'-0"

NORTH

Must be checked by licensed engineer before construction

Notes:

1. B1 indicates concrete beam, see ⊖ for size and reinforcement.
2. G1 indicates concrete girder, see ⊖ for size and reinforcement.
3. Opening location and sizes to be verified with architectural drawings.

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2ND FLOOR FRAMING PLAN

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3/16" = 1'-0"

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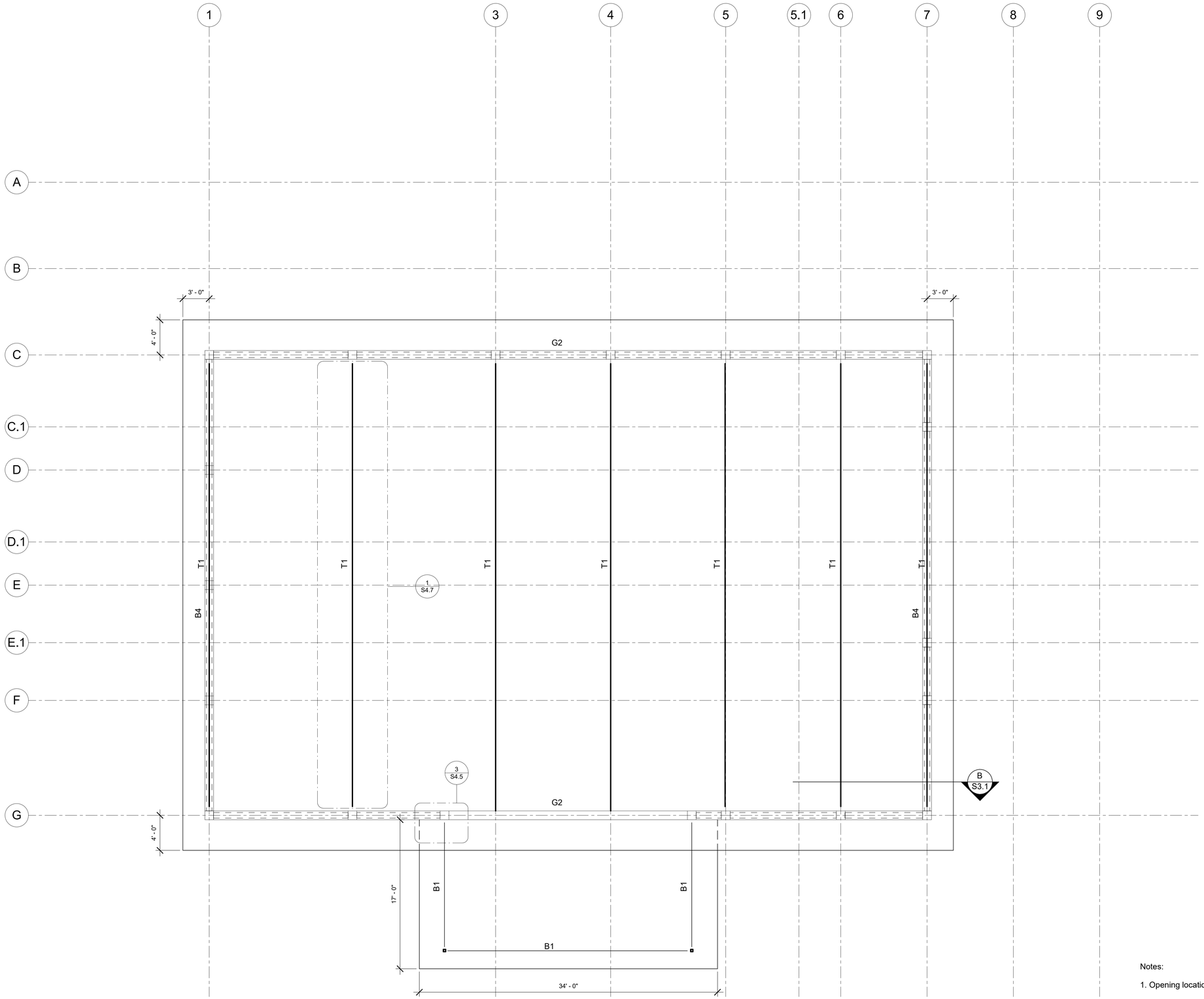

1 ROOF PLAN
3/16" = 1'-0"

NORTH

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Notes:

1. Opening location and sizes to be verified with architectural drawings.

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ROOF FRAMING PLAN

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3/16" = 1'-0"

