Appendix A: Typical Floor Layout

Figure 35: Second Floor Layout of As-Built Building

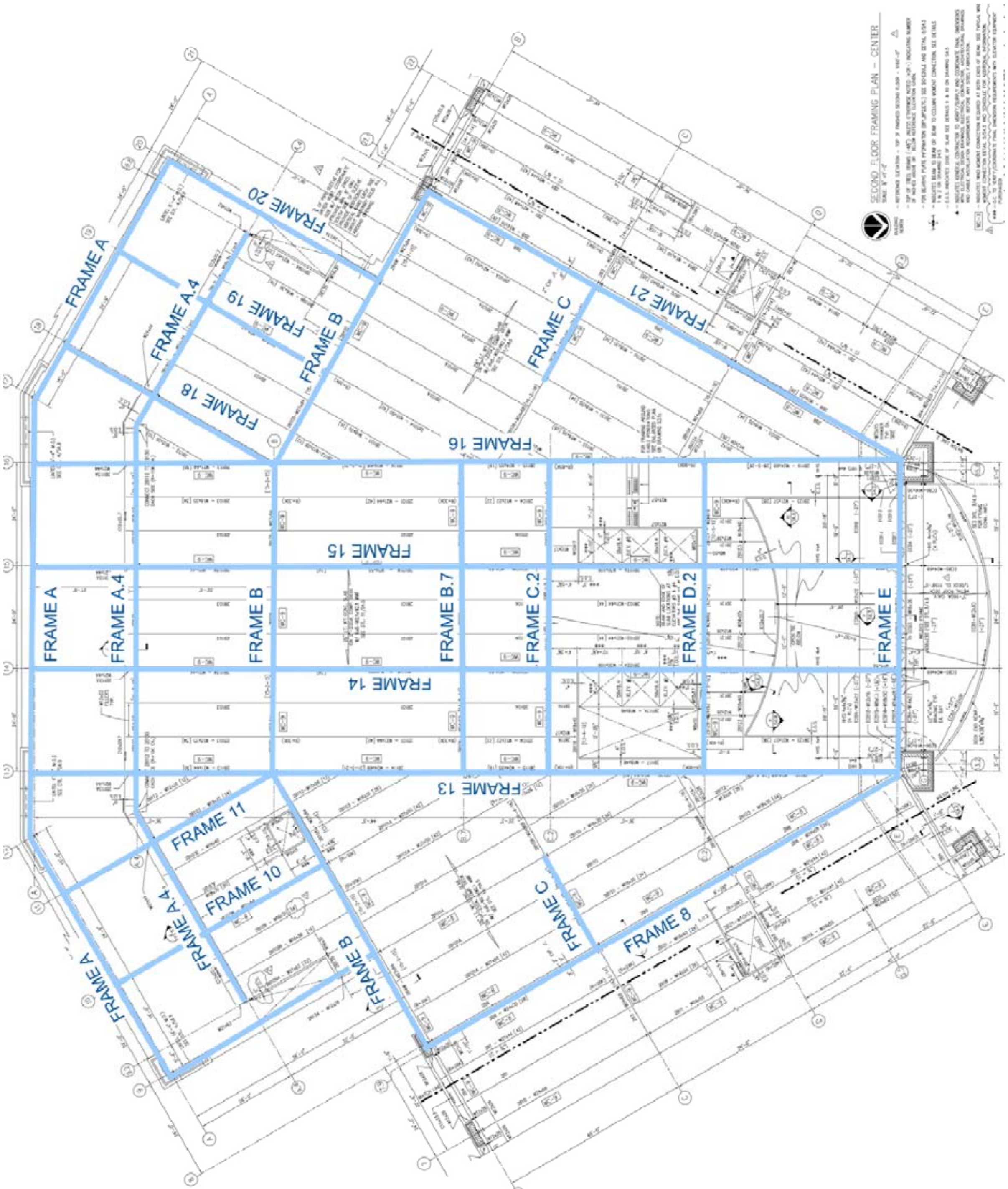


Figure 36: Second Floor Layout of Center or As-Built building

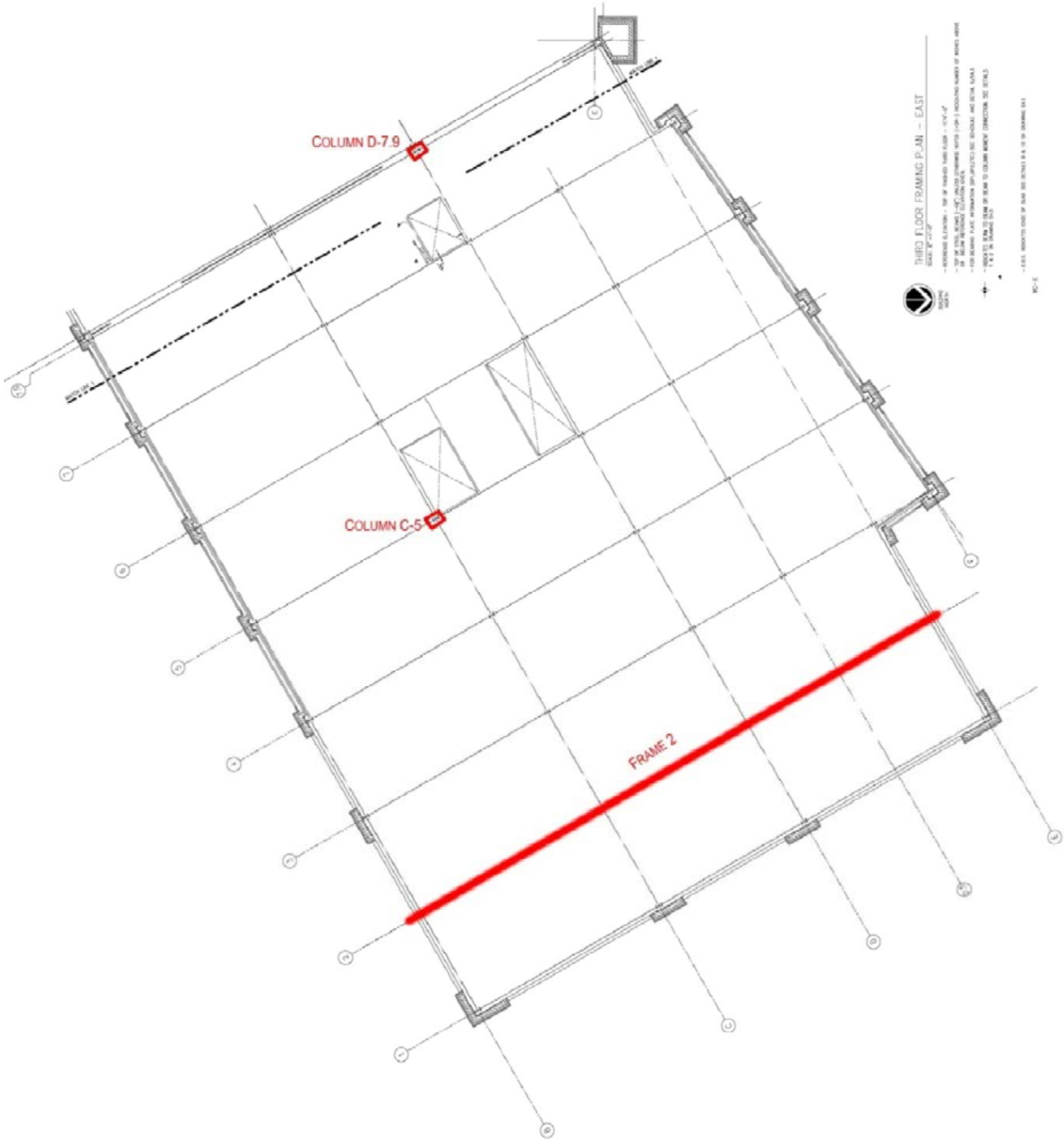


Figure 37: Third Floor East of Redesigned Concrete Building with Portal Analysis Frame Indicated and Columns for Column Checks Indicated

