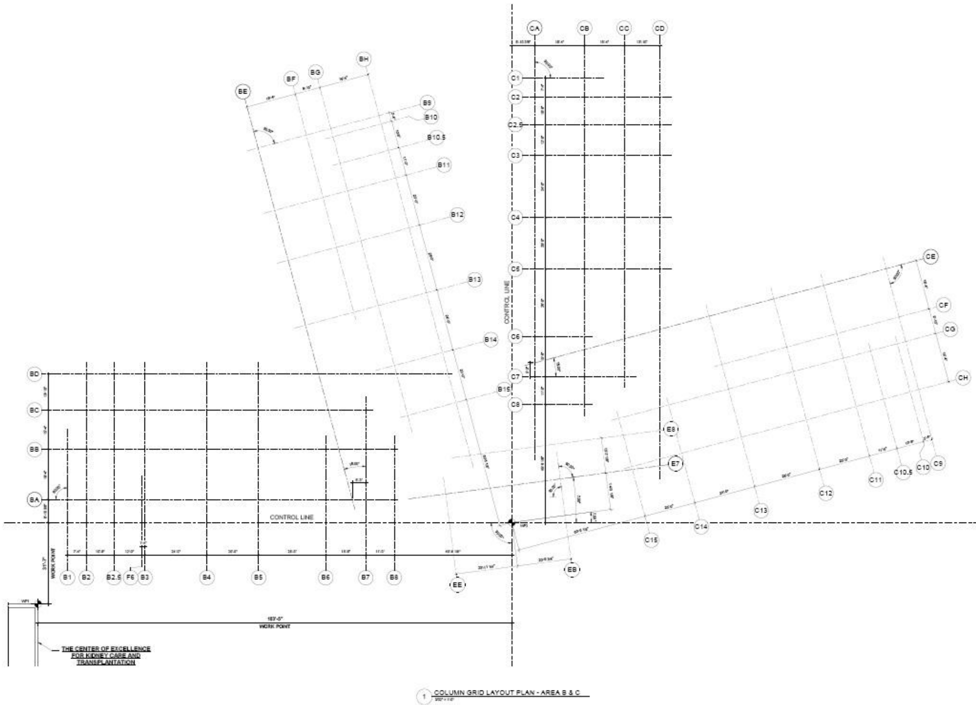
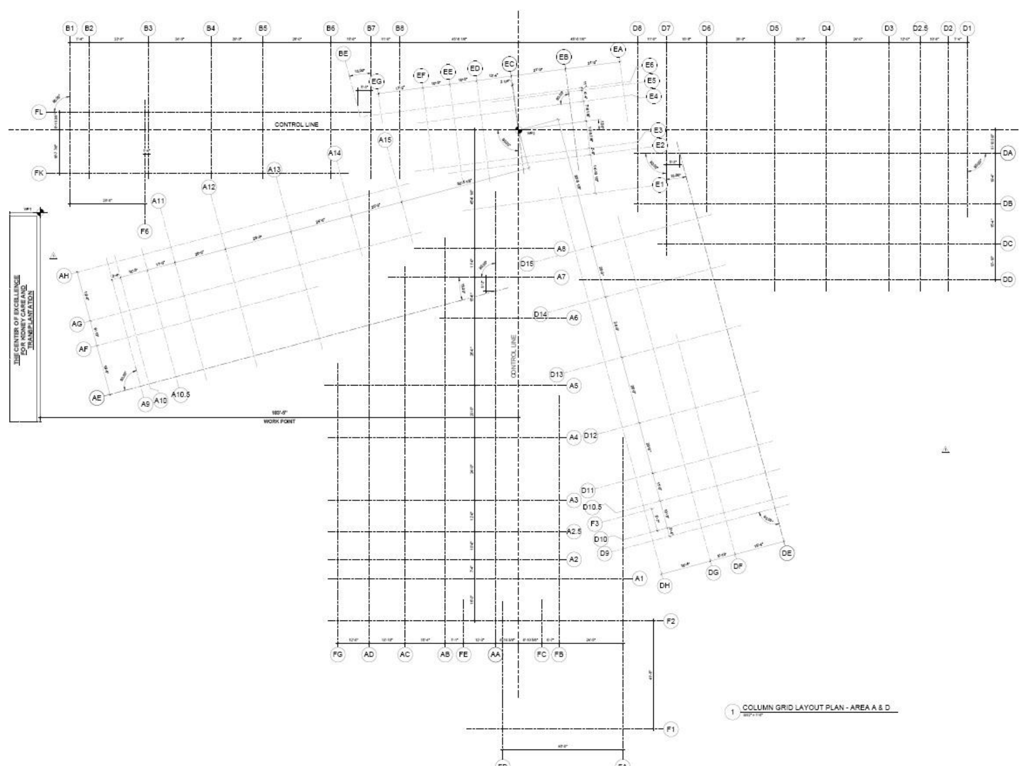
APPENDICES

Appendix A: Existing Grid Layouts





Appendix B: Gravity System Redesign

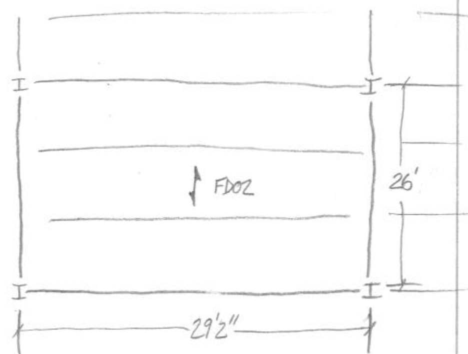
Gravity Design | Los Angeles, CA | BRIAN BRUNNET | 1

Deck Design

Loads:

- LL = 80psf
- Floor DL:
  - + Metal Deck = 3psf
  - + MEP = 20psf
  - + Framing = 12psf
  - + LWC topping = 58psf
  - + Blend. Fiber Reinf. = 12psf

105 psf + partitions = 20psf = 125psf



$$\text{Span} = \frac{26'\text{-}0''}{3_{spans}} = 8.67'$$

From Vulcraft Deck Manual:

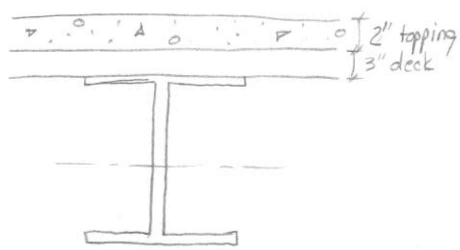
- 3VLI20 w/ total slab depth = 5"

Results:

+ SDI Max Unshored Clear Span = 14'7" > 8.67" ☑ ok
+ Superimp. LL = 142 psf (interpol.) > 125psf ☑ ok
+ Deck wt. 35psf < 58psf ☑ ok (conservative)
+ Fire rating: w/ cementious FP ⟶ 2hr. Rating ☑

Use 3VLI20 composite deck w/ t_{Tot} = 5"

Typical Beam



Deck: (3VLI20)
w/5" tot thickness ($t = 2''$)

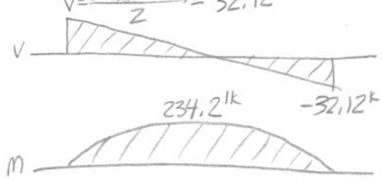
Properties:
Spacing = 8.67'
Span = 29'2"
$F'_c = 3$ ksi
$F_y = 50$ ksi
Studs: $\frac{3}{4}''$ / 1 per rib
Deck: perpendic. / LWC

$$b_{eff} = \begin{cases} \frac{29'2''}{4} = 7.292' \text{ (governs)} \\ \text{spacing} = 8.67' \end{cases}$$

$A_T = (8.67)(29'2'') = 252.8\ ft^2$ ☒ No LL red.

$w_u = ((1.2)(105) + (1.6)(80))(8.67') = 2.2$ klf

$V = \frac{(2.2)(29.167')}{2} = 32.12^k$



$V'_c = (.85)(3)(87.5'')(2'') = 446.25^k$

$V'_s = (7.69in^2)(50ksi) = 384.5^k$

Since $V'_q < V'_s + V'_c$ → partially composite

try W14x26 $A = 7.69 in^2$

$\Sigma Q_n = \frac{279^k}{17.2^k/std} = 16$ studs (try)

$16 \text{studs} = \frac{\Sigma Q_n}{17.2} = 275.2^k = V'_q$

$a = \frac{275.2}{(.85)(3)(87.5'')} = 1.233''$ → since $a < 3''$ deck depth, suffic. conc. is available

$A_{s-c} = \frac{384.5 - 275.2}{2(50)} = 1.093 in^2$

$x = \frac{1.093}{5.03''} = 0.217'' < 0.420''$ (t_f) (PNA in flange)

$M_n = 384.5^k\left(\frac{13.9''}{2}\right) + 275.2^k\left(5.03'' - \frac{1.233}{2}\right) - 109.3^k\left(\frac{.217''}{2}\right)$

$M_n = 3875.01''^k$

$\phi M_n = (0.9)\left(\frac{3875.01}{12}\right) = \boxed{290.63'^k} > 234.2'^k$ ∴ ok

Typ. Beam

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

$w_D = (105psf)(8.67') = 0.91$ klf

$w_L = (80psf)(8.67') = 0.694$ klf

$w_{TL} = (.91) + (.694) = 1.6$ klf

$$\Delta_{DL} = \frac{5(.91)(29.167)^4(1728)}{384(29000)(657.4)} = 0.777''$$

$$\Delta_{LL} = \frac{5(.694)(29.167)^4(1728)}{384(29000)(657.4)} = 0.593'' < 0.97'' \text{ ok}$$

$$\Delta_{TL} = \frac{5(1.6)(29.167)^4(1728)}{384(29000)(657.4)} = 1.37'' < 1.46'' \text{ ok}$$

$$\Delta_{LL}^{allow} = \frac{L}{360} = \frac{(29.167')(12)}{360} = 0.97''$$

$$\Delta_{TL}^{allow} = \frac{L}{240} = \frac{29.167(12)}{240} = 1.46''$$

$Y2 = 4.384''$

$Y1 = 0.217''$

$I_{LB} = 657.4\ in^2$

$\phi V_n = V_q'$

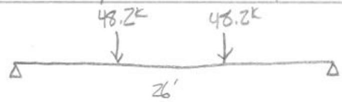
$$V_u = \frac{wL}{2} = \frac{(1.2(.91) + 1.6(.694))(29.167)}{2}$$

$V_u = 32.1^k$

$\phi V_n = 275.2^k > 32.1^k$ ok

Use W14×26 for typ. beam

w/ 16 shear studs



A5-A6

$b_{eff} = \begin{cases} \frac{26'}{4} = 6.5' \text{ (governs)} \\ \text{spac.} = 14.33' \end{cases}$

$Y1 = 0.309''$

$Y2 = 4.135''$

$I_{LB} = 1190.4 in^4$

$V_c' = (.85)(3)(78'')(2'') = 397.8^k$

$A_T = (26')(24.25') = 630.5 ft^2$

$V_s' = (10.3 in^2)(50) = 515.0^k$

since $V_q' < V_c' + V_s'$ → Partially Composite

$a = \frac{344^k}{(.85)(3)(78)} = 1.73'' < 3''$ ☑ ok

$A_{s-c} = \frac{515.0 - 344}{2(50)} = 1.71 in^2$

$x = \frac{1.71}{5.53} = 0.309'' < 0.440''$ (PNA in flange)

$M_n = 515\left(\frac{15.9}{2}\right) + 344\left(5.53 - \frac{1.73}{2}\right) - 171\left(\frac{.309}{2}\right) = 5672.5'^k$

$\phi M_n = (.9)\left(\frac{5672.5}{12}\right) = 425.4'^k > 417.7'^k$ ☑ ok

Deflection:

$\Delta = \frac{PL^3}{28EI_{LB}}$

$\Delta_{DL} = \frac{(20.4)(26)^3(1728)}{28(29000)(1190.4)} = 0.641''$

$\Delta_{LL} = \frac{(15.1)(26)^3(1728)}{28(29000)(1190.4)} = 0.474'' < 0.867''$ ☑ ok

$\Delta_{TL} = \frac{(35.5)(26)^3(1728)}{28(29000)(1190.4)} = 1.115'' < 1.3''$ ☑ ok

$\Delta_{LL}^{allow} = \frac{26(12)}{360} = 0.867''$ $\Delta_{TL}^{allow} = \frac{26(12)}{240} = 1.3''$

USE W18×35 (w/ 20 shear studs) for typ. girder (A5-A6)

large span = $P = 32.1^k$

small span:

Tot. DL = 105psf + 3psf (beam) = 108 psf

$w_D = (108)(8.67') = 0.94^{klf}$

$w_L = 0.694 klf$

$w_{tot} = 1.2(.94) + 1.6(.694) = 2.24^{klf}$

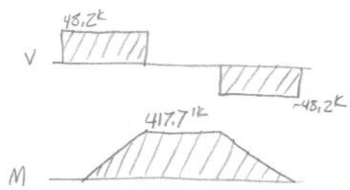
$P = (2.24)\left(\frac{14.33'}{2}\right) = 16.05^k$