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S2.3

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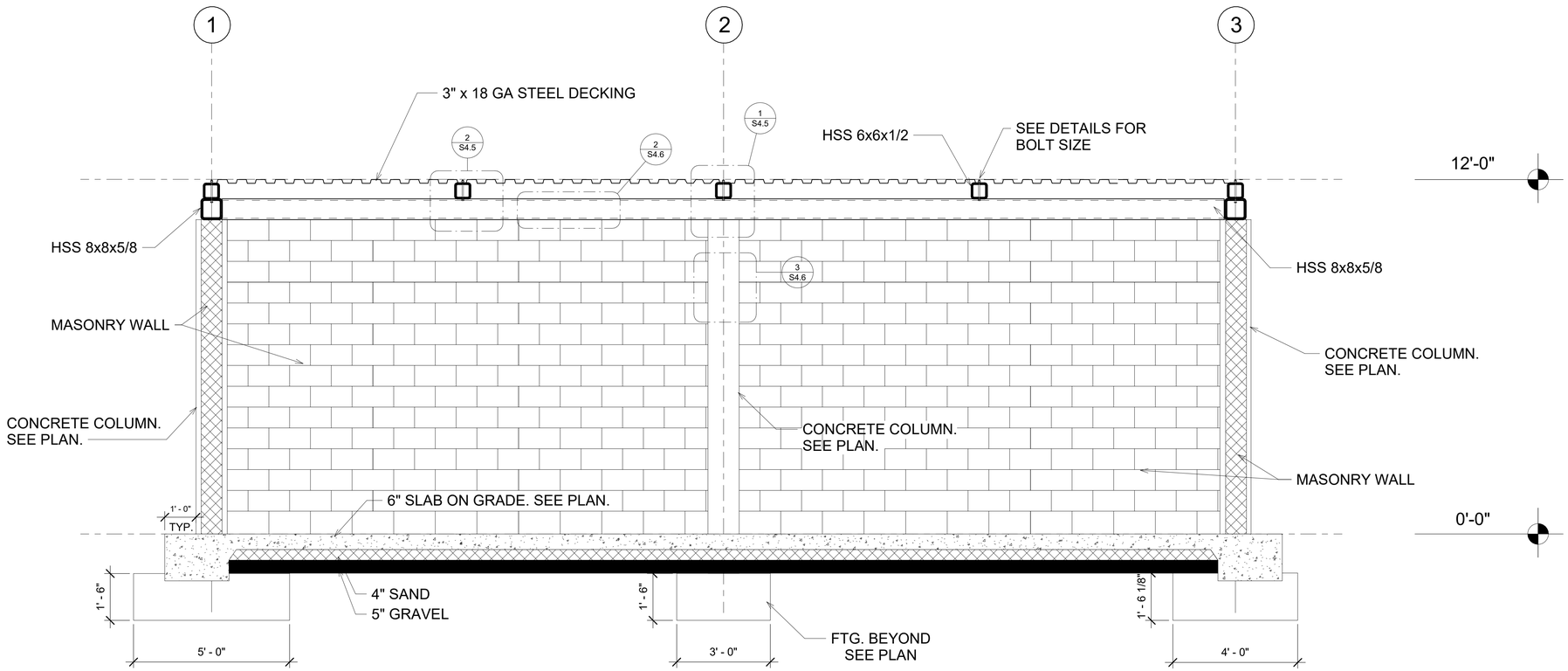
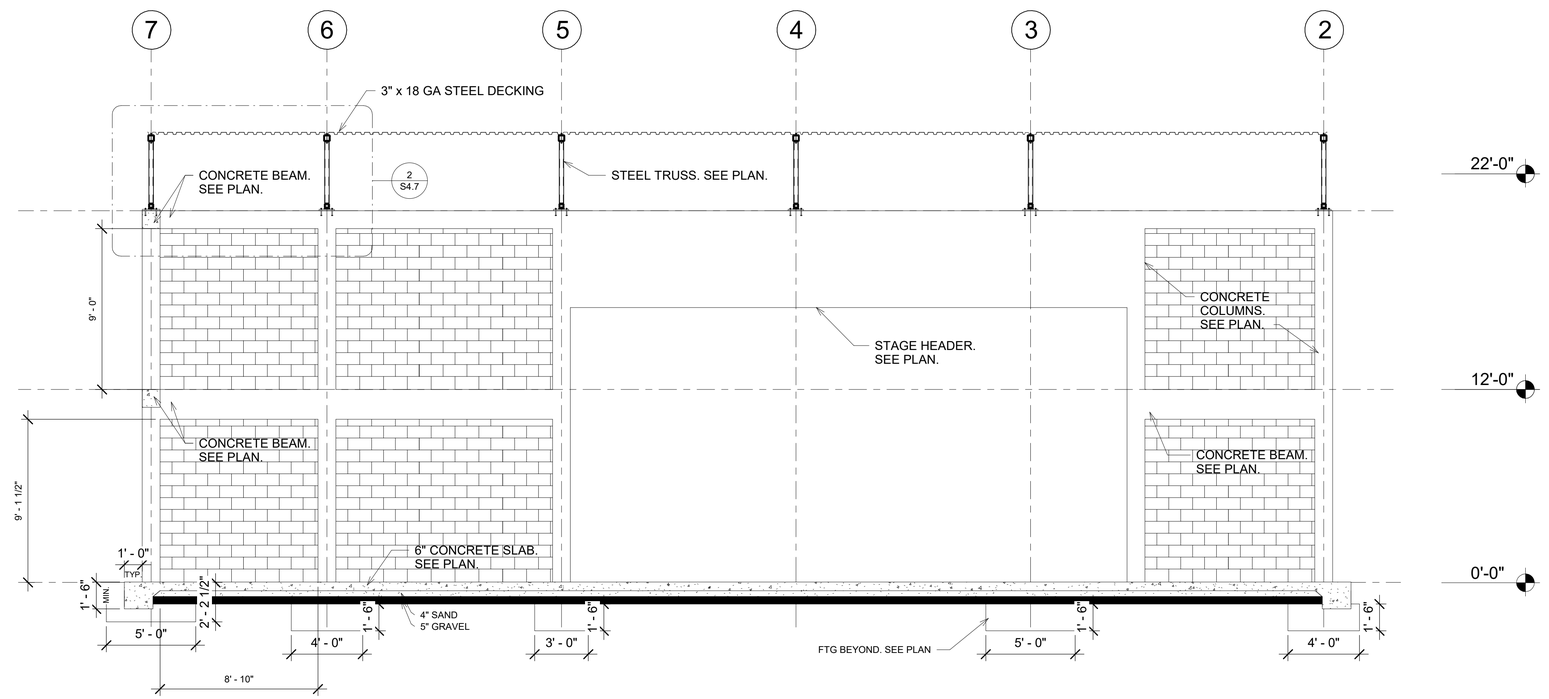