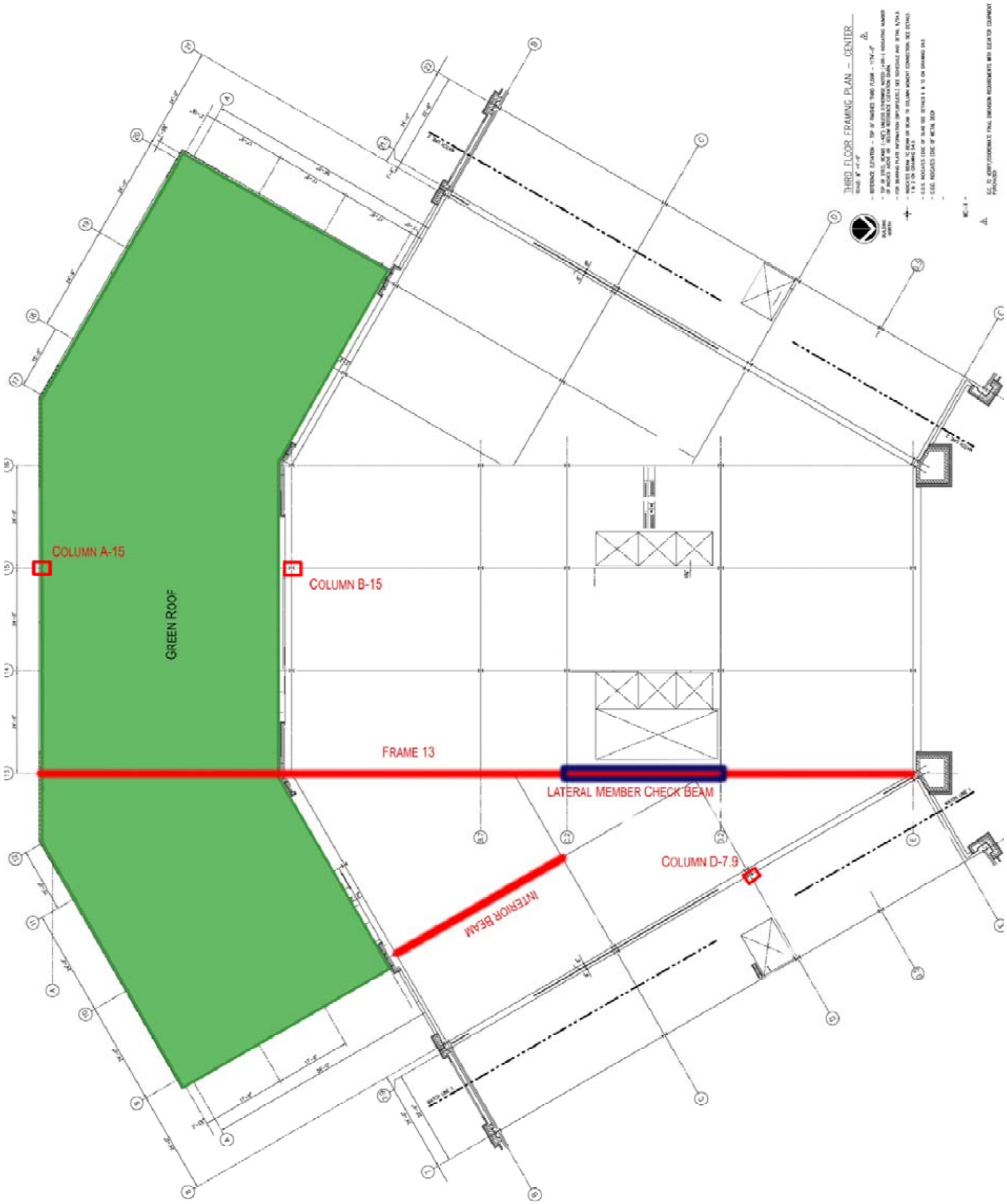


Figure 38: Third Floor Center of Redesigned Concrete Building with Portal Analysis Frame Indicated and Columns for Column Checks Indicated

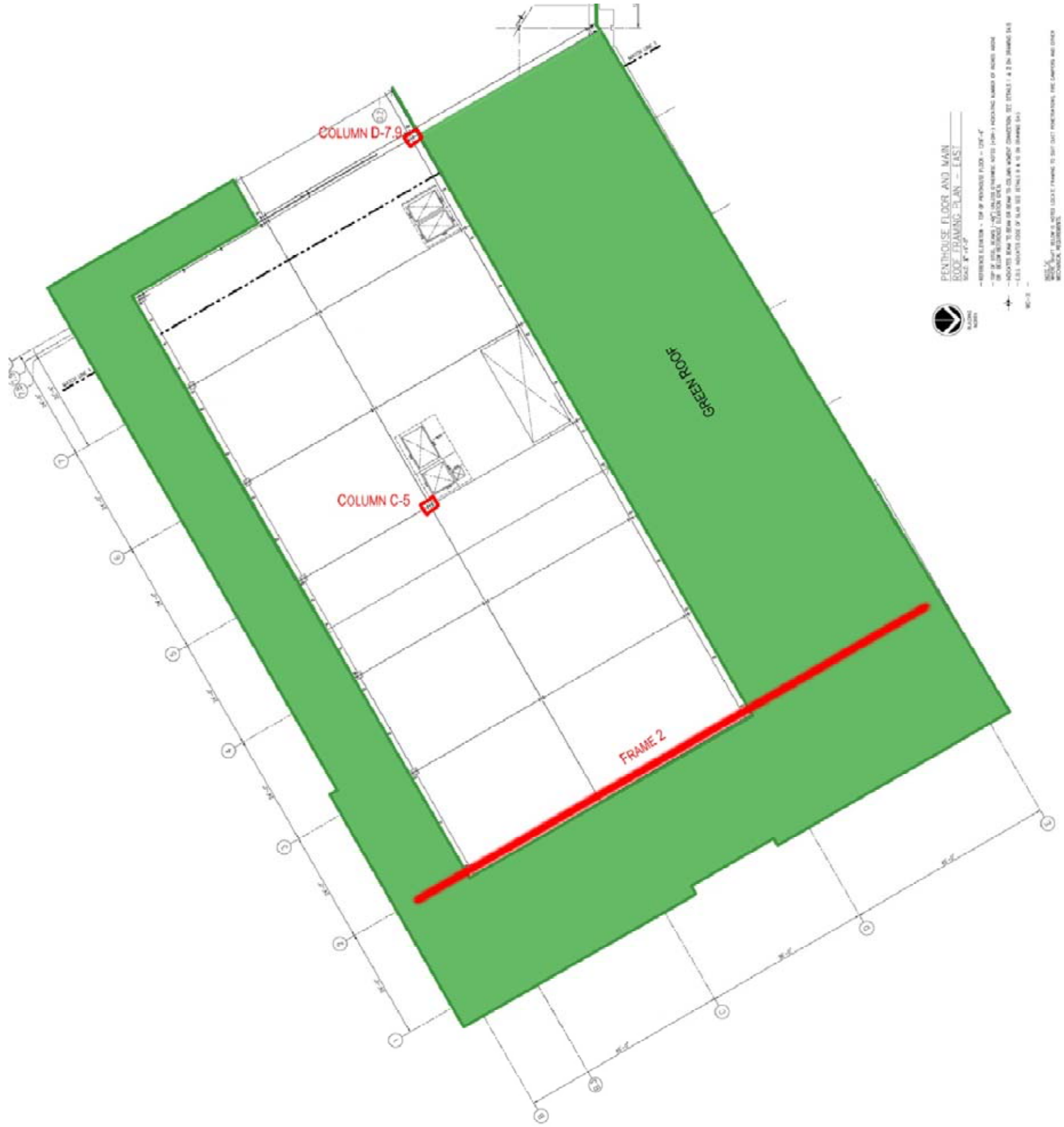


Figure 39: Green Roof Plan East of Redesigned Building with Portal Frame Analysis and Spot Checked Columns Indicated