$P_{tot} = 32.1^k + 16.1^k = 48.2^k$

$V_u = 48.2^k$

$\phi V_n = V_q' = 344^k > 48.2^k$ ☑ ok

$M_u = (48.2^k)(8.67) = 417.9'^k$



Try W18×35 $A = 10.3 in^2$

$\Sigma Q_n = \frac{335}{17.2} = 19.5$ studs

try 20 studs

$20(17.2) = 344^k = V_q'$

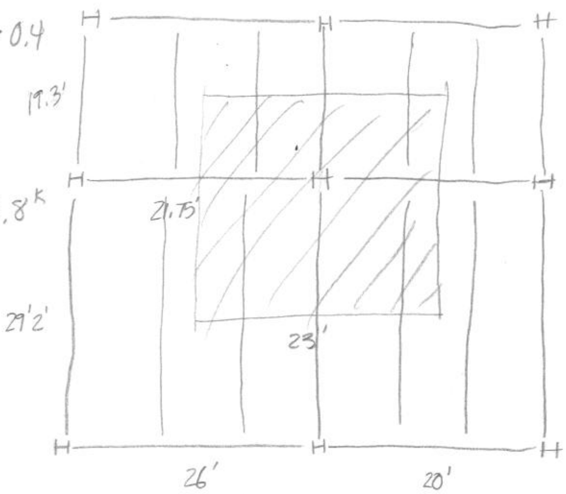
$P_D = \left[.94\left(\frac{29.167}{2}\right) + .94\left(\frac{14.3}{2}\right)\right] = 20.4^k$

$P_L = \left[.694\left(\frac{29.167}{2}\right) + .694\left(\frac{14.3}{2}\right)\right] = 15.1^k$

$P_{TL} = 48.6^k$

Column A5-AB

$LL_{red} = 0.25 + \frac{15}{\sqrt{4(5)557.75}} = 0.39 \rightarrow 0.4$



$P_L = 0.4(80psf)(5)(557.75ft^2) = 89.2^k$

$P_D = (35psf)(557.8) + (105psf)(4)(557.8) = 253.8^k$

$P_U = 1.2(253.8) + 1.6(89.2^k)$

$P_U = 447.3^k$

$K_x = 1.0 \quad L_x = 16' \quad KL_x = 16'$

$KL_y = \frac{16}{r_x/r_y}$

$A_T = (23')(24.25') = 557.75$ ☑ can reduce LL.

Table 4-1: Try W10×60 ($\phi P_n = 528^k$)

$\phi P_n = 528^k > 447.3^k$ ☑ ok $\qquad KL_y = \frac{16}{1.71} = 9.4' < 16'$ ☑ ok

USE W10×60 for Column A5-AB (at base)

GRAVITY COLUMN SCHEDULE:

Ground/1st Floors	AREA A		Ground/1st Floors	AREA B	
Column Line	Column Line	Size	Column Line	Column Line	Size
A2	AD	W10x45	B2	BD	W10x45
A3	AA	W10x54	B3	BA	W10x54
A3	AB	W10x60	B3	BB	W10x60
A3	AD	W10x54	B3	BD	W10x54
A4	AA	W10x49	B4	BA	W10x49
A4	AB	W10x60	B4	BB	W10x60
A4	AD	W10x54	B4	BD	W10x54
A5	AA	W10x49	B5	BA	W10x49
A5	AB	W10x60	B5	BB	W10x60
A5	AD	W10x54	B5	BD	W10x54
A6	AA	W10x49	B6	BA	W10x49
A6	AB	W10x60	B6	BB	W10x60
A7	AC	W10x45	B7	BC	W10x45
A10	AH	W10x33	B10	BH	W10x33
A11	AE	W10x39	B11	BE	W10x39
A11	AF	W10x49	B11	BF	W10x49
A11	AH	W10x45	B11	BH	W10x45
A12	AE	W10x39	B12	BE	W10x39
A12	AF	W10x49	B12	BF	W10x49
A12	AH	W10x49	B12	BH	W10x49
A13	AE	W10x45	B13	BE	W10x45
A13	AF	W10x49	B13	BF	W10x49
A13	AH	W10x49	B13	BH	W10x49
A14	AG	W10x60	B14	BG	W10x60
A14	AH	W10x39	B14	BH	W10x39

Ground/1st Floors	AREA C		Ground/1st Floors	AREA D	
Column Line	Column Line	Size	Column Line	Column Line	Size
C2	CD	W10x45	D2	DD	W10x45
C3	CA	W10x54	D3	DA	W10x54
C3	CB	W10x60	D3	DB	W10x60
C3	CD	W10x54	D3	DD	W10x54
C4	CA	W10x49	D4	DA	W10x49
C4	CB	W10x60	D4	DB	W10x60
C4	CD	W10x54	D4	DD	W10x54
C5	CA	W10x49	D5	DA	W10x49
C5	CB	W10x60	D5	DB	W10x60
C5	CD	W10x54	D5	DD	W10x54
C6	CA	W10x49	D6	DA	W10x49
C6	CB	W10x60	D6	DB	W10x60
C7	CC	W10x45	D7	DC	W10x45
C10	CH	W10x33	D10	DH	W10x33
C11	CE	W10x39	D11	DE	W10x39
C11	CF	W10x49	D11	DF	W10x49
C11	CH	W10x45	D11	DH	W10x45
C12	CE	W10x39	D12	DE	W10x39
C12	CF	W10x49	D12	DF	W10x49
C12	CH	W10x49	D12	DH	W10x49
C13	CE	W10x45	D13	DE	W10x45
C13	CF	W10x49	D13	DF	W10x49
C13	CH	W10x49	D13	DH	W10x49
C14	CG	W10x60	D14	DG	W10x60
C14	CH	W10x39	D14	DH	W10x39

2nd/3rd Floors	AREA A		2nd/3rd Floors	AREA B	
Column Line	Column Line	Size	Column Line	Column Line	Size
A2	AD	W10x33	B2	BD	W10x33
A3	AA	W10x54	B3	BA	W10x54
A3	AB	W10x49	B3	BB	W10x49
A3	AD	W10x54	B3	BD	W10x54
A4	AA	W10x54	B4	BA	W10x54
A4	AB	W10x49	B4	BB	W10x49
A4	AD	W10x54	B4	BD	W10x54
A5	AA	W10x54	B5	BA	W10x54
A5	AB	W10x49	B5	BB	W10x49
A5	AD	W10x54	B5	BD	W10x54
A6	AA	W10x39	B6	BA	W10x39
A6	AB	W10x49	B6	BB	W10x49
A7	AC	W10x33	B7	BC	W10x33
A10	AH	W10x33	B10	BH	W10x33
A11	AE	W10x33	B11	BE	W10x33
A11	AF	W10x39	B11	BF	W10x39
A11	AH	W10x33	B11	BH	W10x33
A12	AE	W10x33	B12	BE	W10x33
A12	AF	W10x39	B12	BF	W10x39
A12	AH	W10x33	B12	BH	W10x33
A13	AE	W10x33	B13	BE	W10x33
A13	AF	W10x39	B13	BF	W10x39
A13	AH	W10x33	B13	BH	W10x33
A14	AG	W10x49	B14	BG	W10x49
A14	AH	W10x33	B14	BH	W10x33

2nd/3rd Floors	AREA C		2nd/3rd Floors	AREA D	
Column Line	Column Line	Size	Column Line	Column Line	Size
C2	CD	W10x33	D2	DD	W10x33
C3	CA	W10x54	D3	DA	W10x54
C3	CB	W10x49	D3	DB	W10x49
C3	CD	W10x54	D3	DD	W10x54
C4	CA	W10x54	D4	DA	W10x54
C4	CB	W10x49	D4	DB	W10x49
C4	CD	W10x54	D4	DD	W10x54
C5	CA	W10x54	D5	DA	W10x54
C5	CB	W10x49	D5	DB	W10x49
C5	CD	W10x54	D5	DD	W10x54
C6	CA	W10x39	D6	DA	W10x39
C6	CB	W10x49	D6	DB	W10x49
C7	CC	W10x33	D7	DC	W10x33
C10	CH	W10x33	D10	DH	W10x33
C11	CE	W10x33	D11	DE	W10x33
C11	CF	W10x39	D11	DF	W10x39
C11	CH	W10x33	D11	DH	W10x33
C12	CE	W10x33	D12	DE	W10x33
C12	CF	W10x39	D12	DF	W10x39
C12	CH	W10x33	D12	DH	W10x33
C13	CE	W10x33	D13	DE	W10x33
C13	CF	W10x39	D13	DF	W10x39
C13	CH	W10x33	D13	DH	W10x33
C14	CG	W10x49	D14	DG	W10x49
C14	CH	W10x33	D14	DH	W10x33

4th/PH Floors	AREA A		4th/PH Floors	AREA B	
Column	Column	Size	Column	Column	Size
A2	AD	W10x33	B2	BD	W10x33
A3	AA	W10x33	B3	BA	W10x33
A3	AB	W10x33	B3	BB	W10x33
A3	AD	W10x33	B3	BD	W10x33
A4	AA	W10x33	B4	BA	W10x33
A4	AB	W10x33	B4	BB	W10x33
A4	AD	W10x33	B4	BD	W10x33
A5	AA	W10x33	B5	BA	W10x33
A5	AB	W10x33	B5	BB	W10x33
A5	AD	W10x33	B5	BD	W10x33
A6	AA	W10x33	B6	BA	W10x33
A6	AB	W10x33	B6	BB	W10x33
A7	AC	W10x33	B7	BC	W10x33
A10	AH	W10x33	B10	BH	W10x33
A11	AE	W10x33	B11	BE	W10x33
A11	AF	W10x33	B11	BF	W10x33
A11	AH	W10x33	B11	BH	W10x33
A12	AE	W10x33	B12	BE	W10x33
A12	AF	W10x33	B12	BF	W10x33
A12	AH	W10x33	B12	BH	W10x33
A13	AE	W10x33	B13	BE	W10x33
A13	AF	W10x33	B13	BF	W10x33
A13	AH	W10x33	B13	BH	W10x33
A14	AG	W10x33	B14	BG	W10x33
A14	AH	W10x33	B14	BH	W10x33

4th/PH Floors	AREA C		4th/PH Floors	AREA D	
Column Line	Column Line	Size	Column Line	Column Line	Size
C2	CD	W10x33	D2	DD	W10x33
C3	CA	W10x33	D3	DA	W10x33
C3	CB	W10x33	D3	DB	W10x33
C3	CD	W10x33	D3	DD	W10x33
C4	CA	W10x33	D4	DA	W10x33
C4	CB	W10x33	D4	DB	W10x33
C4	CD	W10x33	D4	DD	W10x33
C5	CA	W10x33	D5	DA	W10x33
C5	CB	W10x33	D5	DB	W10x33
C5	CD	W10x33	D5	DD	W10x33
C6	CA	W10x33	D6	DA	W10x33
C6	CB	W10x33	D6	DB	W10x33
C7	CC	W10x33	D7	DC	W10x33
C10	CH	W10x33	D10	DH	W10x33
C11	CE	W10x33	D11	DE	W10x33
C11	CF	W10x33	D11	DF	W10x33
C11	CH	W10x33	D11	DH	W10x33
C12	CE	W10x33	D12	DE	W10x33
C12	CF	W10x33	D12	DF	W10x33
C12	CH	W10x33	D12	DH	W10x33
C13	CE	W10x33	D13	DE	W10x33
C13	CF	W10x33	D13	DF	W10x33
C13	CH	W10x33	D13	DH	W10x33
C14	CG	W10x33	D14	DG	W10x33
C14	CH	W10x33	D14	DH	W10x33

Appendix C: Gravity and Lateral Calculations

DEAD LOADS:

- ROOF DL:
  - + Metal Deck = 3 psf
  - + Insulation = 2 psf
  - + MEP = 18 psf
  - + Framing = 12 psf
  - 35 psf

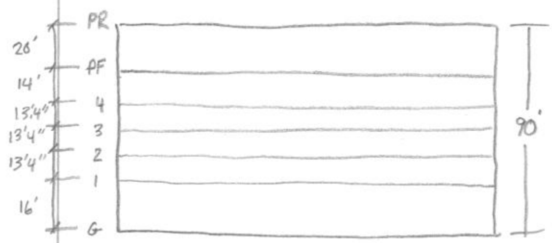
- PENTHOUSE FLOOR DL:
  - + Metal Deck = 3 psf
  - + MEP = 20 psf
  - + Framing = 12 psf
  - + NWC topping = $145 pcf \times \frac{6''}{12} = 72.5 psf$
  - + Blended Fiber Reinforcement = $25 pcf \times \frac{6''}{12} = 12.5 psf$
  - 120 psf

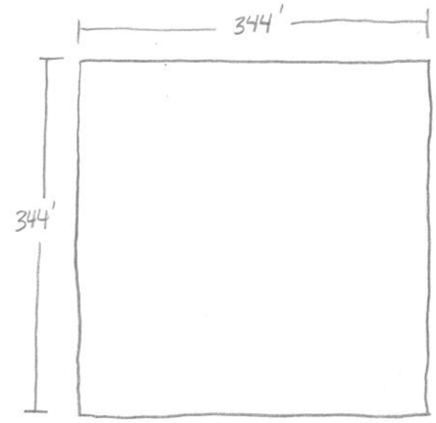
- FLOORS 1 through 4 DL:
  - + Metal Deck = 3 psf
  - + LWC topping = $115 pcf \times \frac{6''}{12} = 57.5 psf$
  - + Blended Fiber Reinforcement = $25 pcf \times \frac{6''}{12} = 12.5 psf$
  - + MEP = 18 psf
  - + Framing = 12 psf
  - 105 psf

LIVE LOADS:

- Hospitals: per ASCE 7-10
  - + Patient Rooms = 40 psf
  - + Corridors = 80 psf
- Roofs:
  - + Flat, pitched, curved = 20 psf
  - + Balconies = 100 psf

USING MWFRS (ASCE 7-10 §27)
(Directional Procedure)





Plan View:

Note: Simplified Complex building footprint into a square box shape using accurate building heights and widths.