A N-S SECTION - GRIDLINE 1
1/2" = 1'-0"



B N-S SECTION - GRIDLINE 7
1/4" = 1'-0"

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N-S SECTION

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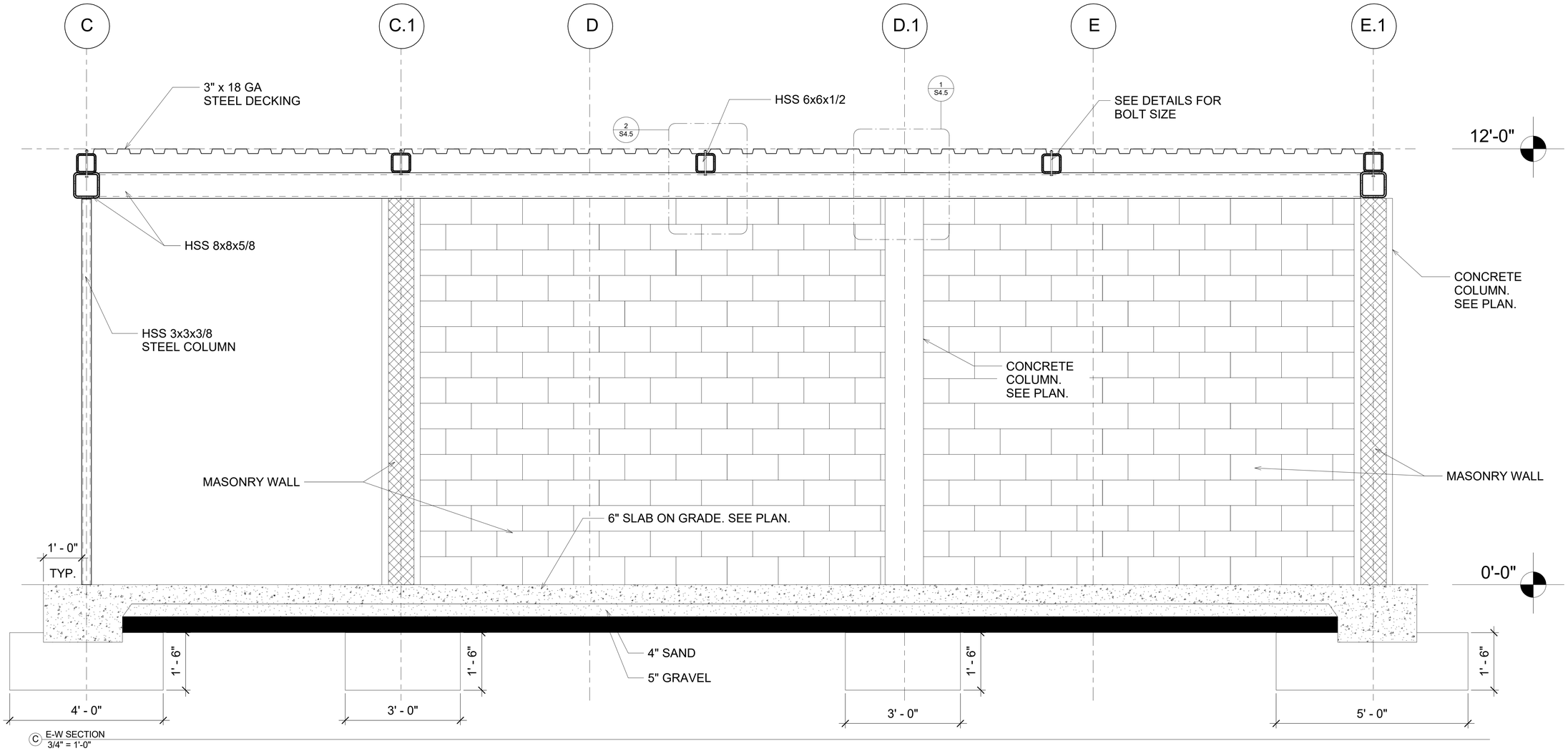