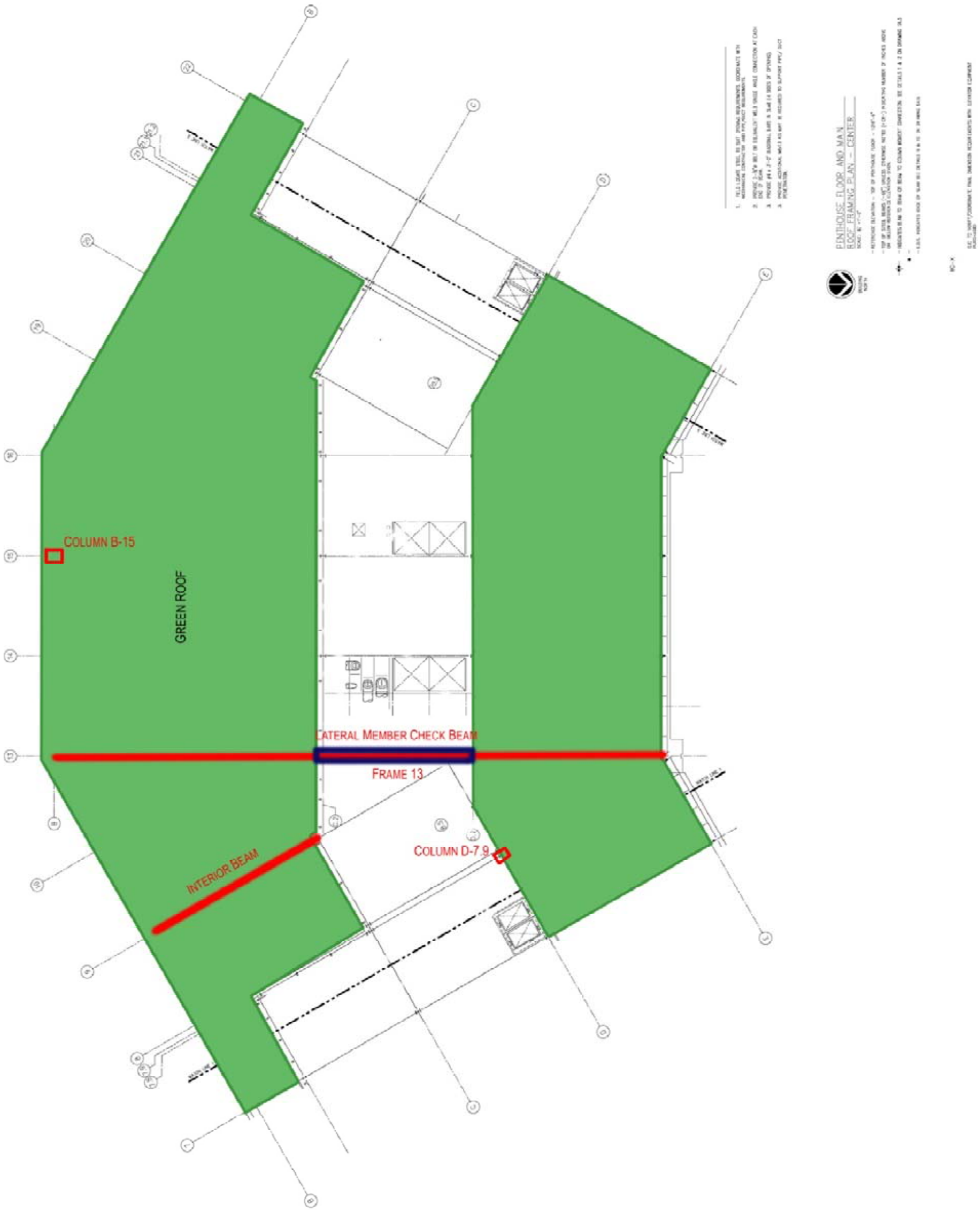


Figure 40: Green Roof Plan Center of Redesigned Building with Portal frame Analysis, lateral Beam Check, Interior Beam Check, and Spot Checked Columns Indicated

Appendix B: Torsion Effects Calculations

The centers of rigidity for each direction were determined by taking the sum of the stiffness in one direction multiplied by the distance from the perpendicular distance from the origin (distance from the opposite origin) all divided by the sum of the stiffness for each frame used in the calculation. For example, the center of rigidity in the Y direction was calculated by taking the K in the X direction and multiplying it by the distance from the Y origin, and finding the sum of all the values divided by the sum of the K's in the X direction (Kix*dix/ΣKix). The Ix was calculated by taking the sum of the K's in the X direction multiplied by the distance from the Y origin squared ($\Sigma kix{*}yi^2$). The Iy was calculated using the same method.

Center of Rigidity in Y= Kix*dix/Σkix
Center of Rigidity in X= Kiy*dix/Σkiy
$Ix = \Sigma kix{*}yi^2$
$Iy = \Sigma kiy{*}xi^2$

After the K values were determined, the K in the direction of the force was divided by the sum of the K's in the same direction and multiplied by the force in the specific direction. The torsion induced moment in each direction was determined differently for wind and for seismic.

For seismic forces, the torsion induced moment was calculated by taking the force at the specified story multiplied by the center of rigidity subtracted from center of mass in the direction perpendicular to the force.

Torsion Induced Moment X= (Force)*(Center of Mass in Y direction- Center of Rigidity in X direction)

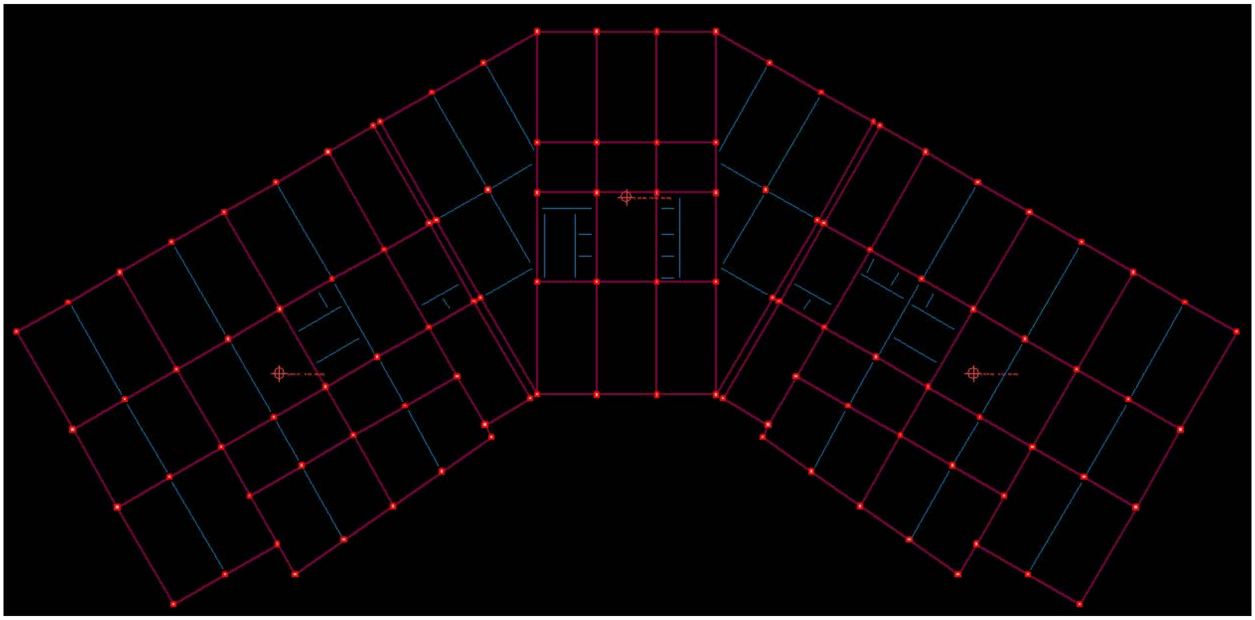


Figure 41: Centers of Mass for New Building

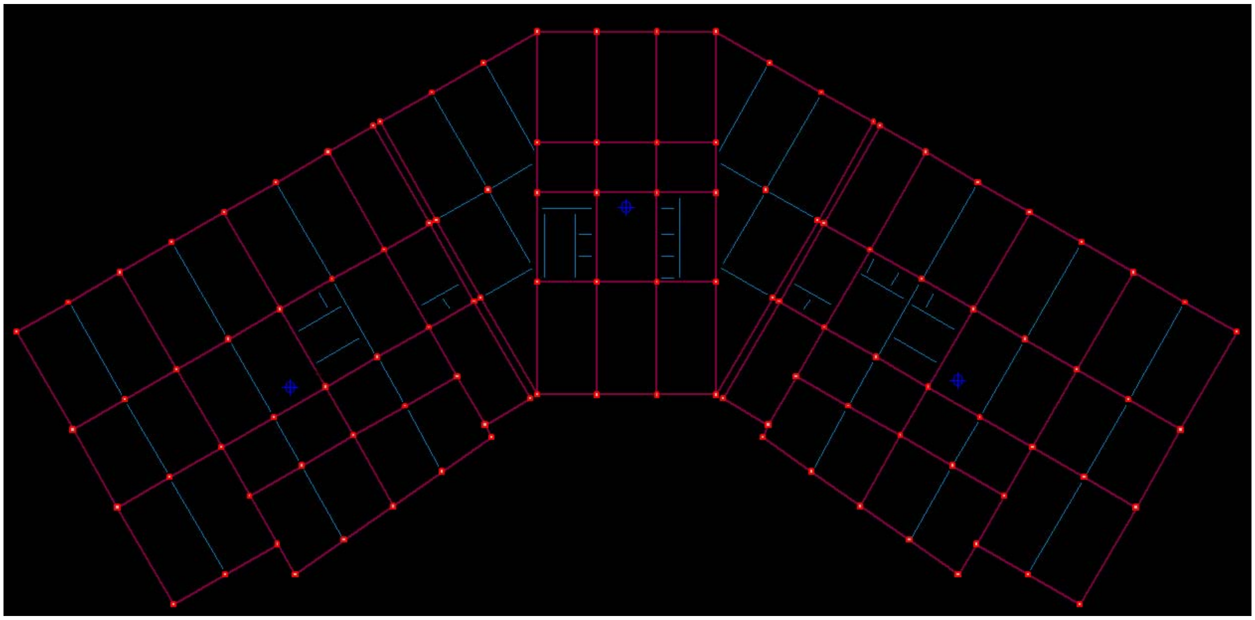


Figure 42: Centers of Rigidity for New Building

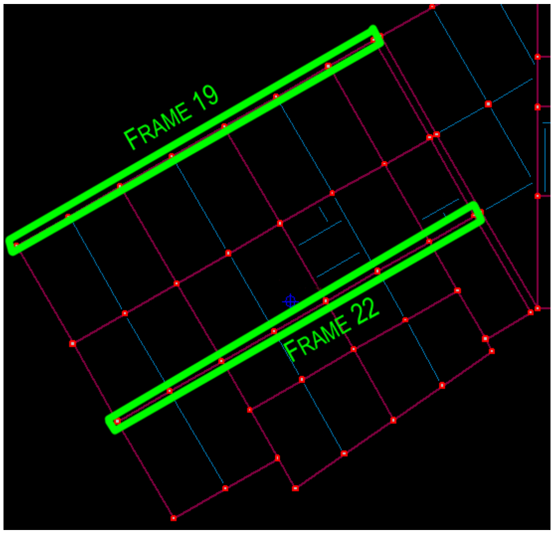


Figure 43: Center of Rigidity and Frames for Comparison

As is seen in the following figures of the wind shears from frames 19 and 22, the further away from the center of rigidity the frame is located, the more torsion and shear the frame takes. The concept of torsion is evident in these frames.