1.) Determine Risk Category (Tab. 1.4-1)

→ Category III

$h = 90' < 300'$ ☑ ok

$h = 90' < 4(344)$ ☑ ok

2.) Determine Basic Wind Speed

→ for Los Angeles, CA → $V = 115\,mph$

→ n_a found using §26.9.3

3.) Determine Wind Load Parameters

$K_d = 0.85$ Exposure = B ← surrounded by buildings

$K_{zt} = 1.00$

To find G_f: → calculate Approx. Nat. Frequency (n_1)

$n_1 = \frac{75}{H} = \frac{75}{90'} = 0.833 < 1\,Hz$ (Flexible)

$g_R = \sqrt{2\ln(3600(.833))} + \frac{0.577}{\sqrt{2\ln(3600(.833))}} = 4.146$

$L_z = 320\left(\frac{54}{33}\right)^{\frac{1}{3}} = 377.09$

$I_z = 0.3\left(\frac{33}{54}\right)^{\frac{1}{6}} = 0.276$

$g_Q = g_v = 3.4$

$Q = \sqrt{\frac{1}{1 + 0.63\left(\frac{344+90}{377.09}\right)^{0.63}}} = 0.77$

$N_1 = \frac{(.833)(377.09)}{85.84} = 3.659$

$\bar{V}_z = (.45)\left(\frac{54}{33}\right)^{\frac{1}{4}}\left(\frac{88}{60}\right)(115) = 85.84\,mph$

$\eta_h = 4.6(.833)\frac{90}{85.84} = 4.02$

$\eta_B = 4.6(.833)\frac{344}{85.84} = 15.35$

$\eta_L = 15.4(.833)\frac{344}{85.84} = 51.41$

$R_n = \frac{7.47(3.659)}{(1+10.3(3.659))^{5/3}} = 0.062$

$R_h = \frac{1}{4.02} - \frac{1}{2(4.02)^2}\left(1 - e^{-2(4.02)}\right) = 0.218$

$R_B = \frac{1}{15.35} - \frac{1}{2(15.35)^2}\left(1 - e^{-2(15.35)}\right) = 0.063$

$R_L = \frac{1}{51.41} - \frac{1}{2(51.41)^2}\left(1 - e^{-2(51.41)}\right) = 0.019$

$G_f = 0.925\left[\frac{1 + 1.7(.276)\sqrt{(3.4)^2(0.77)^2 + (4.146)^2(.023)^2}}{1 + 1.7(3.4)(.276)}\right]$

$R = \sqrt{\frac{1}{.02}(.062)(.218)(.063)(0.53 + 0.47(.019))} = 0.023$

$G_f = 0.859$

Enclosure Classification ⟶ Fully Enclosed
↓
($GC_{pi} = \pm 0.18$)

4.) Determine velocity pressure exposure coeff.:

$K_z = K_h = 0.96$ (@ 90', Exposure B)

5.) Determine velocity pressure:

$q_z = 0.00256 K_z K_{zt} K_d V^2$

$q_z = 0.00256(0.96)(1.0)(0.85)(115)^2 = \underline{27.63\,psf}$

6.) Determine external pressure coefficient C_p:

Wall C_p:

$\frac{L}{B} = \frac{344'}{344'} = 1.0$ ↑ symmetric in plan view

Windward walls: $C_p = 0.8$

Leeward walls: $C_p = -0.5$

Side walls: $C_p = -0.7$

Roof C_p:

Max. Roof Slope: $\frac{0.75''}{12''} = 3.58^\circ < 10^\circ$

$\frac{h}{L} = \frac{90'}{344'} = 0.262 < 0.5$

horiz. distance from windward edge:

$0 - \frac{h}{2}$: $C_p = -0.9$

$\frac{h}{2} - h$: $C_p = -0.9$

$h - 2h$: $C_p = -0.5$

$> 2h$: $C_p = -0.3$

Note: To save time, the following procedure will be done in excel to get windward pressures at each level.

7.) Calculate wind pressure, p, on each surface: $p = q_z G_f C_p - q_i (GC_{pi})$ in psf

Controlling Pressures:

Windward walls:

$p = (27.63)(0.859)(0.8) - (27.63)(\pm 0.18) = 18.99 \pm 4.97\,psf$ ⟶ $+23.96\,psf$

Leeward Walls:

$p = (27.63)(.859)(-0.5) - (27.63)(\pm .18) = -11.87 \pm 4.97\,psf$ ⟶ $-16.84\,psf$

Roof:

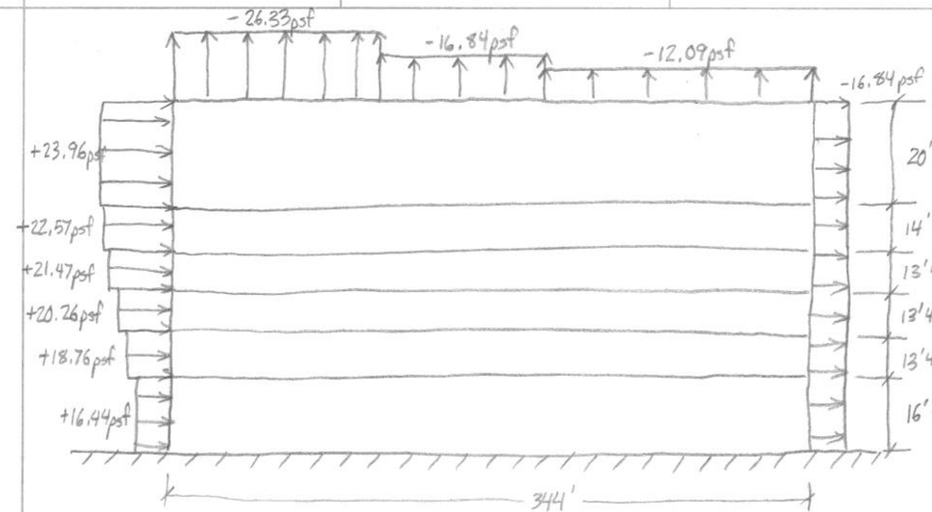
0-90': $p = (27.63)(.859)(-.9) - (27.63)(\pm .18) = -21.36 \pm 4.97\,psf$ ⟶ $-26.33\,psf$

90'-180': $p = (27.63)(.859)(-.5) - (27.63)(\pm .18) = -11.87 \pm 4.97\,psf$ ⟶ $-16.84\,psf$

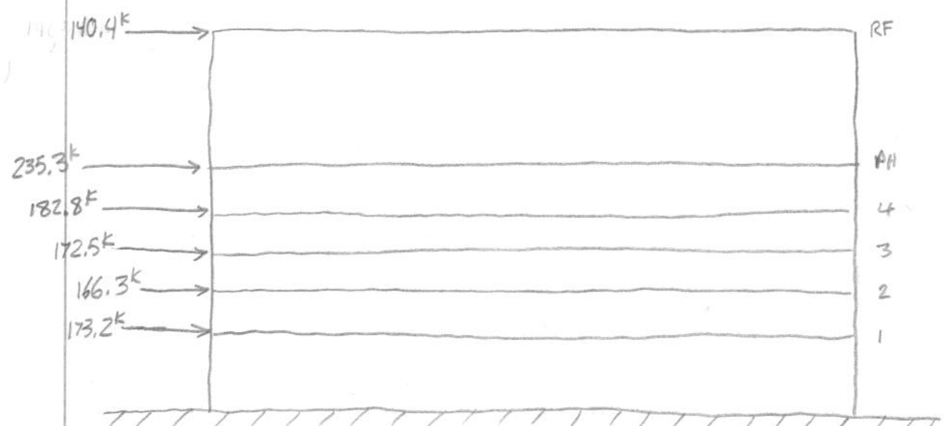
>180': $p = (27.63)(.859)(-.3) - (27.63)(\pm .18) = -7.12 \pm 4.97\,psf$ ⟶ $-12.09\,psf$

Side walls:

$p = (27.63)(.859)(-0.7) - (27.63)(\pm .18) = -16.61 \pm 4.97\,psf$ ⟶ $-21.59\,psf$



Wind Pressures



$F_{RF} = (23.96 + 16.84)\left(\frac{20'}{2}\right)(344') = 140{,}352 \text{ lb} = 140.4^k$

$F_{PH} = \left((23.96)\left(\frac{20'}{2}\right) + (22.57)\left(\frac{14'}{2}\right)\right)(344) + (16.84)\left(\frac{14'}{2} + \frac{20'}{2}\right)(344') = 235{,}251 \text{ lb} = 235.3^k$

$F_4 = \left((22.57)\left(\frac{14}{2}\right) + (21.47)\left(\frac{13.3}{2}\right)\right)(344) + (16.84)(344)\left(\frac{14}{2} + \frac{13.3}{2}\right) = 182{,}757 \text{ lb} = 182.8^k$

$F_3 = (21.47 + 20.26)\left(\frac{13.3}{2}\right)(344) + (16.84)(344)(13.3) = 172{,}508 \text{ lb} = 172.5^k$

$F_2 = (20.26 + 18.76)\left(\frac{13.3}{2}\right)(344) + (16.84)(344)(13.3) = 166{,}309 \text{ lb} = 166.3^k$

$F_1 = \left((18.76)\left(\frac{13.3}{2}\right) + (16.44)(8')\right)(344) + (16.84)(344)\left(\frac{16}{2} + \frac{13.3}{2}\right) = 173{,}229 \text{ lb} = 173.2^k$

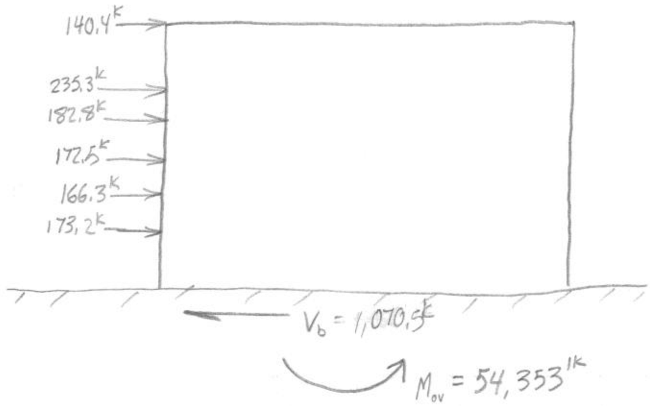
$\Sigma F_x = V_{base} = 1070.5^k$

Overturning Moment:

$$+\curvearrowright \Sigma M: (140.4)(90') + (235.3)(70') + (182.8)(56') + (172.5)(42.67') + (166.3)(29.33) + (173.2)(16') = M$$

$$M_{OT} = 54,353^{'k}$$

Wind Load Summary:



Location: Los Angeles, CA
Roof DL = 35 psf
Penth. Floor DL = 77 psf
Floors 1 - 4 DL = 65 psf
Exterior Walls DL = 30 psf

Assume: Soil Classif. : Site Class D (Stiff Soil)
Risk Category: III

Using USGS's U.S. Seismic "Design Maps" Web Application:

$S_s = 2.432g$ $S_{MS} = 2.432g$ $S_{DS} = 1.622g$
$S_1 = 0.853g$ $S_{M1} = 1.279g$ $S_{D1} = 0.853g$

+ Seismic Design Category = E
+ $F_a = 1.0$
+ $F_v = 1.5$
+ $T_L = 8 sec$ $T_0 = 0.105 sec$ $T_S = 0.526 sec$
+ $PGA = 0.920g$
+ $C_{RS} = 0.942$ $C_{R1} = 0.958$

must be special since: 90' > 60' (table 12.2-1)

Special

For Concentrically Braced Frame:
$R = 6.0$ (12.2-1)
$I_e = 1.25$ (1.5-2)

$V = C_s W$ $C_s = \dfrac{S_{DS}}{\left(\frac{R}{I_e}\right)} = \dfrac{1.622g}{\left(\frac{6}{1.25}\right)}$