Ⓒ E-W SECTION
3/4" = 1'-0"

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E-W SECTION

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3/4" = 1'-0"

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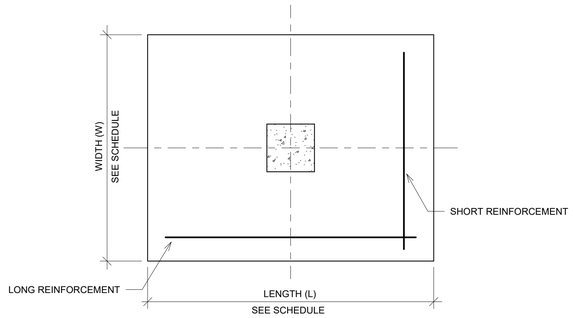
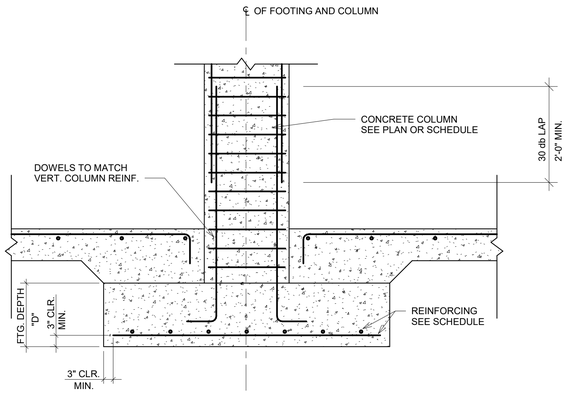


PLAN SECTION



ELEVATION SECTION

FOOTING SCHEDULE			
MARK	SIZE		REINFORCING DETAILS
	"W" x "L"	DEPTH	
F1	4'-0" SQ.	1'-6"	No. 4 @ 12" O.C. EACH WAY
F2	5'-0" SQ.	1'-6"	No. 4 @ 12" O.C. EACH WAY
F3	3'-0" SQ.	1'-6"	No. 4 @ 12" O.C. EACH WAY
F4	4'-0" SQ.	1'-6"	No. 4 @ 12" O.C. EACH WAY

1 FOOTING DETAIL AND SCHEDULE
1" = 1'-0"

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1" = 1'-0"

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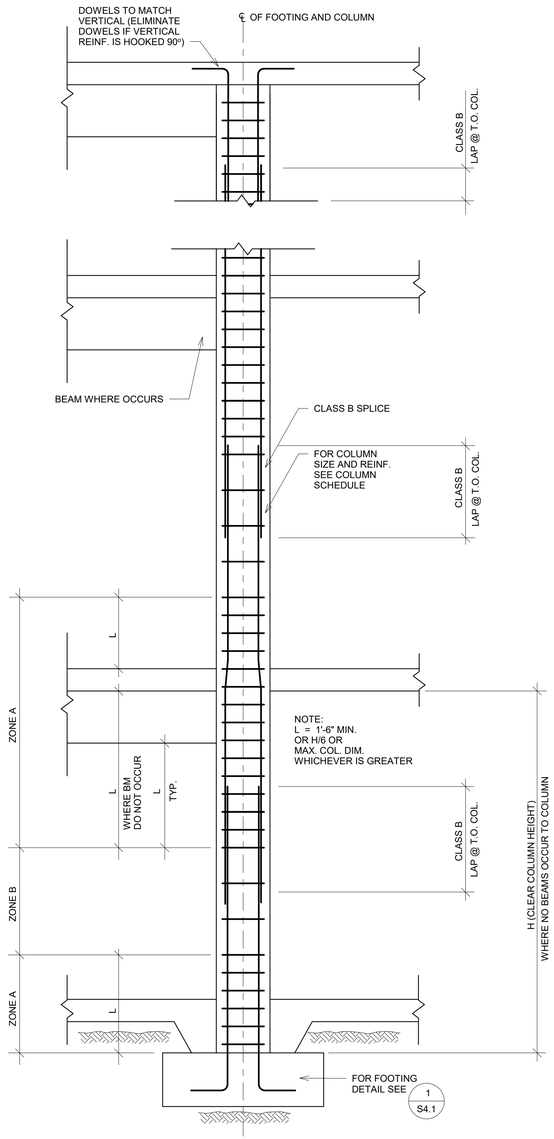
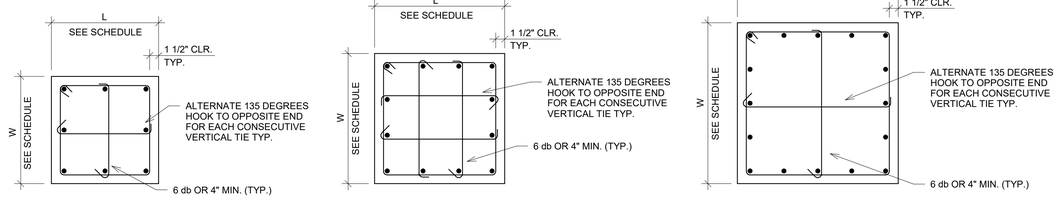