Load Case: W9 Wind Wind_IBC06_4_X+Y_CW

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
Roof	24.27	24.27	17.43	17.43
Fifth	29.05	4.78	20.97	3.54
Fourth	43.42	14.37	31.90	10.93
Third	51.17	7.75	38.22	6.32
Second	46.66	-4.51	33.40	-4.82
First	-9.04	-55.70	-11.12	-44.52

Figure 44: Wind Shears Frame 19

Load Case: W9 Wind Wind_IBC06_4_X+Y_CW

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
Penthouse	3.26	3.26	3.47	3.47
Roof	3.71	0.45	7.56	4.10
Fifth	9.77	6.06	15.69	8.12
Fourth	12.68	2.91	20.61	4.92
Third	18.67	5.99	27.52	6.92
Second	19.37	0.70	35.57	8.05
First	-3.24	-22.62	-10.30	-45.87

Figure 45: Wind Shears Frame 22

Load Case: E1 Seismic EQ_IBC06_X_+E_F

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
Roof	50.00	50.00	15.85	15.85
Fifth	49.63	-0.37	14.53	-1.33
Fourth	64.72	15.09	19.06	4.54
Third	66.40	1.68	20.10	1.04
Second	73.12	6.72	15.00	-5.10
First	-23.19	-96.31	7.26	-7.74

Figure 46: Seismic Shears Frame 19

Load Case: E1 Seismic EQ_IBC06_X_+E_F

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
Penthouse	20.03	20.03	6.15	6.15
Roof	26.35	6.32	-6.05	-12.20
Fifth	47.99	21.64	-4.00	2.05
Fourth	56.10	8.12	-5.38	-1.38
Third	65.66	9.56	-5.03	0.35
Second	60.39	-5.28	-4.42	0.61
First	-17.19	-77.57	6.33	10.75

Figure 47: Seismic Shears Frame 22

APPENDIX C: WIND LOAD CALCULATIONS

MAIN WIND-FORCE RESISTING SYSTEM (ASCE 7-05)

Table 18: Wind Calculation Conditions

Basic Wind Speed (V) mph	90
Exposure Category	B
Importance Factor (I)	1
Wind Directionality Factor (Kd)	0.85
Topographic Factor (Kzt)	1

BUILDING L/B AND VALUES

Table 19: Windward, Leeward, and Sidewall constants

		L/B	C_p
East-West Direction			
	Windward	4.317	0.8
	Leeward	4.317	-0.2
	Sidewall	4.317	-0.7
North-South Direction			
	Windward	0.232	0.8
	Leeward	0.232	-0.5
	Sidewall	0.232	-0.7

Table 17: Wind Calculation Constants

	Wind Direction	
Variable	N-S	E-W
Stiffness	Flex	Flex
B	544	126
L	126	544
h	92.5	92.5
z	30'	30'
ℓ	320	320
ϵ	0.333	0.333
α	0.25	0.25
β	0.05	0.05
V	90	90
V_z	67.644	67.644
L_z	380.55	380.55
n_1	1.163	1.163
N_1	6.54	6.54
R_n	0.043	0.043
R_h	0.127	0.127
R_b	0.023	0.095
R_L	0.030	0.007
b	0.45	0.45
R	0.037	0.074
I_z	0.275	0.275
g_R	0.000	0.000
q_p	14.836	14.836
g_V	3.4	3.4
Q	0.731	0.832
G_f	0.772	0.830

WIND CALCULATIONS CONTINUED:

$q_p =$ $0.00256\ K_h K_{zt} K_d V^2 I =$ 14.836

GCpn= 1.5 -1

Pp = q_pGCpn = 22.254 -14.836

$n_1 = \dfrac{43.5}{H^{0.9}}$ 1.163 eq (C6-15)

$n_1 > 1$ therefore Rigid structure

$g_Q =$ $g_V =$ 3.4

G= 0.85

z= 0.6h = 55.5

z_{min} = 30'

$I_z = c(33/z)^{1/6} =$ 0.275

$L_z = l(z/33)^{\epsilon}$ = 380.55

$Q_{N\text{-}S} =$ $\sqrt{(1/(1+0.63(\ B+h/L_z)^{0.63}))}$ = 0.731

$Q_{E\text{-}W} =$ $\sqrt{(1/(1+0.63(\ B+h/L_z)^{0.63}))}$ = 0.832

$G_{f\ N\text{-}S} = 0.925\ [(1+1.7 I_z g_Q Q)/(1+1.7 g_v I_z)] =$ 0.772274

$G_{f\ E\text{-}W} = 0.925\ [(1+1.7 I_z g_Q Q)/(1+1.7 g_v I_z)] =$ 0.829674

WIND CALCULATIONS CONTINUED:

Table 20: Design Wind Pressure in N-S

Design Wind Pressures p in N-S Direction (Table 5.41)						
Location	Height above Ground Level z (ft)	q(psf)	External Pressure qGC_p (psf)	Internal Pressure q_hGC_{pi}	Net Pressure p (psf)	
					+Gcpi	-Gcpi
Windward	92.5	14.354	8.87	2.67	6.20	11.54
	74.5	13.47	8.32	2.67	5.65	10.99
	70	13.20	8.16	2.67	5.49	10.83
	60	12.61	7.79	2.67	5.12	10.46
	50	12.02	7.42	2.67	4.75	10.09
	46	11.72	7.24	2.67	4.57	9.91
	40	11.28	6.97	2.67	4.30	9.64
	32	10.56	6.53	2.67	3.86	9.20
	30	9.79	6.05	2.67	3.38	8.72
	25	9.20	5.68	2.67	3.01	8.35
	20	8.46	5.22	2.67	2.55	7.90
	18	8.46	5.22	2.67	2.55	7.90
	15	8.46	5.22	2.67	2.55	7.90
Leeward	All	14.35	-5.54	2.67	-8.21	-2.87
Side	All	14.35	-7.76	2.67	-10.43	-5.09

Table 21: Design Wind Pressure in E-W

Design Wind Pressures p in E-W Direction (Table 5.41)						
Location	Height above Ground Level z (ft)	q(psf)	External Pressure qGC_p (psf)	Internal Pressure q_hGC_{pi}	Net Pressure p (psf)	
					+Gcpi	-Gcpi
Windward	92.5	14.35	9.53	2.67	6.86	12.20
	74.5	13.47	8.94	2.67	6.27	11.61
	70	13.20	8.76	2.67	6.09	11.43
	60	12.61	8.37	2.67	5.70	11.04
	50	12.02	7.98	2.67	5.31	10.65
	46	11.72	7.78	2.67	5.11	10.45
	40	11.28	7.48	2.67	4.81	10.15
	32	10.56	7.01	2.67	4.34	9.68
	30	10.39	6.89	2.67	4.22	9.56
	25	9.79	6.50	2.67	3.83	9.17
	20	9.20	6.11	2.67	3.43	8.78
	18	8.90	5.91	2.67	3.24	8.58
	15	8.46	5.61	2.67	2.94	8.28
Leeward	All	13.47	-2.24	2.67	-4.91	0.44
Side	All	13.47	-7.82	2.67	-10.49	-5.15

WIND CALCULATIONS CONTINUED:

Table 22: Total Wind pressures by Height

Floor Heights	Level	Total Height	K_Z	q_Z	Wind Pressures (psf)					
					N-S Windward	N-S Leeward	N-S Side Wall	E-W Windward	E-W Leeward	E-W Sidewall
18	Penthouse	92.5	0.9675	14.354	11.54	-8.21	-10.43	12.20	-4.91	-10.49
14.5	Roof	74.5	0.908	13.471	10.99	-8.21	-10.43	11.61	-4.91	-10.49
14	5	60	0.85	12.611	10.46	-8.21	-10.43	11.43	-4.91	-10.49
14	4	46	0.79	11.720	9.91	-8.21	-10.43	11.04	-4.91	-10.49
14	3	32	0.712	10.563	9.20	-8.21	-10.43	10.65	-4.91	-10.49
18	2	18	0.59	8.902	7.90	-8.21	-10.43	10.45	-4.91	-10.49

Table 23: Wind Forces, Shears, and Moment

Level	Wind Design					
	Load (kips)		Shear (kips)		Moment (ft-k)	
	N-S	E-W	N-S	E-W	N-S	E-W
Pent	193.4	38.8	0	0	3481.3	698.2
Roof	151.5	30.2	193.4	38.8	2196.7	437.6
5	144.8	29.3	344.9	69.0	2026.7	410.7
4	138.0	28.1	489.7	98.3	1932.5	393.8
3	132.6	27.4	627.7	126.4	1856.3	384.1
2	140.2	31.0	760.3	153.9	2523.7	557.2
Total	900.5	184.8	900.5	184.8	10535.9	2183.4

Note: Total Base Shear includes load from Windward and Leeward pressures

Wind Calculations Continued:

RAM Comparison

As these tables show, RAM values are around the same change from floor to floor as the hand calculations.