$C_s = 0.338$

$T_a = C_T h_w^x$
$= 0.02(90')^{0.75}$

$T_a = 0.584 sec < T_L = 8 sec$

C_s should be: $< \dfrac{S_{D1}}{\left(\frac{R}{I_e}\right)T} = \dfrac{0.853g}{\left(\frac{6.0}{1.25}\right)(0.584)} = 0.304 < 0.338$ (0.304 controls)

> 0.01 ☑

$C_s = 0.304$

roof DL = 35psf, wall DL = 30psf

pent FL DL = 77psf, wall DL = 30psf

Floors 1-4 DL = 65psf, wall DL = 30psf

Roof:

perimet. PH

$W_{rf} = (17{,}527sf)(35psf) + (971.5ft)(\frac{20'}{2})(30psf) = \underline{904.9^k}$

PH Floor + Roof:

perim. of plan

$W_{PF} = (17{,}527sf)(77psf) + (36{,}003sf)(35psf) + (971.5ft)(\frac{20'}{2})(30psf) + (2045ft)(\frac{14'}{2})(30psf)$

$W_{PF} = \underline{3330.6^k}$

4th FL:

$W_4 = (53{,}530sf)(65psf) + (\frac{14'}{2} + \frac{13.3'}{2})(2045ft)(30psf) = \underline{4317.9^k}$

2+3 FL:

$W_{2,3} = (53{,}530sf)(65psf) + (13.3')(2045ft)(30psf) = \underline{4297.4^k}$

1st FL:

$W_1 = (53{,}530sf)(65psf) + (\frac{13.3'}{2} + \frac{16'}{2})(2045ft)(30psf) = \underline{4{,}379.2^k}$

Total Weight:

$W_{tot} = W_{rf} + W_{PF} + W_4 + W_3 + W_2 + W_1 = 904.9^k + 3330.6^k + 4317.9^k + 2(4297.4^k) + 4379.2^k$

$W_{tot} = 21{,}527.4^k$

$V_b = C_s W = (0.304)(21{,}527^k) = \underline{6550.6^k}$

$F_x = C_{vx} V_b$ where $C_{vx} = \frac{w_x h_x^k}{\sum w_i h_i^k}$

$K = 1.0$ for $T \leq 0.5sec$

$K = 2.0$ for $T > 2.5sec$

$(T_a = 0.584s)$

using interpolation:

$K = 1.042$

$\Sigma w_i h_i^k = (904.9^k)(90')^{1.042} + (3330.6^k)(70')^{1.042} + (4317.9^k)(56')^{1.042} + (4297.4^k)(42.667')^{1.042} +$
$(4297.4^k)(29.333')^{1.042} + (4379.2^k)(16')^{1.042}$

$\Sigma w_i h_i^k = 98{,}383^k + 278{,}685^k + 286{,}341^k + 214{,}663^k + 145{,}276^k + 78{,}720^k$

$\Sigma w_i h_i^k = 1{,}102{,}068^k$

$C_{rf} = \dfrac{98{,}383^k}{1{,}102{,}068^k} = 0.089 \qquad F_{rf} = (.089)(6550.6^k) = 583.0^k$

$C_{PF} = \dfrac{278{,}685^k}{1{,}102{,}068^k} = 0.253 \qquad F_{PF} = (.253)(6550.6^k) = 1657.3^k$

$C_4 = \dfrac{286{,}341^k}{1{,}102{,}068^k} = 0.260 \qquad F_4 = (.260)(6550.6^k) = 1703.2^k$

$C_3 = \dfrac{214{,}663^k}{1{,}102{,}068^k} = 0.194 \qquad F_3 = (.194)(6550.6^k) = 1270.8^k$

$C_2 = \dfrac{145{,}276^k}{1{,}102{,}068^k} = 0.131 \qquad F_2 = (.131)(6550.6^k) = 858.1^k$

$C_1 = \dfrac{78{,}720^k}{1{,}102{,}068^k} = 0.071 \qquad F_1 = (.071)(6550.6^k) = 465.1^k$

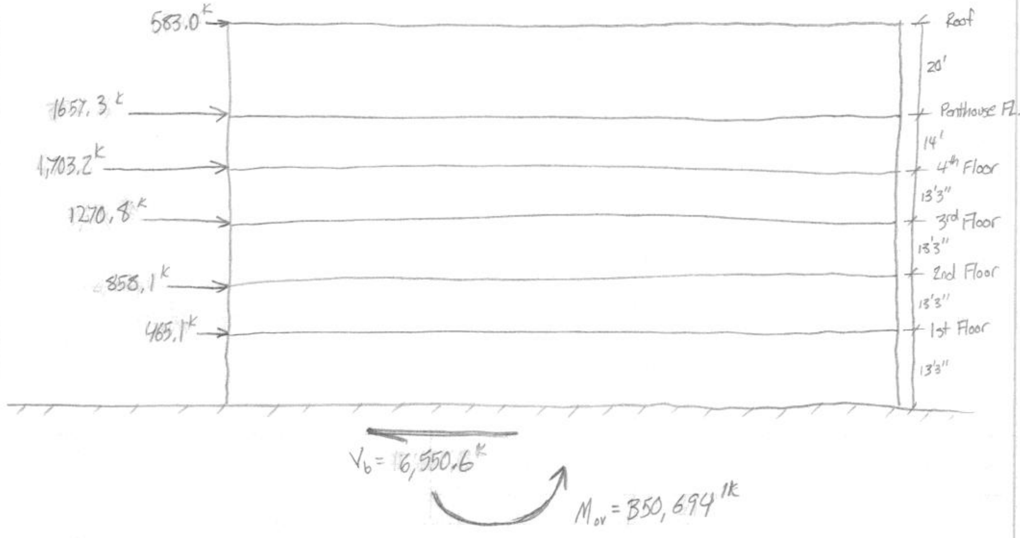
1.000 ☑ $\qquad V_b = 6550.6^k$ ☑

Overturning Moment:

$\Sigma M = (583.0^k)(90') + (1657.3^k)(70') + (1703.2^k)(56') + (1270.8^k)(42.667') + (858.1^k)(29.333') + (465.1^k)(16')$

$M_{ov} = 350{,}694^{'k}$

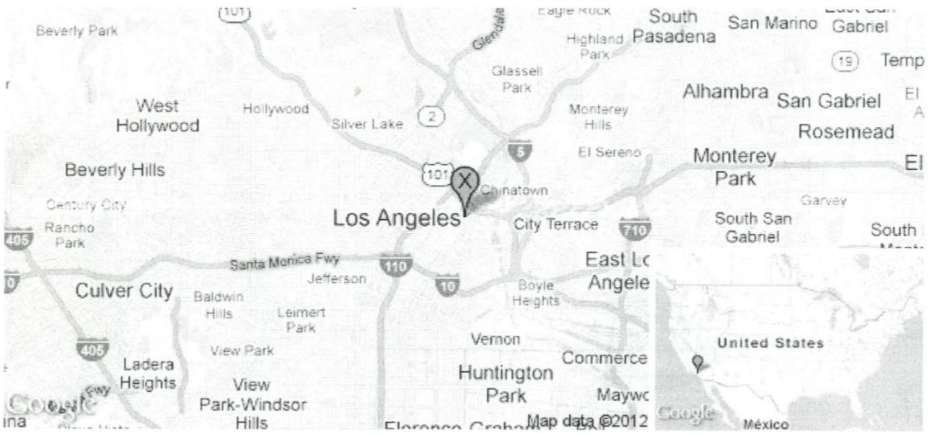
Seismic Load Summary:



USGS "DesignMaps" Summary Report

User–Specified Input

Report Title	Los Angeles, CA Thu March 15, 2012 18:34:28 UTC
Building Code Reference Document	2010 ASCE 7 Standard (which makes use of 2008 USGS hazard data)
Site Coordinates	34.05223°N, 118.24368°W "los angeles, ca"
Site Soil Classification	Site Class D – "Stiff Soil"
Site Risk Category	Risk Category III – "Substantial Hazard"

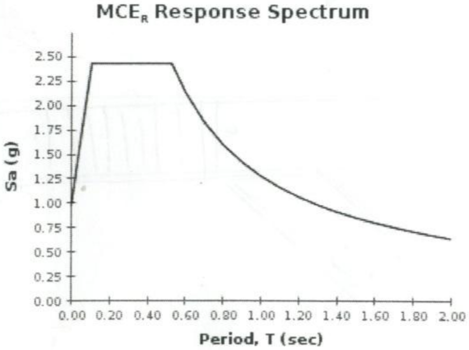


USGS–Provided Output

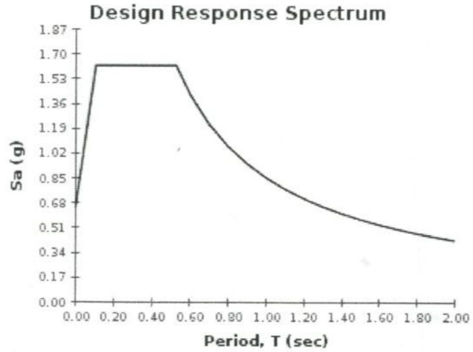
$S_S =$ 2.432 g	$S_{MS} =$ 2.432 g	$S_{DS} =$ 1.622 g
$S_1 =$ 0.853 g	$S_{M1} =$ 1.279 g	$S_{D1} =$ 0.853 g

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.

MCE$_R$ Response Spectrum



Design Response Spectrum



USGS "DesignMaps" Detailed Report

2010 ASCE 7 Standard (34.05223°N, 118.24368°W)

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1).

From Figure 22-1	S_S = 2.432 g
From Figure 22-2	S_1 = 0.853 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3-1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.5$	$S_S = 0.75$	$S_S = 1$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = 3 and S_s = 2.432, F_a = 1.000

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \le 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 \ge 0.5$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = 3 and S_1 = 0.853, F_v = 1.500

Equation (11.4–1):	$S_{MS} = F_aS_S = 1.000 \times 2.432 = 2.432$ g
Equation (11.4–2):	$S_{M1} = F_vS_1 = 1.500 \times 0.853 = 1.279$ g

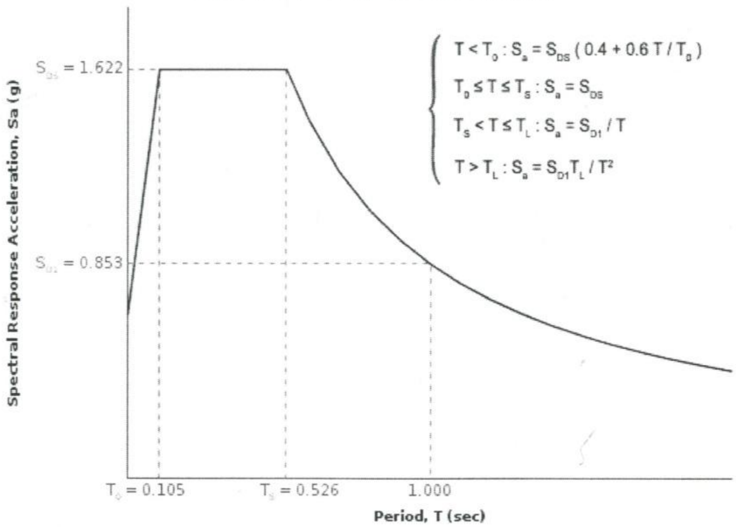
Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4–3):	$S_{DS} = ⅔\, S_{MS} = ⅔ \times 2.432 = 1.622$ g
Equation (11.4–4):	$S_{D1} = ⅔\, S_{M1} = ⅔ \times 1.279 = 0.853$ g

Section 11.4.5 — Design Response Spectrum

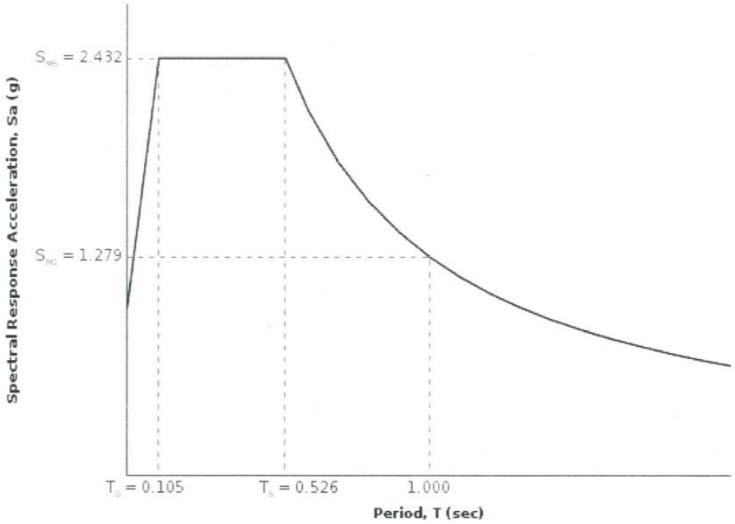
From Figure 22-12	T_L = 8 seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 PGA = 0.920