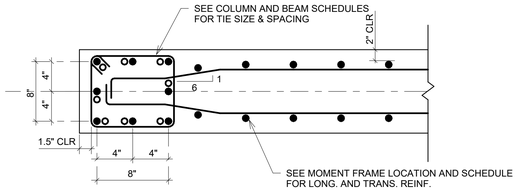
1 COLUMN DETAIL AND SCHEDULE
1" = 1'-0"

COLUMN SCHEDULE

C1/4/5/6	C2	C3	C7	C8	COLUMN MARK	
12" x 12"	12" x 12"	12" x 12"	HSS 3x3x1/8	HSS 3x3x3/16	SIZE	2ND LEVEL
8 #4's	8 #6's	8 #5's	-	-	VERT. REINF.	
#4's @ 3" o.c.	#4's @ 3" o.c.	#4's @ 3" o.c.	-	-	ZONE A TIES	
#4's @ 3" o.c.	#4's @ 4" o.c.	#4's @ 3" o.c.	-	-	ZONE B TIES	
2A / S4.2	2A / S4.2	2B / S4.2	-	-	COLUMN SECTION	
12" x 12"	12" x 12"	12" x 12"	HSS 3x3x1/8	HSS 3x3x3/16	SIZE	1ST LEVEL.
8 #4's	8 #6's	8 #5's	-	-	VERT. REINF.	
#4's @ 3" o.c.	#4's @ 3" o.c.	#4's @ 3" o.c.	-	-	ZONE A TIES	
#4's @ 3" o.c.	#4's @ 4" o.c.	#4's @ 3" o.c.	-	-	ZONE B TIES	
2A / S4.2	2A / S4.2	2B / S4.2	-	-	COLUMN SECTION	



2 TYPICAL CONCRETE COLUMN TYPES
1" = 1'-0"



3 MOMENT FRAME COLUMN TO BEAM
1" = 1'-0"

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COLUMN DETAIL AND SCHEDULE

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1" = 1'-0"

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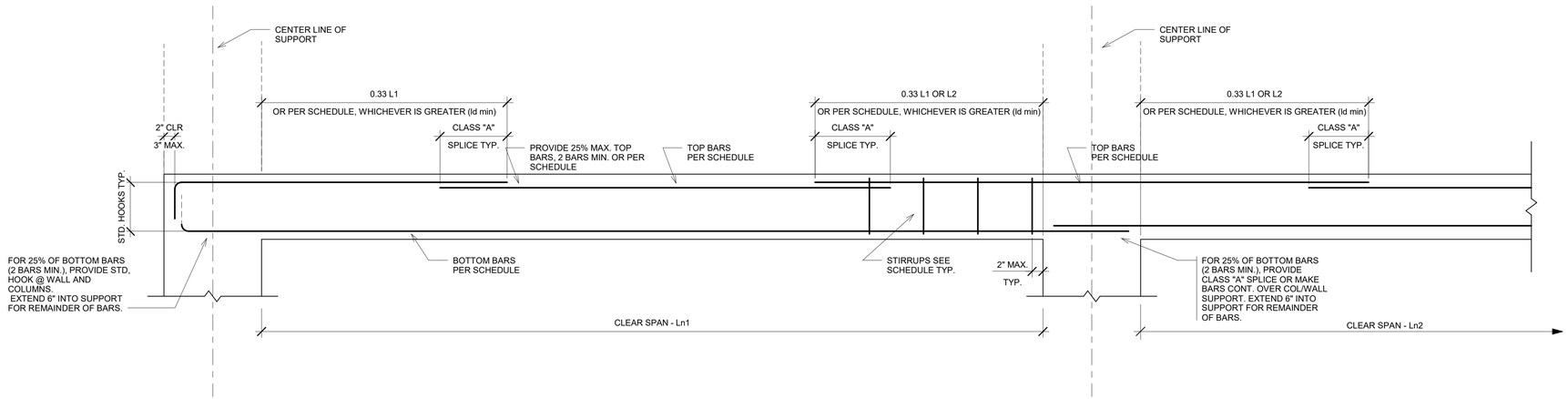


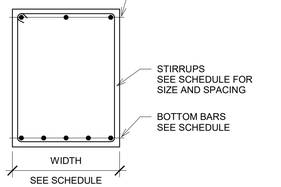
NOTES:

1. FOR TOP BARS AT INTERIOR SUPPORT, PROVIDE THE LARGEST STEEL AREA REQUIRED FOR ADJACENT SPANS.

2. TOP LEFT BARS ARE SOUTH AND WEST END, TOP RIGHT ARE NORTH AND EAST END U.N.O. ON PLANS OR SCHEDULE.

3. SEE LAP SPLICE SCHEDULE FOR ld

1 BEAM DETAIL
1" = 1'-0"



2 CONCRETE BEAM SECTION
1" = 1'-0"

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BEAM DETAIL

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1" = 1'-0"