RAM values were compared further to the hand calculation method results used throughout the report and used in previous technical reports. The main differences have already been addressed, such as the possibility of a finite element analysis. The wind design table below is the final story force and story shears for the east portion of the building.

RAM Calculated Values

Table 24: RAM Calculated Wind Values

Floor Heights	Level	Total Height	K_Z	q_Z	RAM Wind Pressures (psf)					
					N-S Windward	N-S Leeward	N-S Side Wall	E-W Windward	E-W Leeward	E-W Sidewall
18	Penthouse	92.5	0.966	14.331	11.57	-8.23	-10.46	11.57	-5.98	-8.23
14.5	Roof	74.5	0.909	13.486	11.05	-8.23	-10.46	11.05	-5.98	-8.23
14	5	60	0.854	12.670	10.54	-8.23	-10.46	10.54	-5.98	-8.23
14	4	46	0.792	11.750	9.97	-8.23	-10.46	9.97	-5.98	-8.23
14	3	32	0.714	10.593	9.25	-8.23	-10.46	9.25	-5.98	-8.23
18	2	18	0.605	8.976	8.25	-8.23	-10.46	8.25	-5.98	-8.23

Table 25: RAM Wind Forces, Shears, and Moments

Level	Wind Design					
	Load (kips)		Shear (kips)		Moment (ft-k)	
	N-S	E-W	N-S	E-W	N-S	E-W
Pent	193.9	39.8	0	0	3491.0	716.6
Roof	152.1	31.1	193.9	39.8	2205.3	451.1
5	143.0	29.7	346.0	70.9	2001.8	415.3
4	138.6	28.1	489.0	100.6	1940.9	393.9
3	133.2	26.9	627.7	128.7	1864.2	376.2
2	161.4	28.7	760.8	155.6	2904.7	516.3
Total	922.2	184.3	922.2	184.3	10916.9	2152.9

Note: Total Base Shear includes load from Windward and Leeward pressures

Appendix D: Seismic Load Calculations

Table 26: Seismic Design Values

Seismic Design Values, ASCE 7-05			
Response Modification Coefficient	R= 3	R= 3.5	Table 12.2-1
Coefficient	C_U= 1.7	C_U= 1.7	Table 12.8-1
Fundamental Period	T= 1.497	T= 1.497	Sec. 12.8.2
Seismic Response Coefficient	C_S= 0.016	C_S= 0.014	Eq. 12.8-3
Building Height (above grade)	h= 74.5	h= 74.5	

Table 27: Seismic Design Values continued

Seismic Design Values, ASCE 7-05		
Occupancy	II	Table 1-1
Importance Factor	I= 1	Table 11.5-1
Site Class	D	Table 20.3-1
Spectral Response Acceleration, short	S_S= 0.12	Figure 22-1
Spectral Response Acceleration, 1 sec	S_1= 0.046	Figure 22-2
Site Coefficient F_a	F_a= 1.6	Table 11.4-1
Site Coefficient F_V	F_V= 2.4	Table 11.4-2
MCE Spectral Response Acceleration, short	S_{MS}= 0.192	Eq. 11.4-1
MCE Spectral Response Acceleration, 1 sec	S_{M1}= 0.1104	Eq. 11.4-2
Design Spectral Acceleration, short	S_{DS}= 0.128	Eq. 11.4-3
Design Spectral Acceleration, 1 sec	S_{D1}= 0.0736	Eq. 11.4-4
Seismic Design Category	B	Table 11.6-1

Table 28: Fv Values

F_V Values (Table 11.4-2 ASCE 7-05)					
	$S_1 \leq 0.1$	S_1=0.3	S_1=0.3	S_1=0.4	$S_1 \geq 0.5$
D	2.4	2	1.8	1.6	1.5

Table 29: Fa Values

F_a Values (Table 11.4-1 ASCE 7-05)					
	$S_S \leq 0.25$	S_S=0.5	S_S=0.75	S_S=1.0	$S_S \geq 1.25$
D	1.6	1.4	1.2	1.2	1

SEISMIC CALCULATIONS CONTINUED:

The values for all the seismic coefficients were determined using ASCE 7-05 equations and tables. The building was first confirmed as Seismic design category B by using Table 11.6-2 of ASCE 7-05. Once the design category had been confirmed, the approximate period was calculated by using equation 12.8-7 and table 12.8-2. Since ASCE 7-05 section 11.6 requires where an S_1 value is less than 0.75 the Seismic Design Category can be determined solely on table11.6-1 and 11.6-2 when $T_a > 0.8T_S$, the period used to calculate drift is less than T_S, equation 12.8-2 is used to find C_S, and rigid diaphragms are present.

Table 30: Seismic Response Value Comparison

Calculated Values		USGS Website Values
S_S= 0.12	(From Figure 22-1)	S_S= 0.125
S_1= 0.046	(From Figure 22-2)	S_1= 0.048
S_{MS}= F_a*S_S = 0.192		S_{MS}= 0.2
S_{M1}= F_V*S_1 = 0.1104		S_{M1}= 0.116
S_{DS}= $2S_{MS}/3$= 0.128	A (Table 11.6-1)	S_{DS}= 0.133
S_{D1}= $2S_{M1}/3$= 0.0736	B (Table 11.6-2)	S_{D1}= 0.077

C_T = 0.016 (From Table 12.8-2)
X = 0.9 (From Table 12.8-2)

$T_a = C_t h_n^x = 0.9411255$
$T_s = S_{D1}/S_{DS} = 0.575$
$0.8T_s = 0.46$ $<T_a$ therefore must use Table 11.6-1,2

T_L= 12 (From Fig. 22-15 p. 228 ASCE 7-05)

C_S values were calculated according to Section 12.8.1.1 equations 12.8-2, 12.8-3, and 12.8-4 and checked against the minimum requirement from EQ 12.8-5 of $C_S \geq 0.01$. Equation 12.8-3 is a maximum for this structure, and equation 12.8-4 does not apply since equation 12.8-3 does. The values were then compared based on R and what the professional calculated.

R=3

C_S= MAX for $T>T_L$

$S_{DS}/(R/I)$ =	0.0427
$S_{D1}/(T*R/I)$ =	0.0153
$S_{D1}T_L/(T^2R/I)$ =	0.3324
≥	0.01

C_S= 0.0153

T= C_U*T_a = 1.5999134

k= 1.550

W= 106734.9

V= C_s*W= 1636.69

The floor weights used for the seismic calculations were calculated using a 10" NWC slab over the entire area, added to the column weights. Also, the superimposed loads were added and a bracing allowance to account for beams as part of the floor system.

Table 31: Beams on 4th floor with total beam weight

Beams:			
Shape	Unit Weight (lb/ft)	Beam Length (ft)	Total Weight
32x34	1095.56	0	0.0 kips
30x34	1027.08	0	0.0 kips
34x34	1164.03	48	55.9 kips
24x34	821.667	5443.9	4473.1 kips
Total Weight=	4528.9 kips		

Table 32: Fourth Floor weight calculation

Floor # 4

Approx. Area: 64231.7 ft^2 Floor to Floor Height: 14

Slab:

NWC	145	PCF
Thickness=	10	inches
unit weight=	120.8333	psf
total weight=	7761	kips

Columns:

Shape	Quantity	Unit Weight (lb/ft)	Column Height (ft)	Total Weight	
24x24	102	580	14	828.2	kips
28x28	3	789.44444	14	33.2	kips
30x30	6	906.25	14	76.1	kips
32x32	0	1031.1111	14	0.0	kips
34x34	0	1164.0278	14	0.0	kips
36x36	0	1305	14	0.0	kips
48x48	0	2320	14	0.0	kips

Column Reinf =	22.35	Kips
X-verse Reinf=	2.77	kips
Total Weight=	962.6	kips
Beam =	4528.9	kips
Reinforcement=	156.177	kips
Total Weight=	4685.1	kips

Super Imposed:

MEP=	5	psf
Finishes=	3	psf
Total Weight=	513.9	kips

TOTAL FLOOR WEIGHT: 13922.9 kips or 216.8 psf

The values in this portion of the report were calculated using the method described in the Seismic design portion of this report and the same method used in Technical Report One.