Equation (11.8-1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.920 = 0.92$ g

Table 11.8-1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.1	PGA = 0.2	PGA = 0.3	PGA = 0.4	PGA ≥ 0.5
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of PGA

For Site Class = 3 and PGA = 0.920, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 C_{RS} = 0.942

From Figure 22-18 C_{R1} = 0.958

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

For Risk Category = III and S_{DS} = 1.622, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

For Risk Category = III and S_{D1} = 0.853, Seismic Design Category = D

Note: When S_1 is greater than 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

Appendix D: ETABS Lateral System

LATERAL SYSTEM COLUMN SCHEDULE:

Ground/1st	AREA A		Ground/1st	AREA B	
Column	Column	Size	Column	Column	Size
A1	AA	W14x211	B1	BA	W14x283
A1	AB	W14x211	B1	BB	W14x283
A8	AA	W14x233	B8	BA	W14x257
A8	AB	W14x233	B8	BB	W14x257
A9	AE	W14x283	B9	BE	W14x257
A9	AF	W14x283	B9	BF	W14x257
A15	AG	W14x283	B15	BG	W14x233
A15	AH	W14x283	B15	BH	W14x233
Ground/1st	AREA C		Ground/1st	AREA D	
Column	Column	Size	Column	Column	Size
C1	CA	W14x233	D1	DA	W14x283
C1	CB	W14x233	D1	DB	W14x283
C8	CA	W14x233	D8	DA	W14x283
C8	CB	W14x233	D8	DB	W14x283
C9	CE	W14x283	D9	DE	W14x211
C9	CF	W14x283	D9	DF	W14x211
C15	CG	W14x257	D15	DG	W14x233
C15	CH	W14x257	D15	DH	W14x233

2nd/3rd	AREA A		2nd/3rd	AREA B	
Column	Column	Size	Column	Column	Size
A1	AA	W14x90	B1	BA	W14x99
A1	AB	W14x90	B1	BB	W14x99
A8	AA	W14x90	B8	BA	W14x99
A8	AB	W14x90	B8	BB	W14x99
A9	AE	W14x99	B9	BE	W14x99
A9	AF	W14x99	B9	BF	W14x99
A15	AG	W14x99	B15	BG	W14x90
A15	AH	W14x99	B15	BH	W14x90
2nd/3rd	AREA C		2nd/3rd	AREA D	
Column	Column	Size	Column	Column	Size
C1	CA	W14x90	D1	DA	W14x99
C1	CB	W14x90	D1	DB	W14x99
C8	CA	W14x90	D8	DA	W14x99
C8	CB	W14x90	D8	DB	W14x99
C9	CE	W14x99	D9	DE	W14x90
C9	CF	W14x99	D9	DF	W14x90
C15	CG	W14x99	D15	DG	W14x90
C15	CH	W14x99	D15	DH	W14x90

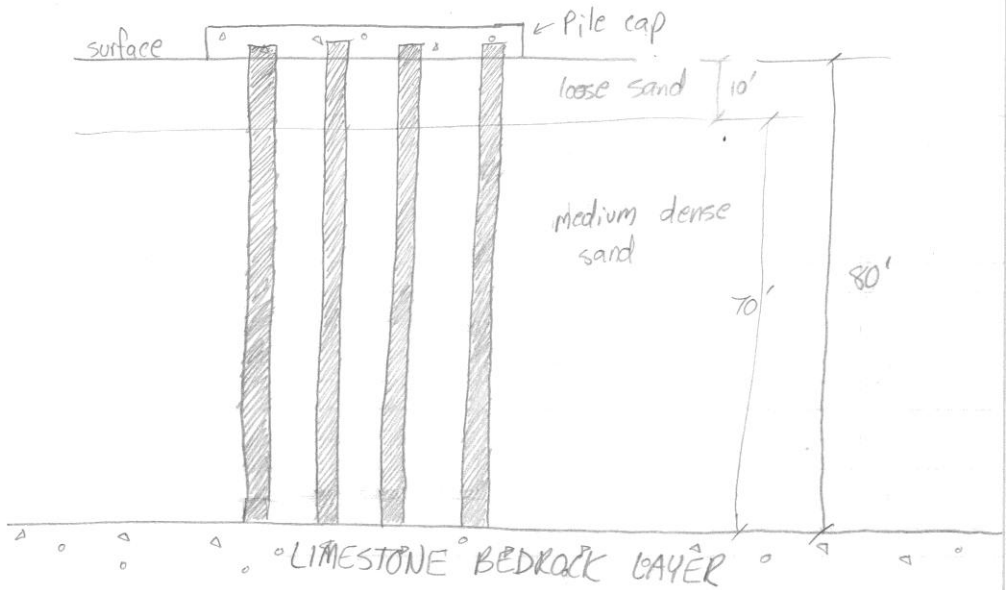
4th/PH	AREA A		4th/PH	AREA B	
Column	Column	Size	Column	Column	Size
A1	AA	-	B1	BA	W14x82
A1	AB	-	B1	BB	W14x82
A8	AA	-	B8	BA	W14x82
A8	AB	-	B8	BB	W14x82
A9	AE	-	B9	BE	-
A9	AF	-	B9	BF	-
A15	AG	-	B15	BG	-
A15	AH	-	B15	BH	-

4th/PH	AREA C		4th/PH	AREA D	
Column	Column	Size	Column	Column	Size
C1	CA	-	D1	DA	W14x82
C1	CB	-	D1	DB	W14x82
C8	CA	-	D8	DA	W14x82
C8	CB	-	D8	DB	W14x82
C9	CE	-	D9	DE	-
C9	CF	-	D9	DF	-
C15	CG	-	D15	DG	-
C15	CH	-	D15	DH	-

Lateral System Braced Frame Schedule:

Frame	Size					
	Ground	1st Floor	2nd Floor	3rd Floor	4th Floor	Penthouse
A1	HSS 9x9x3/16	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8
A8	HSS 9x9x3/16	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8
A9	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8	HSS 6x6x1/8
A15	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8	HSS 6x6x1/8
B1	HSS 9x9x3/16	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8
B8	HSS 9x9x3/16	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8
B9	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8	HSS 6x6x1/8
B15	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8	HSS 6x6x1/8
C1	HSS 9x9x3/16	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8
C8	HSS 9x9x3/16	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8
C9	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8	HSS 6x6x1/8
C15	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8	HSS 6x6x1/8
D1	HSS 9x9x3/16	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8
D8	HSS 9x9x3/16	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8
D9	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8	HSS 6x6x1/8
D15	HSS 9x9x1/8	HSS 8x8x1/8	HSS 7x7x1/8	HSS 7x7x1/8	HSS 6x6x1/8	HSS 6x6x1/8

Appendix E: Foundation Calculations



Consider using Vibratory Pile driver:

- quieter than other pile driving methods
- creates less damage to the pile, compared to impact driving

$$Q_u = \frac{3.6(F_c + 11 W_B)}{1 + 1.8\times10^{10} \frac{V_p}{c}\sqrt{OCR}} \cdot \frac{L_E}{L}$$

where:

F_c = centrif. Force
W_B = bias weight
v_p = final rate of pile penetrat.
c = speed of light (5.91×10^{10} ft/min)
OCR = overconsolid. ratio
L_E = embedded length of pile
L = pile length

Use a Bodine Resonant Pile Driver:

try ICE Model
W_B = 1,400 lb

Assume:

OCR = 2.0
V_p = 0.005 ft/sec

$$Q_u = \frac{3.6\left(148{,}000\,lb + 11\,(3{,}785\,lb)\right)}{1 + 1.8\times10^{10}\,\dfrac{0.005\,ft/s\,(60\,sec/min)}{5.91\times10^{10}\,ft/min}\cdot\sqrt{2.0}}\cdot\frac{79'}{80'}$$

$$Q_u = 597.01^k \approx 597^k/\text{pile}$$

For a group of piles:

$Q_{g(u)} = n \cdot Q_u$ if spaced at $\geq 2.5D$ where D = pile width, n = # piles in group

$$Q_{g,\,allowable} = \frac{Q_{g(u)}}{F.S.}$$

Assume: $F.S. = 3.5$

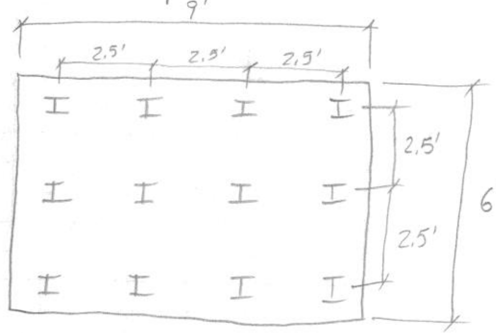
$$Q_{g,\,allowable} = \frac{n(597^k)}{4} \geq P_{u,max}$$

From ETABS Model: $P_{u,max} = 2000^k$

$$\frac{n(597^k)}{3.5} \geq 2000^k$$

$n = 11.7$ piles

* use 12 piles



Select HP12×84:

$D = 12.28''$ $\quad I_x = 650\,in^4$

$A = 24.6\,in^2$ $\quad I_y = 213\,in^4$

$w_t = 0.685''$

$d_2 = 12.295''$

ICE® Model 14C
Hydraulic Vibratory Driver/ Extractor with Model 230G Power Unit

Patented design combines high eccentric moment (1,400 in-lbs, 16 kg-m) and suspended weight with clamp (5,280 lbs, 2395 kg).
Lighter weight provides for increased reach or use with smaller cranes.
Reduced height allows better access in low-overhead situations.
Up to 48 tons (430 kN) line pull for extraction.

Patented Dual-pull™ suppressor provides maximum vibration isolation during driving and light extraction combined with high pull capability for tough extraction jobs.

225HP (168 kW) CAT C6.6 Tier 3 (State IIIA) engine meets all EPA & EU emission regulations.

Optional 2,650 lbs (1200 kg) bias weights increase pile penetration rates in difficult soils.

Full range of clamps available for sheet piling, H-Beams, pipe & caissons and timber & concrete piles.

Maximum efficiency and reliability are provided by our open-loop hydraulic system and application proven piston pumps and motors.

Remote-control pendant for vibrator and clamp with emergency stop. Engine speed control for fuel efficiency.

Adaptable for underwater, low headroom or box leads operation.

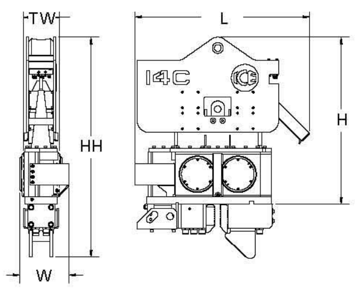
Environmentally friendly Chevron Clarity® non-toxic, biodegradable hydraulic oil.

Designed and manufactured in the USA by ICE®, world leader in cost-effective foundation equipment since 1974.

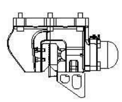
INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

ICE® Model 14C
Hydraulic Vibratory Driver/ Extractor with Model 230G Power Unit

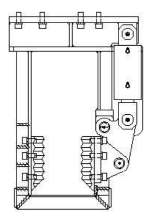
Dimensions



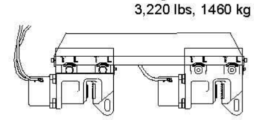
Clamps & Accessories



Model 90 Sheeting Clamp
Clamping force
90 tons, 800 kN
Weight
1065 lbs, 483 kg



Model 40 Wood, Concrete & Pipe Clamp
Clamping force
40 tons, 355 kN
Weight
3,220 lbs, 1460 kg



3' Caisson Beam with Model 100BH Caisson Clamps
Clamping force
220 tons, 1950 kN
Weight
3,010 lbs, 1376 kg

Other Model 14C Accessories
- Bias weights
- Vibrator stand
- 5' Caisson Beam

Model 14C Vibrator Specifications

Eccentric moment	1,400 in-lbs	16 kg-m
Maximum frequency	1900 vpm	
Driving force	74 tons	660 kN
Centrifugal force	72 tons	640 kN
Amplitude (free w/o clamp)	1.2 in	30 mm
Standard line pull for extracting	48 tons	430 kN
Maximum line pull for extracting	48 tons	430 kN
Weight (no clamp or hoses)	3,785 lbs	1716 kg
Non-vibrating weight	1,400 lbs	635 kg
Height without clamp (H)	62 in	1565 mm
Length (L)	65 in	1635 mm
Width (W)	19 in	460 mm
Throat width (TW)	13.25 in	337 mm
Hydraulic hose length	100 ft	30 m
Hydraulic hose weight	850 lbs	385 kg
Height with sheeting clamp* (HH)	81 in	2060 mm
Weight with sheeting clamp & 1/2 hoses*	5280 lbs	2395 kg
Height with beam & caisson clamps*	95 in	2400 mm
Weight with beam & caisson clamps*	7,190 lbs	3260 kg

* See "Clamps and Accessories Manual" for in depth description

Model 230G Power Unit Specifications

Engine	Caterpillar C6.6	
Power	225 HP	168 kW
Operating speed	2,100 rpm	2100 rpm
Max. motors pressure	4,500 psi	310 bar
Motors flow (no load)	70 gpm	265 lpm
Clamp pressure	4,500 psi	310 bar
Clamp flow	6 gpm	25 lpm
Weight (w/ full fluid & 1/2 fuel)	9,310 lbs	4225 kg
Length	110 in	2800 mm
Width	58 in	1475 mm
Height	77 in	1960 mm
Hydraulic reservoir	275 gal	1040 liters
Fuel capacity	120 gal	460 liters

International Construction Equipment, Inc.
301 Warehouse Drive
Matthews, NC 28104 USA
888-ICE-USA1 / 704-821-8200
sales@iceusa.com / www.iceusa.com

Constant improvement and engineering progress make it necessary that ICE®, Inc reserve the right to make specification changes without notice. Please consult ICE® for the latest available information.