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BEAM SCHEDULE

MARK	WIDTH	DEPTH	SUPPORT BEAM OR FACE OF WALL	SUPPORT BEAM OR FACE OF WALL	TRANSVERSE REINFORCEMENT LEFT	TRANSVERSE REINFORCEMENT MIDDLE	TRANSVERSE REINFORCEMENT RIGHT	REMARKS
B1	-	-	HSS 8x8x5/8		-	-	-	A992 STEEL
B2	-	-	HSS 6x6x1/2		-	-	-	A992 STEEL @ 1.5:12 SLOPE
B3 & B4	12"	12"	T: 2 #6's B: 2 #6's	T: 3 #6's	#3's @ 4" o.c.			
B3 & B4	12"	12"	B: 2 #6's	T: 3 #6's	#3's @ 4" o.c.			
B3 & B4	12"	12"	B: 2 #6's	T: 2 #6's	#3's @ 4" o.c.			
G1	12"	20"	T: 2 #6's B: 2 #6's	T: 3 #6's	#3's @ 8" o.c.			
G1	12"	20"	B: 2 #6's	T: 3 #6's	#3's @ 8" o.c.			
G1	12"	20"	B: 2 #6's	T: 2 #6's	#3's @ 8" o.c.			
G2	12"	12"	T: 2 #7's B: 2 #6's	T: 3 #7's	#3's @ 4" o.c.			
G2	12"	12"	B: 2 #6's	T: 3 #7's	#3's @ 4" o.c.			
G2	12"	12"	B: 2 #6's	T: 2 #7's	#3's @ 4" o.c.			
B5	12"	12"	T: 2 #7's B: 2 #6's	T: 2 #7's	#3's @ 4" o.c.			
B5	12"	12"	B: 2 #6's	T: 2 #7's	#3's @ 4" o.c.			HOOPS PROVIDED A DISTANCE OF 2d AWAY FROM FACE OF COLUMNS; STIRRUPS PROVIDED EVERYWHERE ELSE ALONG BEAM
B5	12"	12"	B: 2 #6's	T: 2 #7's	#3's @ 4" o.c.			
B6	12"	12"	T: 2 #6's B: 2 #5's	T: 2 #6's	#3's @ 4" o.c.			
B6	12"	12"	B: 2 #5's	T: 2 #6's	#3's @ 4" o.c.			HOOPS PROVIDED A DISTANCE OF 2d AWAY FROM FACE OF COLUMNS; STIRRUPS PROVIDED EVERYWHERE ELSE ALONG BEAM
B6	12"	12"	B: 2 #5's	T: 2 #6's	#3's @ 4" o.c.			
H1	12"	53"	T: 3 #8's B: 3 #8's	T: 3 #8's	#4's @ 24" o.c.			ABOVE STAGE OPENING
H2	12"	18"	T: 2 #6's B: 3 #6's	T: 2 #6's	#3's @ 3" o.c.			ABOVE ALL WINDOW/DOOR HDRS ON GRIDLINES C&G
H3	12"	26"	T: 2 #6's B: 3 #6's	T: 2 #6's	#3's @ 6" o.c.			ABOVE ALL WINDOW/DOOR HDRS ON GRIDLINES 1&7

1 BEAM SCHEDULE
1" = 1'-0"

Must be checked by licensed engineer before construction

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BEAM SCHEDULE

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1" = 1'-0"

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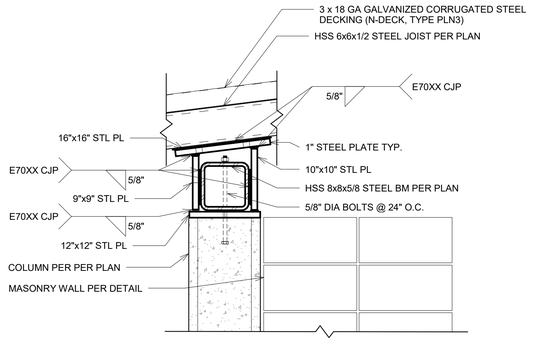
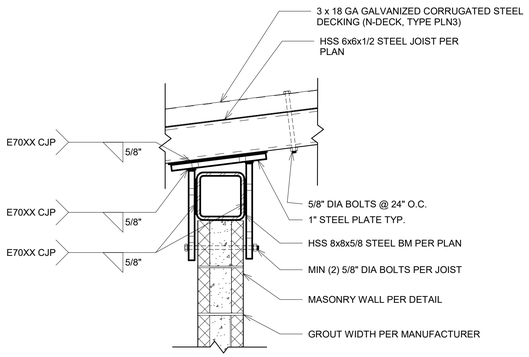
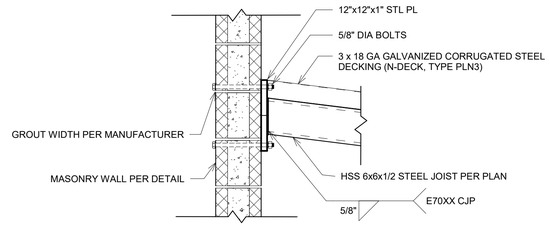
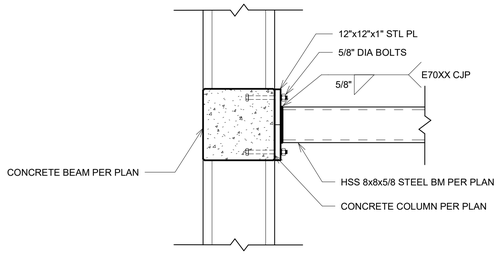