Table 33: Seismic Forces, Shears and Moments for As- Built with R=3

R=3

Floor	w_x (k)	h_x (ft)	h_x^k (ft)	$w_x h_x^k$	C_{vx}	Story Force F_x (k)	Story Shear V_x (k)	Moment at Floor (ft-k)
Roof	4240.5	74.5	639.41	2711449	0.359	167.42	0	12473.065
5	4713.6	60	462.27	2178985	0.288	134.55	167.42	8072.7394
4	4726.5	46	310.43	1467216	0.194	90.60	301.97	4167.4204
3	4724.0	32	180.20	851252	0.113	52.56	392.57	1681.9916
2	4653.4	18	76.08	354028	0.047	21.86	445.13	393.48265
1	5444.4						466.99	
Sum	28502.4	74.5	1668.39	7562930	1.000	466.99	466.99	26788.699

Table 34: Seismic Forces, Shears, and Moments for As-Built with R=3.5

R=3.5

Floor	w_x (k)	h_x (ft)	h_x^k (ft)	$w_x h_x^k$	C_{vx}	Story Force F_x (k)	Story Shear V_x (k)	Moment at Floor (ft-k)
Roof	4240.5	74.5	639.41	2711449	0.359	143.51	0	10691.199
5	4713.6	60	462.27	2178985	0.288	115.32	143.51	6919.4909
4	4726.5	46	310.43	1467216	0.194	77.65	258.83	3572.0746
3	4724.0	32	180.20	851252	0.113	45.05	336.48	1441.7071
2	4653.4	18	76.08	354028	0.047	18.74	381.54	337.27085
1	5444.4						400.28	
Sum	28502.4	74.5	1668.39	7562930	1.000	400.28	400.28	22961.742

Table 35: Seismic Forces, Shears, and Moments for Redesigned with R=3

Floor	w_x (k)	h_x (ft)	h_x^k (ft)	$w_x h_x^k$	C_{vx}	Story Force F_x (k)	Story Shear V_x (k)	Moment at Floor (ft-k)
Penthouse	6481.1	92.5	1115.41	7229044	0.179	293.33	0	27133.348
Roof	18245.1	74.5	797.56	14551503	0.361	590.46	293.33	43989.083
5	14162.0	60	570.24	8075727	0.200	327.69	883.79	19661.364
4	13922.9	46	377.75	5259370	0.130	213.41	1211.48	9816.8534
3	16960.3	32	215.24	3650482	0.091	148.13	1424.89	4740.0283
2	17785.3	18	88.23	1569200	0.039	63.67	1573.02	1146.1239
1	19178.2						1636.69	
Sum	106734.9	92.5	3164.42	40335326	1.000	1636.69	1636.69	106486.8

APPENDIX E: MEMBER DESIGNS AND CHECKS

Interior 45' span beam Design

GIRDER DESIGN - INTERIOR - FLOOR

LOADING: DEAD: 125 PSF + 8 PSF + GIRDER WT
LIVE: 50 PSF + 20 PSF

*NO LIVE LOAD REDUCTION TO BE CONSERVATIVE SINCE TENANT FIT-OUT DWG'S UNAVAILABLE

$W_u = 1.2(125+8) + 1.6(50+20) = 272$ PSF

$\boxed{W_u = 272 \text{ PSF}}$

MAXIMUM MOMENT DETERMINATION

M_{MAX} @ ENDS $= \frac{wl^2}{12} = \frac{(0.272 \text{ KSF})(24')(45')^2}{12} = 1101.6$ k-ft

M_{MAX} @ MID $= \frac{wl^2}{24} = \frac{(0.272 \text{ KSF})(24')(45')^2}{24} = 550.8$ k-ft

GIRDER SIZE

$bd^2 = 20M_u$

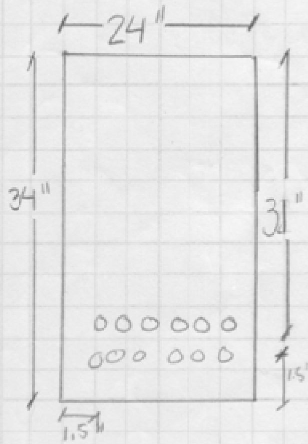
$24(d)^2 = 20(1102)$

$d = 30.3''$ TRY #8'S

$h = d + 1.5 + d_b/2 = 30.3 + 1.5 + 1/2 = 32.3$

$\boxed{h = 34''}$ $d = h - 1.5 - 3d_b/2 = 34 - 1.5 - 3/2 = 31$

$A_s = \frac{M_u}{4d} = \frac{1102}{4(31)} = 8.89 \text{ in}^2$



· TRY 12 #8'S IN 2 ROWS, $A_s = 9.48 \text{ in}^2$

· ASSUME $f_s > f_y$

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(9.48)(60)}{0.85(4)(24'')} = 6.97''$

$c = a/\beta_1 = 6.97/0.85 = 8.2''$

· CHECK $f_s > f_y$

$f_s = \varepsilon_u/c\,(d-c) = 0.003/8.2(31-8.2) = 0.0083 > 0.005$ ∴ OK $\phi = 0.9$

$\phi M_n = \phi A_s f_y (d - a/2) = 0.9(9.48)(60)(31 - 6.97/2) = 14085.5$ k-in

$\boxed{\phi M_n = 1173.8 \text{ k-ft} > M_u = 1102 \text{ k-ft} \therefore OK}$

MEMBER DESIGN CONTINUED:

· CHECK SHEAR

$V_n = V_c + V_s \qquad \phi V_n \geq V_u$

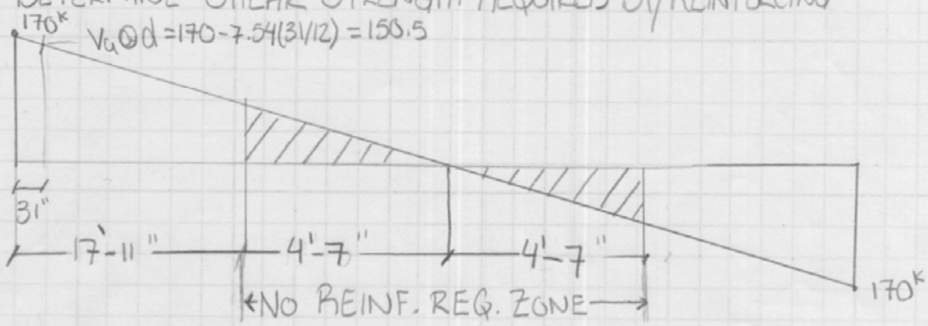
· SHEAR STRENGTH OF CONC. BM w/o STIRRUPS

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

$= 2(1)\sqrt{4000}(24)(31) = 94.1^K$

$\phi V_n = 0.5\,\phi V_c = 0.5(0.75)(94.1) = 35.3^K$

· DETERMINE SHEAR STRENGTH REQUIRED BY REINFORCING



$w_u = [(125+8)\times 24' + (34/12 \cdot 24/12 \cdot 150)]1.2 + (1.6)(24')(70) = 7.54\ klf$

$V_s = \frac{V_u}{\phi} - V_c = \frac{150.5}{0.75} - 94.1 = 106.6^K$

$V_s \leq 8\sqrt{f'c}\, b_w d = 8\sqrt{4000}(24)(31)/1000 = 376.4^K$

$106.6^K < 376.4^K \quad \therefore OK$

· DETERMINE MAXIMUM SPACING OF SHEAR REINF.

IF $V_s \leq 4\sqrt{f'c}\, b_w d = 188.2^K$ THEN $S_{MAX} = MIN \begin{cases} d/2 = 31/2 = 15.5" \\ 24" \end{cases}$

$V_s = 106.6^K < 188.2$

ELSE $S_{MAX} = MIN \begin{cases} d/4 \\ 12" \end{cases}$

S = 15"

MEMBER DESIGN CONTINUED:

• DETERMINE MINIMUM SHEAR REINF.

$$A_{V\,MIN} = MAX \begin{cases} 0.75\sqrt{f'_c}\,b_w S/f_{yt} = 0.75\sqrt{4000}(24)(15)/60\,000 = 0.285\ IN^2 \\ 50\,b_w S/f_{yt} = 50(24)(15)/60\,000 = 0.3\ IN^2 \end{cases}$$