UV14C_230G_Jan2012

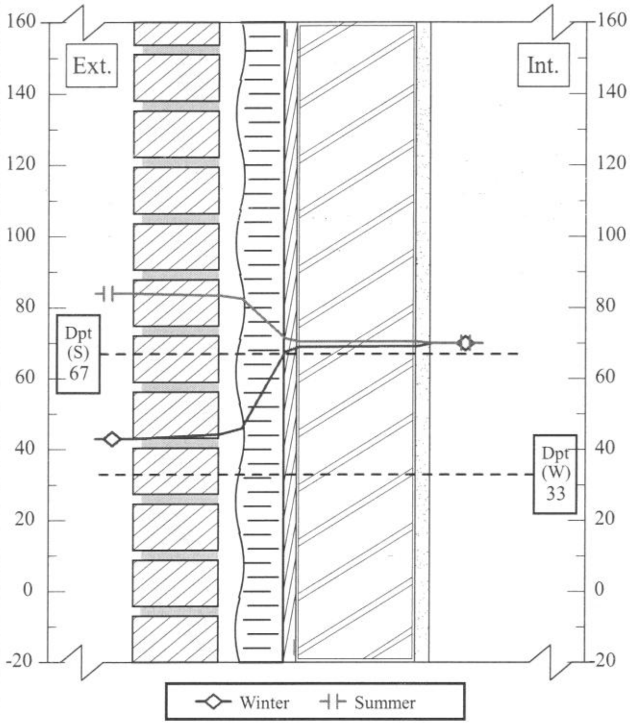
Appendix F: Mechanical Calculations

R VALUE ANALYSIS

The Heat, Air and Moisture Building Science Toolbox - V.1B-E/U (11)

WALL SECTION AND TEMPERATURE GRADIENTS

(°F) (°F)



PROJECT

Name	ECMC Skilled Nursing Facility
Number	001
City	Los Angeles, CA
Date	3/25/12
Analysis by:	Brian Brunnet
Wall Type	
Option	

CLIMATIC CONDITIONS

	Winter		Summer	
	Int.	Ext.	Int.	Ext.
Temp (°F)	70	43	70	84
RH (%)	25	60	50	55
DPT (°F)	33	30	51	67

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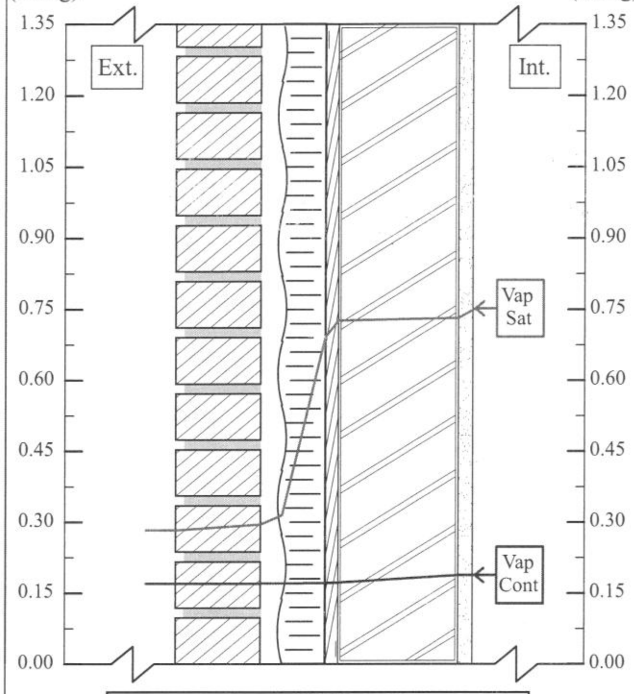
	Generic Material	Manufacturer	Model No.	Thick (in.)	RVal (R)	W.Temp. (°F)	S.Temp. (°F)
1	brick (TTW), 4 in.	No Recor...	Generic...	4.00	0.64	44.3	83.4
2	cavity, 1 in.	No Recor...	Generic...	1.00	0.98	46.0	82.5
3	ureth.(ext.) insul., 2 in.	No Recor...	Generic...	2.00	12.34	67.6	71.3
4	plywood shtg., 5/8 in.	No Recor...	Generic...	0.63	0.81	69.0	70.5
5	steel stud, 5-1/2 in.	No Recor...	Generic...	5.51	0.12	69.2	70.4
6	gypsum bd., 5/8 in., (#1)	No Recor...	Generic...	0.63	0.46	70.0	70.0
	Total or (Layer 0)			13.76	15.35	(43.2)	(84.0)

CONDENSATION ANALYSIS

The Heat, Air and Moisture Building Science Toolbox - V.1B-E/U (11a)

WALL SECTION AND VAPOUR PRESSURE GRADIENTS



** NO CONDENSATION **

PROJECT

Name: ECMC Skilled Nursing Facility

Number: 001

City: Los Angeles, CA

Date: 3/25/12

Analysis by: Brian Brunnet

Wall Type: ____ Option: ____

CLIMATIC CONDITIONS

	Winter		Summer	
	Int.	Ext.	Int.	Ext.
Temp (°F)	70	43	—	—
RH (%)	25	60	—	—
DPT (°F)	33	30	—	—

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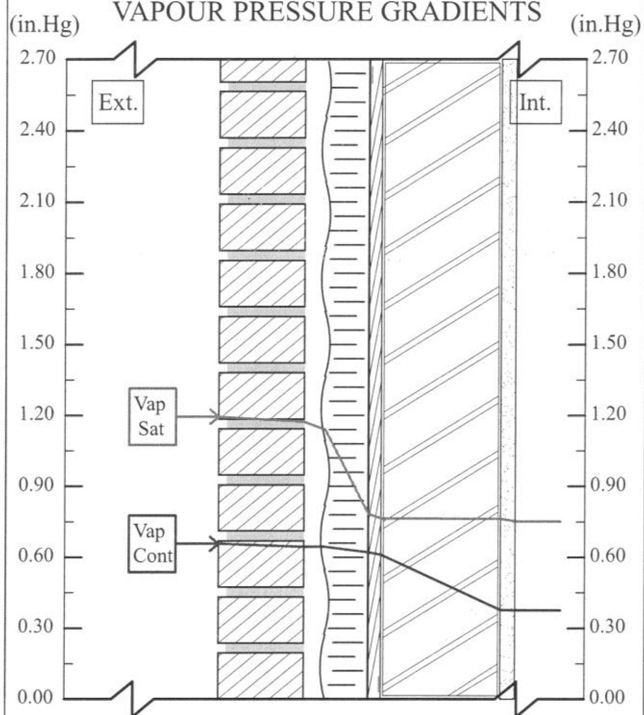
UNIVERSITY PARK, PA, USA, 16802

	Material	Manufacturer	Model No.	Rvap (1/M)	Temp (°F)	VapSat (in.Hg)	VapCont (in.Hg)
1	brick (TTW), 4 in.	No Recor...	Generic...	1.436	44.1	0.291	0.168
2	cavity, 1 in.	No Recor...	Generic...	0.008	45.8	0.310	0.168
3	ureth.(ext.) insul., 2 in.	No Recor...	Generic...	2.873	67.6	0.681	0.169
4	plywood shtg., 5/8 in.	No Recor...	Generic...	1.306	69.0	0.715	0.170
5	steel stud, 5-1/2 in.	No Recor...	Generic...	28.725	69.2	0.720	0.185
6	gypsum bd., 5/8 in., (#1)	No Recor...	Generic...	0.230	70.0	0.740	0.185
7							
8							
9							
10							
11							
12							
	TOTAL or (Layer 0)			34.577	(43.0)	(0.278)	(0.167)

CONDENSATION ANALYSIS

The Heat, Air and Moisture Building Science Toolbox - V.1B-E/U (11a)

WALL SECTION AND VAPOUR PRESSURE GRADIENTS



** NO CONDENSATION **

PROJECT

Name	ECMC Skilled Nursing Facility
Number	001
City	Los Angeles, CA
Date	3/25/12
Analysis by:	Brian Brunnet
Wall Type	
Option	

CLIMATIC CONDITIONS

	Winter		Summer	
	Int.	Ext.	Int.	Ext.
Temp (°F)	—	—	70	84
RH (%)	—	—	50	55
DPT (°F)	—	—	51	67

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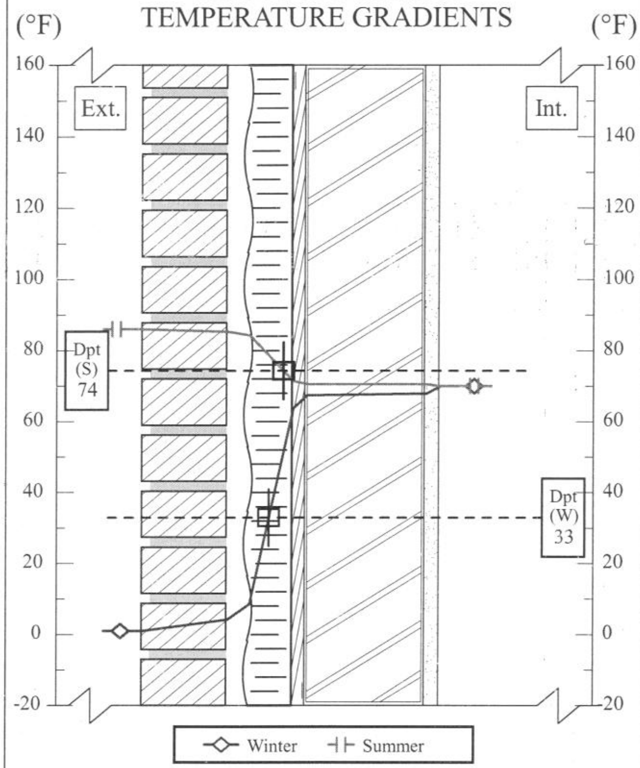
	Material	Manufacturer	Model No.	Rvap (1/M)	Temp (°F)	VapSat (in.Hg)	VapCont (in.Hg)
1	brick (TTW), 4 in.	No Recor...	Generic...	1.436	83.4	1.155	0.635
2	cavity, 1 in.	No Recor...	Generic...	0.008	82.5	1.122	0.635
3	ureth.(ext.) insul., 2 in.	No Recor...	Generic...	2.873	71.3	0.772	0.612
4	plywood shtg., 5/8 in.	No Recor...	Generic...	1.306	70.5	0.753	0.602
5	steel stud, 5-1/2 in.	No Recor...	Generic...	28.725	70.4	0.751	0.372
6	gypsum bd., 5/8 in., (#1)	No Recor...	Generic...	0.230	70.0	0.740	0.370
7							
8							
9							
10							
11							
12							
	TOTAL or (Layer 0)			34.577	(84.0)	(1.176)	(0.647)

R VALUE ANALYSIS

The Heat, Air and Moisture Building Science Toolbox - V.1B-E/U (11)

WALL SECTION AND TEMPERATURE GRADIENTS



PROJECT

Name	ECMC Skilled Nursing Facility
Number	001
City	Buffalo, NY
Date	3/25/12
Analysis by:	Brian Brunnet
Wall Type	Option

CLIMATIC CONDITIONS

	Winter		Summer	
	Int.	Ext.	Int.	Ext.
Temp (°F)	70	1	70	86
RH (%)	25	68	50	67
DPT (°F)	33	-6	51	74