1 STEEL BEAM TO CONCRETE COLUMN
1" = 1'-0"



2 STEEL BEAM TO MASONRY WALL
1" = 1'-0"





3 STEEL BEAM TO CONCRETE AND MASONRY FRAMING SYSTEM
1" = 1'-0"

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STEEL FRAMING DETAILS

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1" = 1'-0"

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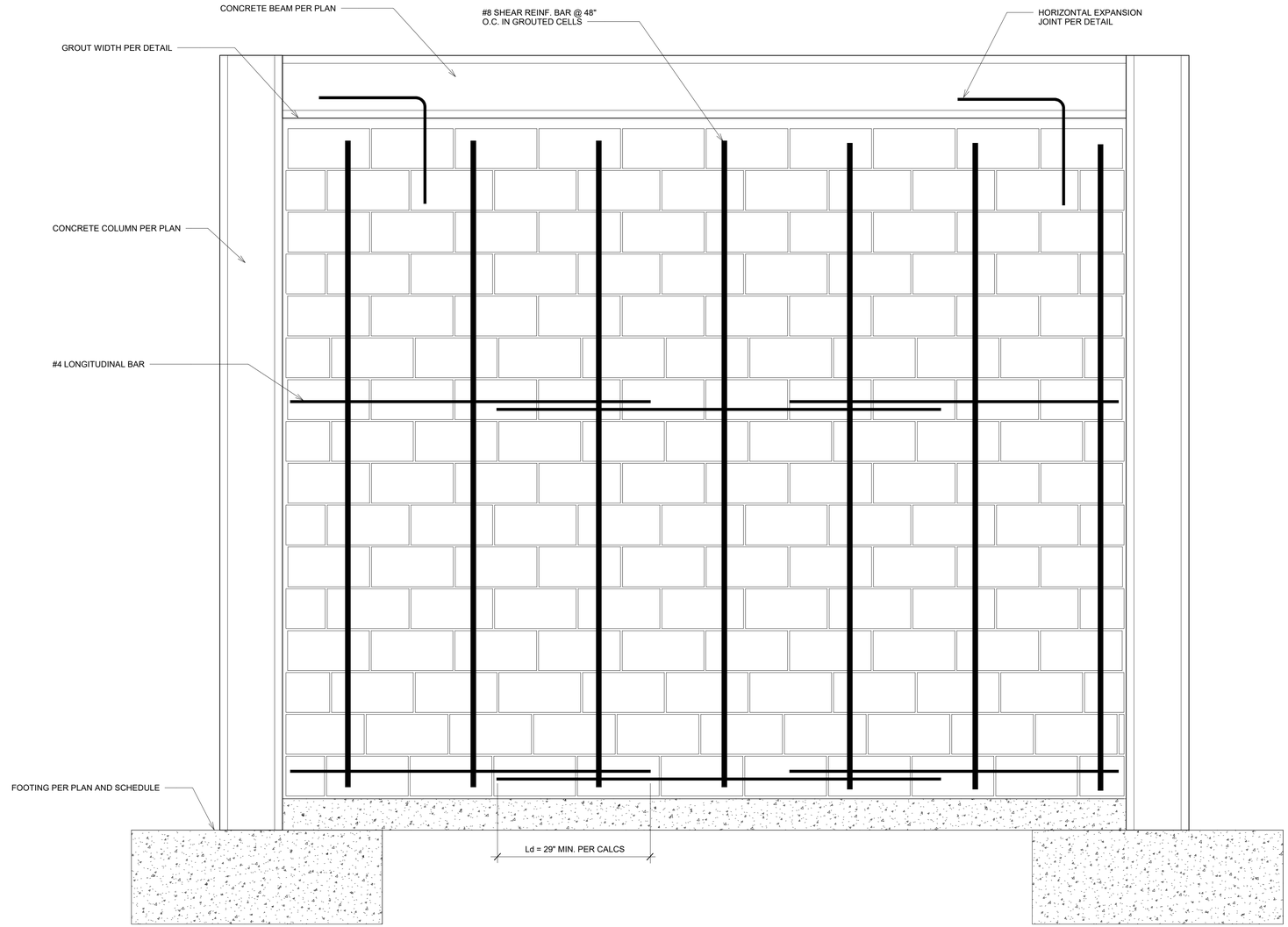
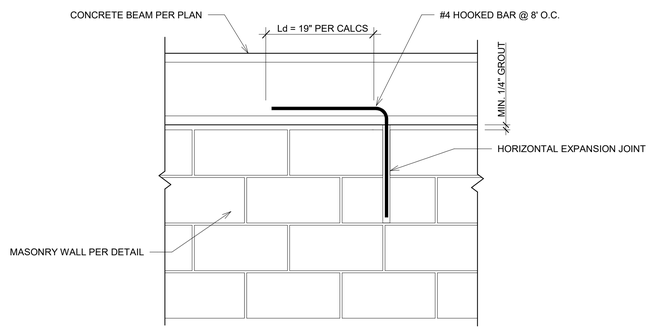
S4.5