$A_{V\,MIN} = 0.3\ IN^2$

USE #3 STIRRUPS @ 15" AS MINIMUM SHEAR REINF.
(3 LEGS = 3(0.11 IN²) = 0.33 IN² > 0.3 IN² ✓OK

• DESIGN SHEAR REINF

$V_S = A_v f_{yt} d/s$

$S = \dfrac{A_v f_{yt} d}{V_S} = \dfrac{0.33(60)(31)}{106.6} = 5.76"$

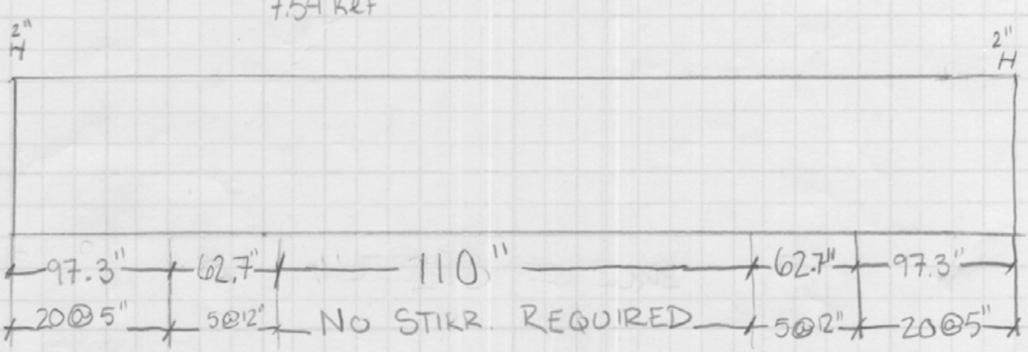
USE (3)#3 @ 5" AT MEMBER ENDS, STARTING 2" FROM FACE OF SUPPORT

• FIND WHERE (3)#3 @ 12" WORKS

$\phi V_n = \phi V_c + \phi V_s = 0.75\left(94.1 + \dfrac{0.33(60)(31)}{12}\right) = 108.9375^k$

DISTANCE WHERE $V_u = 108.9375^k$

$\ell_v = \dfrac{(170 - 108.9)(12''/ft)}{7.54\ klf} = 97.25'' = 8'\text{-}1\tfrac{1}{4}''$



MEMBER DESIGN CONTINUED:

Interior slab thickness design

INTERIOR DESIGN

LOADING:
50 OFFICE LOAD - LIVE
20 PARTITION LOAD - LIVE
8 SUPERIMPOSED DEAD (FOR MEP, ETC)
+ ? CONC SLAB

$W_u = 1.2(8\text{ PSF}) + 1.6(70) = 121.6\text{ PSF}$

MATERIALS:
$f'_c = 4000\text{ PSI}$
$f_y = 60\text{ KSI}$

MINIMUM SLAB THICKNESS:

• ASSUME COLUMNS ARE 24"X24"

$l_n = 24' - 2' = 22'$

• FROM ACI 318-08, TABLE 9.5 $\quad h \geq l_n/28$

$h \geq (22 \times 12)/28$

$h \geq 9.43" \rightarrow \boxed{h = 10"}$

SLAB CONTRIBUTION TO DEAD LOAD

$\text{SLAB WEIGHT} = 150\text{ PCF} \times \frac{10"}{12"/\text{ft}} = 125\text{ PSF}$

$W_{SLAB} = 1.2(125\text{ PSF}) = 150\text{ PSF}$

TOTAL LOAD:

$W_u = 121.6\text{ PSF} + 150\text{ PSF} = 271.6\text{ PSF}$

$\boxed{W_u = 272\text{ PSF}}$

MOMENT VALUES USING ACI COEFFICIENTS

• AT INTERIOR SUPPORTS: $-M = \left(\frac{1}{10}\right) w_u l_n^2 = \left(\frac{1}{10}\right)(272)(22)^2 = 13.165\text{ k-ft}$

• AT MIDSPAN: $+M = \left(\frac{1}{16}\right) w_u l_n^2 = \left(\frac{1}{16}\right)(272)(22)^2 = 8.228\text{ k-ft}$

• UNFACTORED: $M_u = \frac{wl^2}{8} = \frac{(70+8+125)(22)^2}{8} = 12.282\text{ k-ft}$

MEMBER DESIGN CONTINUED:

REQUIRED REINFORCEMENT

- $\rho_{MAX} = 0.85\beta(f'c/fy)\left[\frac{\varepsilon_s}{\varepsilon_s+\varepsilon_t}\right]$

  $\rho_{MAX} = 0.85(0.85)\left(\frac{4}{60}\right)\left[\frac{0.003}{0.003+0.004}\right] = 0.0206$

- EFFECTIVE DEPTH:

  $bd^2 = 20M_u$

  $(12'')(d^2) = 20(13.165\ k\text{-}ft)$

  $d = 4.68''$

- AREA OF STEEL REQUIRED PER FOOT IN TOP OF SLAB:

  $A_s = \frac{M_u}{4d}$

  $A_s = \frac{13.165}{4 \times 4.68} = 0.703\ in^2$

  USE #8 @ 12" ($A_s = 0.79\ in^2$)

- AREA OF STEEL REQUIRED PER FOOT @ MIDSPAN:

  $A_s = \frac{M_u}{4d}$

  $A_s = \frac{8.228}{4 \times 4.68} = 0.4395\ in^2$

  USE #8 @ 12" ($A_s = 0.79\ in^2$) (FOR EASE OF CONSTRUCTION)

- MINIMUM STEEL FOR SHRINKAGE + TEMPERATURE

  $A_{SMIN} = 0.0018(12'')(10'') = 0.216\ in^2$

  $A_{SMIN} = 0.216\ in^2 < A_s = 0.31\ in^2 \quad \therefore OK$

  USE #5 @ 12" O.C.

MEMBER DESIGN CONTINUED:

- CHECK SHEAR
  - SHEAR IN END MEMBERS @ FIRST INTERIOR SUPPORT

$$V_u = \frac{1.15 w_u l_n}{2} = \frac{1.15(0.272)(22)}{2} = 3.44\ K$$

  - SHEAR AT OTHER SUPPORTS

$$V_u = \frac{W_u l_n}{2} = \frac{(0.272)(22)}{2} = 2.99^{K}$$

- ALLOWABLE SHEAR

$$\phi V_n = 0.75(2)\sqrt{f'c}\ bd$$

$$\phi V_n = 0.75(2)\sqrt{4000}\,(12)(4.68)$$

$$\phi V_n = 4.97^{K}$$

$$\boxed{V_u < \phi V_n \quad \therefore OK}$$

- DEFLECTION CHECK (TABLE 9.5 CONFIRMATION)

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

$$I = \frac{(24' \times 12''/1')(12'')^3}{12} = 41472\ IN^4$$

$$E = 57000\sqrt{4000} = 3605\ KSI$$

$$\Delta = \frac{5(0.272\ KSF)(45')(24')^4(1728)}{384(3605\ KSI)(41472\ IN^4)} = 0.611''$$

$$\Delta_{MAX} = \frac{l}{240} = \frac{24 \times 12}{240} = 1.2''$$

$$\boxed{\Delta_{MAX} > \Delta \quad \therefore OK}$$

MEMBER DESIGN CONTINUED: Third Floor Green Roof Slab Design

LOADING: 50 PSF DEAD
100 PSF LIVE
+ SELF

$W_u = 1.2(50) + 1.6(100) = 220$ PSF

MATERIALS: $f'c = 4000$ PSI
$fy = 60$ KSI

MINIMUM SLAB THICKNESS

- ASSUME COLUMNS ARE 24"x24"

$\ell n = 24' - 2' = 22'$

- FROM ACI 318-08, TABLE 9.5 $h \geq \ell n/28$

$h \geq (22 \times 12)/28$

$h \geq 9.43"$ $\rightarrow h = 10"$

SLAB CONTRIBUTION TO DEADLOAD

SLAB WT = $150 \text{PCF} \times \frac{10"}{12"/\text{ft}} = 125$ PSF

$W_{SLAB} = 1.2(125) = 150$ PSF

TOTAL LOAD:

$W_u = 220$ PSF $+ 150$ PSF $= 370$ PSF

$\boxed{W_u = 370 \text{ PSF}}$

MOMENT VALUES USING ACI COEFFICIENTS

- AT INTERIOR SUPPORTS: $-M = \left(\frac{1}{10}\right) w_u \ell n^2 = \frac{1}{10}(370)(22)^2 = 17.91$ K-ft
- AT MIDSPAN: $+M = \frac{1}{16} W_u \ell n^2 = \frac{1}{16}(370)(22)^2 = 11.19$ K-ft

- UNFACTORED: $M_u = \frac{w\ell^2}{8} = \frac{(50+100+125)(22)^2}{8} = 16.64$ K-ft

MEMBER DESIGN CONTINUED:

REQUIRED REINFORCEMENT

- $\rho_{MAX} = 0.85\beta(f'c/fy)\left[\frac{\varepsilon_S}{\varepsilon_S + \varepsilon_t}\right]$

$\rho_{MAX} = 0.85(0.85)(4/60)\left[\frac{0.003}{0.003+0.004}\right] = 0.0206$

- EFFECTIVE DEPTH:

$bd^2 = 20Mu$

$(12")(d^2) = 20(16.64\ k\text{-}ft)$

$d = 5.27"$

- AREA OF STEEL REQUIRED PER FOOT IN TOP OF SLAB:

$As = \frac{Mu}{4d} = \frac{16.64}{4 \times 5.27} = 0.789\ IN^2$

USE #8 @ 12" ($As = 0.79\ IN^2$)

- AREA OF STEEL REQUIRED PER FOOT @ MIDSPAN:

$As = \frac{Mu}{4d} = \frac{11.19}{4 \cdot 5.27} = 0.531\ IN^2$

USE #8 @ 12" ($As = 0.79\ IN^2$)

- MINIMUM STEEL FOR SHRINKAGE + TEMPERATURE:

$As_{MIN} = 0.0018(12")(10") = 0.216\ IN^2$

$As_{MIN} = 0.216 IN^2 < As = 0.31 IN^2\ \therefore OK$

USE #5 @ 12" O.C.