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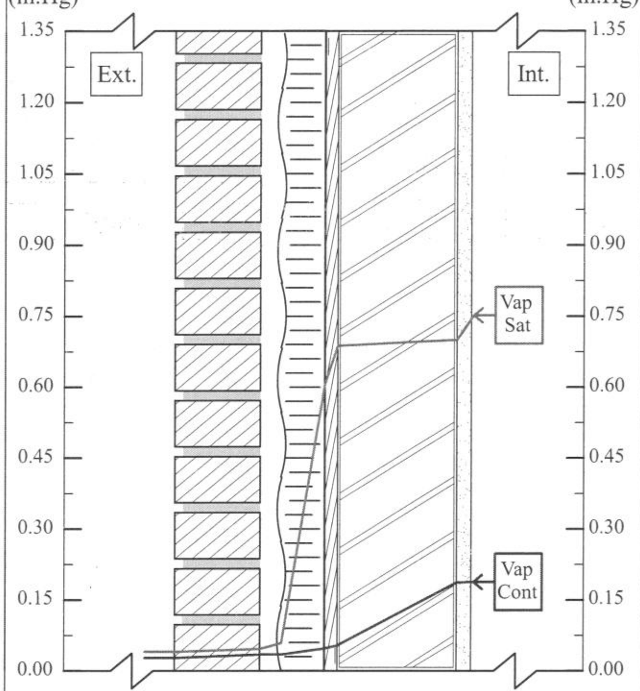
	Generic Material	Manufacturer	Model No.	Thick (in.)	RVal (R)	W.Temp. (°F)	S.Temp. (°F)
1	brick (TTW), 4 in.	No Recor...	Generic...	4.00	0.64	4.2	85.3
2	cavity, 1 in.	No Recor...	Generic...	1.00	0.98	8.6	84.3
3	ureth.(ext.) insul., 2 in.	No Recor...	Generic...	2.00	12.34	63.8	71.4
4	plywood shtg., 5/8 in.	No Recor...	Generic...	0.63	0.81	67.4	70.6
5	steel stud, 5-1/2 in.	No Recor...	Generic...	5.51	0.12	67.9	70.5
6	gypsum bd., 5/8 in., (#1)	No Recor...	Generic...	0.63	0.46	70.0	70.0
	Total or (Layer 0)			13.76	15.35	(1.4)	(86.0)

CONDENSATION ANALYSIS

The Heat, Air and Moisture Building Science Toolbox - V.1B-E/U (11a)

WALL SECTION AND VAPOUR PRESSURE GRADIENTS



** NO CONDENSATION **

PROJECT

Name: ECMC Skilled Nursing Facility
Number: 001
City: Buffalo, NY
Date: 3/25/12
Analysis by: Brian Brunnet
Wall Type: Option:

CLIMATIC CONDITIONS

	Winter		Summer	
	Int.	Ext.	Int.	Ext.
Temp (°F)	70	1	—	—
RH (%)	25	68	—	—
DPT (°F)	33	-6	—	—

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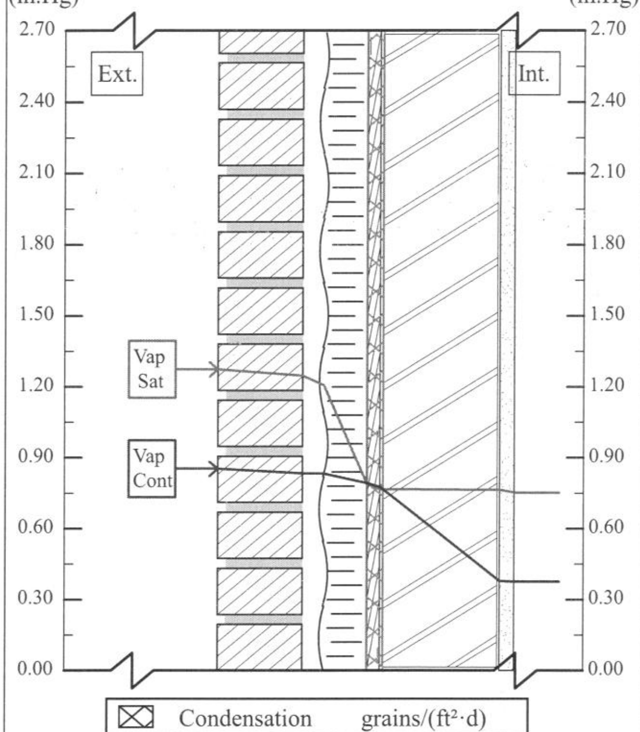
104 ENGINEERING, UNIT A
UNIVERSITY PARK, PA, USA, 16802

	Material	Manufacturer	Model No.	Rvap (1/M)	Temp (°F)	VapSat (in.Hg)	VapCont (in.Hg)
1	brick (TTW), 4 in.	No Recor...	Generic...	1.436	3.9	0.046	0.034
2	cavity, 1 in.	No Recor...	Generic...	0.008	8.3	0.058	0.034
3	ureth.(ext.) insul., 2 in.	No Recor...	Generic...	2.873	63.8	0.596	0.047
4	plywood shtg., 5/8 in.	No Recor...	Generic...	1.306	67.4	0.677	0.053
5	steel stud, 5-1/2 in.	No Recor...	Generic...	28.725	67.9	0.689	0.184
6	gypsum bd., 5/8 in., (#1)	No Recor...	Generic...	0.230	70.0	0.740	0.185
7							
8							
9							
10							
11							
12							
	TOTAL or (Layer 0)			34.577	(1.0)	(0.040)	(0.027)

CONDENSATION ANALYSIS

The Heat, Air and Moisture Building Science Toolbox - V.1B-E/U (11a)

WALL SECTION AND VAPOUR PRESSURE GRADIENTS



PROJECT

Name	ECMC Skilled Nursing Facility
Number	001
City	Buffalo, NY
Date	3/25/12
Analysis by:	Brian Brunnet
Wall Type	
Option	

CLIMATIC CONDITIONS

	Winter		Summer	
	Int.	Ext.	Int.	Ext.
Temp (°F)	—	—	70	86
RH (%)	—	—	50	67
DPT (°F)	—	—	51	74

PENNSYLVANIA STATE UNIVERSITY

104 ENGINEERING, UNIT A
UNIVERSITY PARK, PA, USA, 16802

	Material	Manufacturer	Model No.	Rvap (1/M)	Temp (°F)	VapSat (in.Hg)	VapCont (in.Hg)
1	brick (TTW), 4 in.	No Recor...	Generic...	1.436	85.3	1.228	0.821
2	cavity, 1 in.	No Recor...	Generic...	0.008	84.3	1.188	0.820
3	ureth.(ext.) insul., 2 in.	No Recor...	Generic...	2.873	71.4	0.777	0.781
4	plywood shtg., 5/8 in.	No Recor...	Generic...	1.306	70.6	0.755	0.764
5	steel stud, 5-1/2 in.	No Recor...	Generic...	28.725	70.5	0.752	0.373
6	gypsum bd., 5/8 in., (#1)	No Recor...	Generic...	0.230	70.0	0.740	0.370
7							
8							
9							
10							
11							
12							
	TOTAL or (Layer 0)			34.577	(86.0)	(1.254)	(0.840)

Appendix G: Schedule & Cost Calculations

Steel Weight Calculations:

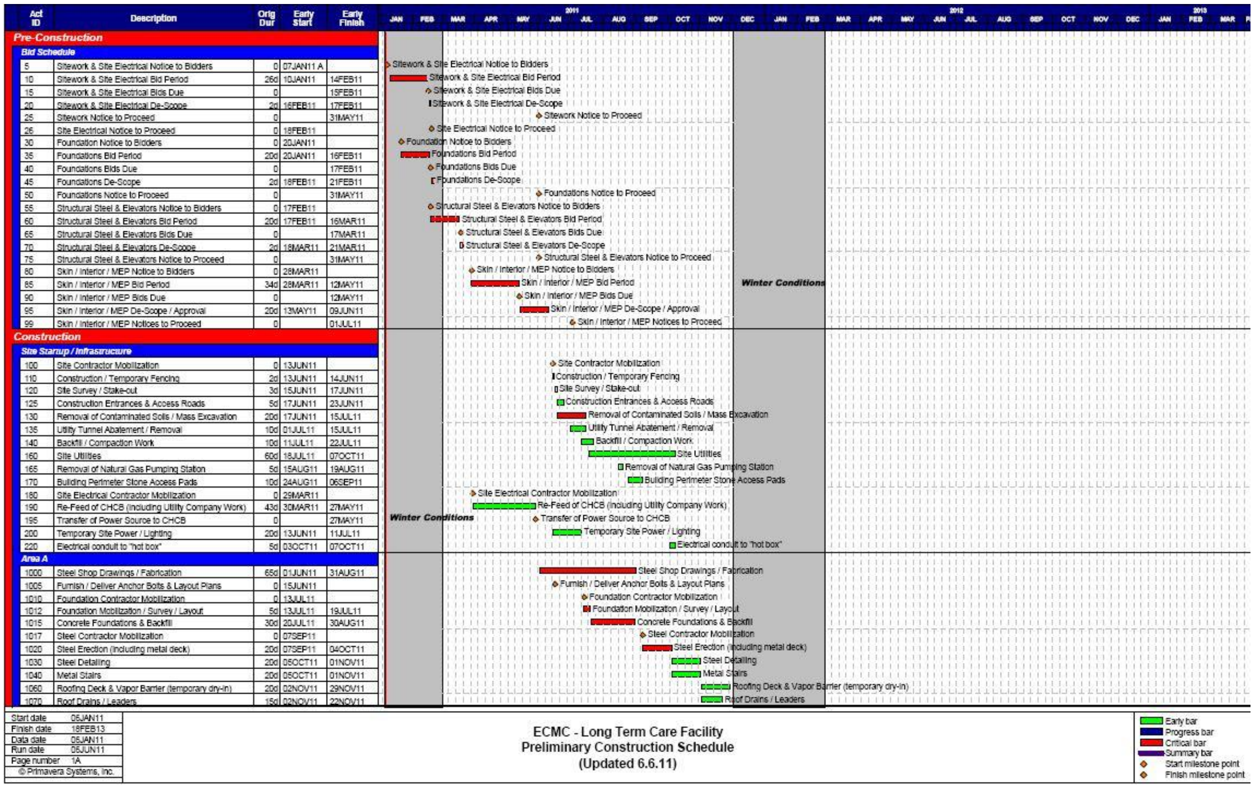
Frame	HSS Steel Weights					
	Ground	1st Floor	2nd Floor	3rd Floor	4th Floor	Penthouse
A1	1110	705	625.1	545.2	554.48	547.66
A8	1110	705	625.1	545.2	554.48	547.66
A9	750	625.1	545.2	545.2	470.83	547.66
A15	750	625.1	545.2	545.2	470.83	547.66
B1	1110	705	625.1	545.2	554.48	547.66
B8	1110	705	625.1	545.2	554.48	547.66
B9	750	625.1	545.2	545.2	470.83	547.66
B15	750	625.1	545.2	545.2	470.83	547.66
C1	1110	705	625.1	545.2	554.48	547.66
C8	1110	705	625.1	545.2	554.48	547.66
C9	750	625.1	545.2	545.2	470.83	547.66
C15	750	625.1	545.2	545.2	470.83	547.66
D1	1110	705	625.1	545.2	554.48	547.66
D8	1110	705	625.1	545.2	554.48	547.66
D9	750	625.1	545.2	545.2	470.83	547.66
D15	750	625.1	545.2	545.2	470.83	547.66
SUM	14880	10640.8	9362.4	8723.2	8202.48	8762.56
					TOTAL (tons)	30.28572

Wt. (lbs)	Length (ft)	# of Members			Total Wt. (tons)
		Gr. /1st	2nd/3rd	4th/PH	
W14x82	16	0	0	8	5.248
W14x90	30.6	0	14	0	19.278
W14x99	30.6	0	18	0	27.2646
W14x211	21.3	4	0	0	8.9886
W14x233	21.3	10	0	0	24.8145
W14x257	21.3	6	0	0	16.4223
W14x283	21.3	12	0	0	36.1674
				TOTAL	138.1834

Cost Comparisons:

Component	Quantity	Labor		Material		TOTALS	
		Unit Cost	Amount	Unit Cost	Amount	Redesigned	Original Design
WF Lateral Steel Columns	138.183 TN	715.68/TN	196,784	2,074.64/TN	286,674	$385,567	$118,605
HSS Steel Bracing	30.3 TN	715.65/TN	21,684	2,074.64/TN	62,862	$84,726	$95,099.00
HP Steel Piles	30720 VLF	-	-	44.25/VLF	1,359,360	$1,359,360	-
Lead Rubber Base Isolators	207	-	-	20,000/LRB	4,140,000	$4,140,000	-
					TOTALS	$5,969,653	$213,704

Sample Existing Schedule:



Act ID	Description	Orig Dur	Early Start	Early Finish
Pre-Construction				
Bid Schedule				
5	Sitework & Site Electrical Notice to Bidders	0	07JAN11 A	
10	Sitework & Site Electrical Bid Period	26d	10JAN11	14FEB11
15	Sitework & Site Electrical Bids Due	0		15FEB11
20	Sitework & Site Electrical De-Scope	2d	16FEB11	17FEB11
25	Sitework Notice to Proceed	0		31MAY11
26	Site Electrical Notice to Proceed	0	18FEB11	
30	Foundation Notice to Bidders	0	20JAN11	
35	Foundations Bid Period	20d	20JAN11	16FEB11
40	Foundations Bids Due	0		17FEB11
45	Foundations De-Scope	2d	18FEB11	21FEB11
50	Foundations Notice to Proceed	0		31MAY11
55	Structural Steel & Elevators Notice to Bidders	0	17FEB11	
60	Structural Steel & Elevators Bid Period	20d	17FEB11	16MAR11
65	Structural Steel & Elevators Bids Due	0		17MAR11
70	Structural Steel & Elevators De-Scope	2d	18MAR11	21MAR11
75	Structural Steel & Elevators Notice to Proceed	0		31MAY11
80	Skin / Interior / MEP Notice to Bidders	0	28MAR11	
85	Skin / Interior / MEP Bid Period	34d	28MAR11	12MAY11
90	Skin / Interior / MEP Bids Due	0		12MAY11
95	Skin / Interior / MEP De-Scope / Approval	20d	13MAY11	09JUN11
99	Skin / Interior / MEP Notices to Proceed	0		01JUL11
Construction				
Site Startup / Infrastructure				
100	Site Contractor Mobilization	0	13JUN11	
110	Construction / Temporary Fencing	2d	13JUN11	14JUN11
120	Site Survey / Stake-out	3d	15JUN11	17JUN11
125	Construction Entrances & Access Roads	5d	17JUN11	23JUN11
130	Removal of Contaminated Soils / Mass Excavation	20d	17JUN11	15JUL11
135	Utility Tunnel Abatement / Removal	10d	01JUL11	15JUL11
140	Backfill / Compaction Work	10d	11JUL11	22JUL11
160	Site Utilities	60d	18JUL11	07OCT11
165	Removal of Natural Gas Pumping Station	5d	15AUG11	19AUG11
170	Building Perimeter Stone Access Pads	10d	24AUG11	06SEP11
180	Site Electrical Contractor Mobilization	0	29MAR11	
190	Re-Feed of CHCB (including Utility Company Work)	43d	30MAR11	27MAY11
195	Transfer of Power Source to CHCB	0		27MAY11
200	Temporary Site Power / Lighting	20d	13JUN11	11JUL11
220	Electrical conduit to "hot box"	5d	03OCT11	07OCT11
Area A				
1000	Steel Shop Drawings / Fabrication	65d	01JUN11	31AUG11
1005	Furnish / Deliver Anchor Bolts & Layout Plans	0	15JUN11	
1010	Foundation Contractor Mobilization	0	13JUL11	
1012	Foundation Mobilization / Survey / Layout	5d	13JUL11	19JUL11
1015	Concrete Foundations & Backfill	30d	20JUL11	30AUG11
1017	Steel Contractor Mobilization	0	07SEP11	
1020	Steel Erection (including metal deck)	20d	07SEP11	04OCT11
1030	Steel Detailing	20d	05OCT11	01NOV11
1040	Metal Stairs	20d	05OCT11	01NOV11
1060	Roofing Deck & Vapor Barrier (temporary dry-in)	20d	02NOV11	29NOV11
1070	Roof Drains / Leaders	15d	02NOV11	22NOV11

Start date	06JAN11
Finish date	18FEB13
Data date	06JAN11
Run date	06JUN11
Page number	1A
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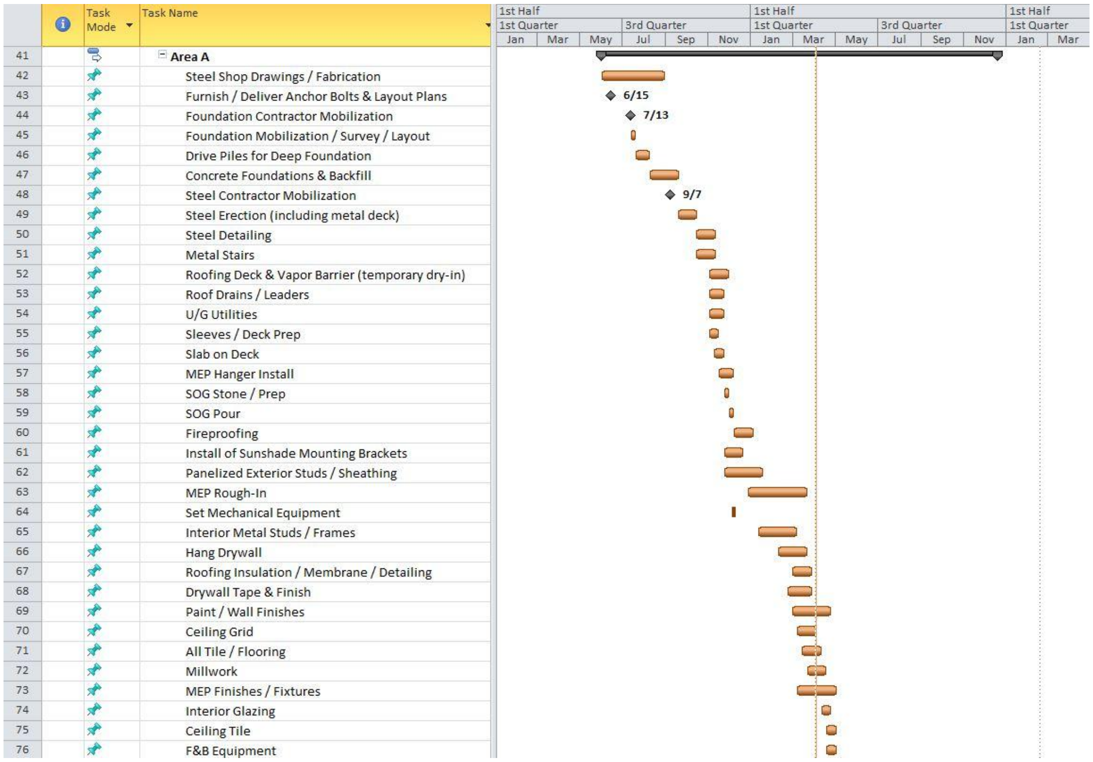
Sample Redesign Schedule:



	Task Mode	Task Name
41		**Area A**
42		Steel Shop Drawings / Fabrication
43		Furnish / Deliver Anchor Bolts & Layout Plans
44		Foundation Contractor Mobilization
45		Foundation Mobilization / Survey / Layout
46		Drive Piles for Deep Foundation
47		Concrete Foundations & Backfill
48		Steel Contractor Mobilization
49		Steel Erection (including metal deck)
50		Steel Detailing
51		Metal Stairs
52		Roofing Deck & Vapor Barrier (temporary dry-in)
53		Roof Drains / Leaders
54		U/G Utilities
55		Sleeves / Deck Prep
56		Slab on Deck
57		MEP Hanger Install
58		SOG Stone / Prep
59		SOG Pour
60		Fireproofing
61		Install of Sunshade Mounting Brackets
62		Panelized Exterior Studs / Sheathing
63		MEP Rough-In
64		Set Mechanical Equipment
65		Interior Metal Studs / Frames
66		Hang Drywall
67		Roofing Insulation / Membrane / Detailing
68		Drywall Tape & Finish
69		Paint / Wall Finishes
70		Ceiling Grid
71		All Tile / Flooring
72		Millwork
73		MEP Finishes / Fixtures
74		Interior Glazing
75		Ceiling Tile
76		F&B Equipment

Summary Existing Cost Estimate:

CANNONDESIGN

Erie County Medical Center
Long Term Care Facility
Design Development - December 2010

Estimate Summary
1/5/2011 4:16 PM

Spreadsheet Level		Takeoff Quantity	Total Cost/Unit	Total Amount
02-00-00 EXISTING CONDITIONS		275,000.00 GSF	0.29 /GSF	79,417
03-00-00 CONCRETE		275,000.00 GSF	11.54 /GSF	3,173,736
04-00-00 MASONRY		275,000.00 GSF	18.32 /GSF	5,036,877
05-00-00 METALS		275,000.00 GSF	29.44 /GSF	8,097,065
06-00-00 WOOD, PLASTICS & COMPOSITES		275,000.00 GSF	6.87 /GSF	1,889,780
07-00-00 THERMAL & MOISTURE PROTECTION		275,000.00 GSF	9.87 /GSF	2,714,952
08-00-00 OPENINGS		275,000.00 GSF	13.89 /GSF	3,819,879
09-00-00 FINISHES		275,000.00 GSF	28.71 /GSF	7,895,446
10-00-00 SPECIALTIES		275,000.00 GSF	7.74 /GSF	2,127,649
11-00-00 EQUIPMENT		275,000.00 GSF	5.97 /GSF	1,642,939
12-00-00 FURNISHINGS		275,000.00 GSF	0.04 /GSF	10,083
14-00-00 CONVEYING EQUIPMENT		275,000.00 GSF	5.12 /GSF	1,406,764
21-00-00 FIRE SUPPRESSION		275,000.00 GSF	3.94 /GSF	1,084,158
22-00-00 PLUMBING		275,000.00 GSF	20.52 /GSF	5,642,521
23-00-00 HVAC		275,000.00 GSF	35.99 /GSF	9,897,738
26-00-00 ELECTRICAL		275,000.00 GSF	21.03 /GSF	5,781,824
27-00-00 COMMUNICATIONS		275,000.00 GSF	10.15 /GSF	2,790,685
28-00-00 ELECTRONIC SAFETY & SECURITY		275,000.00 GSF	3.94 /GSF	1,083,727
31-00-00 EARTHWORK		275,000.00 GSF	4.45 /GSF	1,223,002
32-00-00 EXTERIOR IMPROVEMENTS		275,000.00 GSF	1.88 /GSF	516,946
33-00-00 UTILITIES		275,000.00 GSF	2.88 /GSF	791,724

Estimate Totals

Description	Amount	Totals	Rate	B.	$ / Unit
	66,706,911	66,706,911			239.13 /GSF
GMP RESERVE	1,334,138		2.00 %	T	4.78 /GSF
Bid Day Total	**1,334,138**	**68,041,050**			**243.91 /GSF**
CM GENERAL CONDITIONS	2,500,000			L	8.96 /GSF
CM FEE	1,871,129		2.75 %	T	6.71 /GSF
Total Construction Cost	**4,371,129**	**72,412,178**			**259.58 /GSF**
PARKING GARAGE ALLOWANCE	6,500,000				
Total w/ Parking Garage		**78,912,178**			**282.88 /GSF**

RS Means Total O&P for HP pile foundations:

316216 Steel Piles — Lines 1 - 24 of 24

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
316216130010	**SHEET STEEL PILES**									
316216130100	**Step tapered, round, c...**									
316216130110	8" tip, 60 ton capacity,...	V.L.F.	B19	760.00	0.084	8.45	3.21	2.29	13.95	16.92
316216130120	60' depth	V.L.F.	B19	740.00	0.086	9.55	3.29	2.36	15.20	18.34
316216130130	80' depth	V.L.F.	B19	700.00	0.091	9.85	3.48	2.49	15.82	19.14
316216130150	10" tip, 90 ton capacit...	V.L.F.	B19	700.00	0.091	10.40	3.48	2.49	16.37	19.69
316216130160	60' depth	V.L.F.	B19	690.00	0.093	10.70	3.53	2.53	16.76	20.13
316216130170	80' depth	V.L.F.	B19	670.00	0.096	11.50	3.64	2.60	17.74	21.31
316216130190	12" tip, 120 ton capaci...	V.L.F.	B19	660.00	0.097	14.30	3.69	2.64	20.63	24.50
316216130200	60' depth, 12" diam...	V.L.F.	B19	630.00	0.102	14.35	3.87	2.77	20.99	24.94
316216130210	80' depth	V.L.F.	B19	590.00	0.108	12.65	4.13	2.95	19.73	23.75
316216130250	"H" Sections, 50' long, HP...	V.L.F.	B19	640.00	0.100	14.50	3.81	2.72	21.03	25.00
316216130400	HP10 X 42	V.L.F.	B19	610.00	0.105	16.95	4.00	2.86	23.81	28.14
316216130500	HP10 X 57	V.L.F.	B19	610.00	0.105	23.00	4.00	2.86	29.86	34.99
316216130700	HP12 X 53	V.L.F.	B19	590.00	0.108	21.50	4.13	2.95	28.58	33.80
316216130800	HP12 X 74	V.L.F.	B19A	590.00	0.108	30.50	4.13	3.82	38.45	44.25
316216131000	HP14 X 73	V.L.F.	B19A	540.00	0.119	30.00	4.51	4.18	38.69	44.74
316216131100	HP14 X 89	V.L.F.	B19A	540.00	0.119	36.50	4.51	4.18	45.19	51.74
316216131300	HP14 X 102	V.L.F.	B19A	510.00	0.125	42.00	4.78	4.42	51.20	58.46
316216131400	HP14 X 117	V.L.F.	B19A	510.00	0.125	48.00	4.78	4.42	57.20	65.46
316216131600	Splice on standard poi...	Ea.	1 Sswl	5.00	1.600	95.00	69.00		164.00	229.00
316216131700	12" or 14"	Ea.	1 Sswl	4.00	2.000	138.00	86.00		224.00	307.00
316216131900	Heavy duty points, not...	Ea.	1 Sswl	4.00	2.000	147.00	86.00		233.00	317.00
316216132100	14" wide	Ea.	1 Sswl	3.50	2.286	190.00	98.50		288.50	386.00