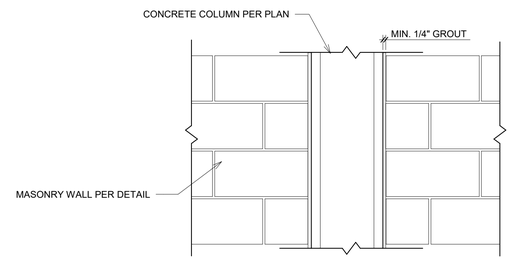
Must be checked by licensed engineer before construction



1 MASONRY WALL
1" = 1'-0"



2 CONCRETE BEAM TO MASONRY WALL
1" = 1'-0"



3 CONCRETE COLUMN TO MASONRY WALL
1" = 1'-0"

Journeyman International

Engineers

Jocelyn Lu
Mindy Trieu

Client

MissionTwenty-Five35

Revisions

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Project

Community Center and Stage

Sheet Name

MASONRY WALL DETAILS

Plot date

6/19/2017
7:16:24 PM

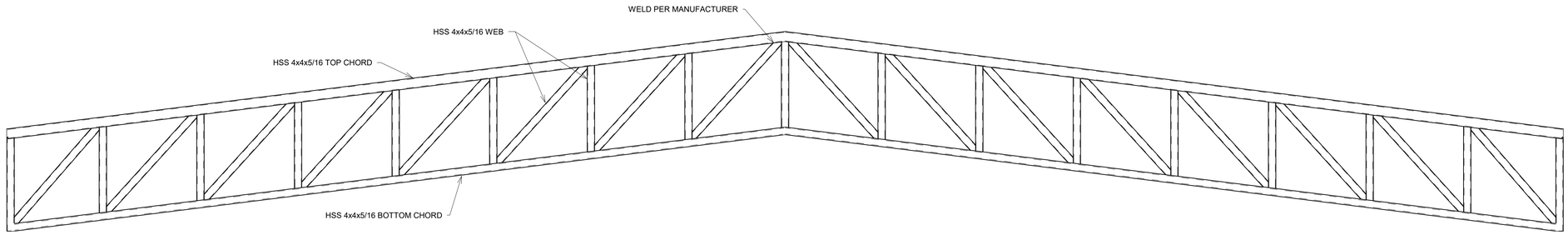
Scale

1" = 1'-0"

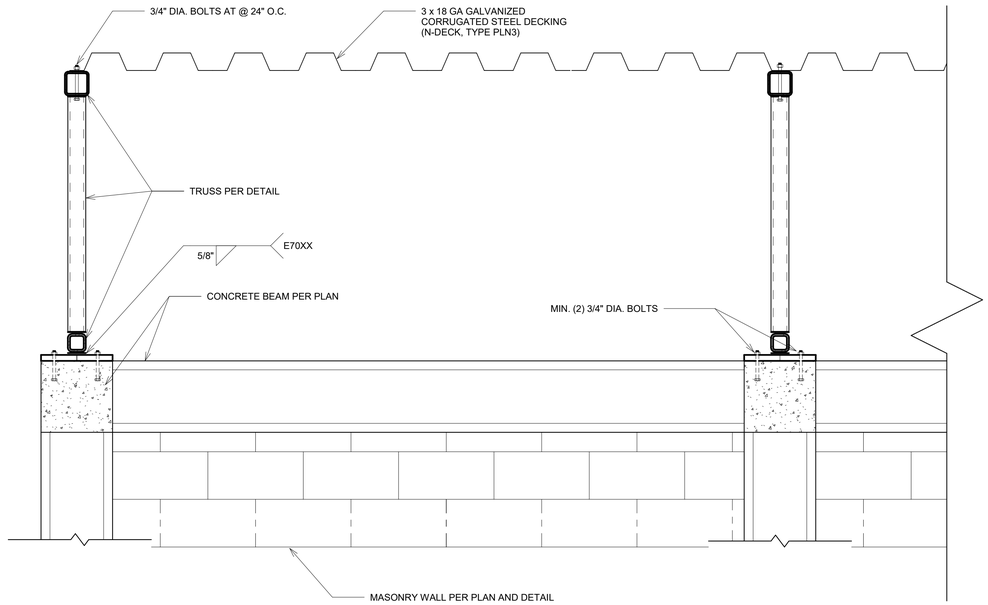
Sheet No.

S4.6

Must be checked by licensed engineer before construction



1 ROOF TRUSS
1/2" = 1'-0"



2 TRUSS TO CONCRETE BEAM AND ROOF DECKING
1" = 1'-0"

Journeyman International

Engineers

Jocelyn Lu
Mindy Trieu

Client

MissionTwenty-Five35

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Project

Community Center and Stage

Sheet Name

TRUSS DETAILS

Plot date

6/19/2017
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Scale

As indicated

Sheet No.

S4.7