MEMBER DESIGN CONTINUED:

- CHECK SHEAR
  - SHEAR IN END MEMBERS @ FIRST INTERIOR SUPPORT

$$V_u = \frac{1.15 w_u l_n}{2} = \frac{1.15(0.37)(22)}{2} = 4.68\text{ K}$$

  - SHEAR AT OTHER SUPPORTS

$$V_u = \frac{w_u l_n}{2} = \frac{(0.37)(22)}{2} = 4.07\text{K}$$

  - ALLOWABLE SHEAR

$$\phi V_n = 0.75(2)\sqrt{f'c}\, bd$$

$$\phi V_n = 0.75(2)\sqrt{4000}\,(12)(5.27)$$

$$\phi V_n = 6^k$$

$$\boxed{\phi V_n = 6^k > V_u = 4.68^k \therefore OK}$$

MEMBER DESIGN CONTINUED: TOP FLOOR GREEN ROOF SLAB DESIGN

LOADING: 8 PSF DEAD
100 PSF LIVE
+SELF

$W_u = 1.2(8) + 1.6(100) = 169.6$ PSF

MATERIALS: $f'c = 4000$ PSI
$f_y = 60$ KSI

MINIMUM SLAB THICKNESS

- ASSUME 24"x24" COLUMNS

$l_n = 24' - 2' = 22'$

- FROM ACI 318-08, TABLE 9.5 $h \geq l_n/28$

$h \geq (22 \times 12)/28$

$h \geq 9.43'' \rightarrow h = 10''$

SLAB CONTRIBUTION TO DEADLOAD

SLAB WT $= 150 \text{ PCF} \times \frac{10''}{12''/\text{ft}} = 125$ PSF

$W_{SLAB} = 1.2(125) = 150$ PSF

TOTAL LOAD:

$W_u = 170 \text{ PSF} + 150 \text{ PSF} = 320$ PSF

$$\boxed{W_u = 320 \text{ PSF}}$$

MOMENT VALUES USING ACI COEFFCIENTS:

- AT INTERIOR SUPPORTS: $-M = \left(\frac{1}{10}\right) W_u l_n^2 = \frac{1}{10}(0.32)(22)^2 = 15.49$ K-ft

- AT MIDSPAN: $+M = \frac{1}{16} W_u l_n^2 = \frac{1}{16}(0.32)(22)^2 = 9.68$ K-ft

- UNFACTORED: $M_u = \frac{w l^2}{8} = \frac{(100+8+125)(22)^2}{8} = 14.1$ K-ft

MEMBER DESIGN CONTINUED:

REQUIRED REINFORCEMENT

- $\rho_{MAX} = 0.85(0.85)(4/60)\left[\frac{0.03}{0.03+0.07}\right] = 0.0206$

- EFFECTIVE DEPTH:

  $bd^2 = 20M_u$

  $12d^2 = 20(14.1) \rightarrow$ **$d = 4.85''$**

- AREA OF STEEL REQUIRED PER FOOT IN TOP OF SLAB:

  $A_S = \frac{M_u}{4d} = \frac{14.1}{4 \times 4.85} = 0.727\ IN^2$

  USE #8 @ 12" ($A_S = 0.79\ IN^2$)

- AREA OF STEEL REQUIRED PER FOOT @ MIDSPAN:

  $A_S = \frac{M_u}{4d} = \frac{9.68}{4 \times 4.85} = 0.50\ IN^2$

  USE #8 @ 12" ($A_S = 0.79\ IN^2$)

- MINIMUM STEEL REQ'D FOR SHRINKAGE + TEMPERATURE:

  $A_{S_{MIN}} = 0.0018(12'')(10'') = 0.216\ IN^2$

  $A_{S_{MIN}} = 0.216\ IN^2 < A_S = 0.31\ IN^2 \therefore OK$ **USE #5 @ 12" O.C.**

- CHECK SHEAR

- SHEAR IN END MEMBER @ FIRST INT. SUPPORT

  $V_u = \frac{1.15 w_u l_n}{2} = \frac{1.15(0.32)22}{2} = 4.048\ K$

- SHEAR @ OTHER SUPPORTS

  $V_u = \frac{w_u l_n}{2} = \frac{0.32(22)}{2} = 3.52\ K$

- ALLOWABLE SHEAR

  $\phi V_n = 0.75(2)\sqrt{4000}(12)(4.85) = 5.52^K$

  $\phi V_n = 5.52^K > V_u = 4.05^K \therefore OK$

MEMBER CHECK CONTINUED: LATERAL BEAM GIRDER CHECK

GIRDER CHECK

LATERAL END MOMENT = 290 ^{1K} [EQ LOAD]

LOADING : DEAD = 125 PSF + 8 PSF + 850 PLF

LIVE = 50 PSF + 20 PSF

$W_u = 1.2(125+8)(12) + 1.2(850) + 1.6(50+20)(12)$

$W_u = 4279.2$ PLF

MAXIMUM MOMENT DETERMINATION

GRAVITY

$M_{MAX@ENDS} = \frac{wl^2}{12} = \frac{(4.28 \text{ KLF})(36')^2}{12} = 462.2 \text{ K-ft}$

$M_{MAX@MID} = \frac{wl^2}{24} = \frac{(4.28 \text{ KLF})(36')^2}{24} = 231.1 \text{ K-ft}$

GRAVITY + LATERAL [1.2D + 1.6L + 1.0E]

$M_{MAX@ENDS} = 462.2 \text{ K-ft} + 290 \text{ K-ft} = 752.2 \text{ K-ft}$

$M_{MAX@MID} = 231.1 \text{ K-ft} + 290 \text{ K-ft} = 521.1 \text{ K-ft}$

BM HAS (8) #8'S IN 2 ROWS

$\therefore d = 31''$

$A_s = 8(0.79 \text{ IN}^2) = 6.32 \text{ IN}^2$

$\phi M_n = \phi A_s f_y (d - a/2) \rightarrow a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(6.32)(60)}{0.85(4)(24)} = 4.647''$

$\phi M_n = 0.9(6.32 \text{ IN}^2)(60 \text{ KSI})(31'' - 4.647''/2)$

$\phi M_n = 9787 \text{ K-IN} = 815.6 \text{ K-ft} > M_u = 752.2 \text{ K-ft}$ √OK

MEMBER CHECK CONTINUED:

CHECK SHEAR

$V_n = V_c + V_s$ $\qquad \phi V_n \geq V_u$

STRENGTH OF CONC

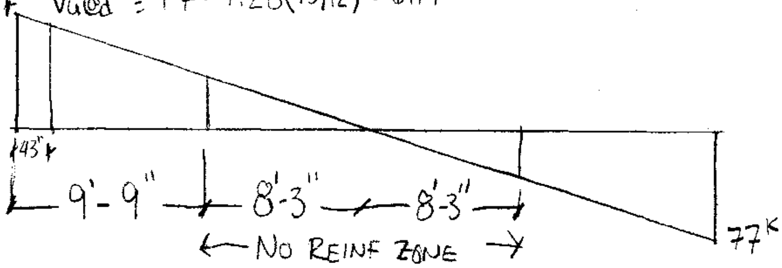
$V_c = 2\lambda\sqrt{f'_c}\, b_w \cdot d$

$= 2\sqrt{4000}\,(24)(31) = 94.1^K$

$\phi V_n = 0.5\phi V_c = 0.5(0.75)(94.1) = 35.29^K$

• DETERMINE SHEAR STRENGTH REQ'D BY REINFORCING

$77^K \quad V_u @ d = 77 - 4.28(43/12) = 61.7^K$



$V_s = \frac{V_u}{\phi} - V_c = \frac{61.7}{0.75} - 94.1 = -11.88^K \quad \therefore$ MIN

$V_s \leq 8\sqrt{f'_c}\, b_w d = 8\sqrt{4000}(24)(31)/1000 = 376.4^K$ ✓OK

· DETERMINE MAX SPACING

If $V_s \leq 4\sqrt{f'_c}\, b_w d = 188.2$ ✓OK THEN $S_{MAX} = \begin{cases} 15.5" \\ 24" \end{cases}$

ELSE $S_{MAX} = MIN \begin{cases} d/4 \\ 12" \end{cases}$

S = 15"

MEMBER CHECK CONTINUED:

DETERMINE MIN. SHEAR REINF.

$$A_{V\,MIN} = MAX \begin{cases} 0.75\sqrt{f'c}\,b_w S/f_{yt} = 0.75\sqrt{4000}(24)(15)/60000 = 0.285\ IN^2 \\ 50 b_w S/f_{yt} = 50(24)(15)/60000 = 0.3\ IN^2 \end{cases}$$

$A_{V\,MIN} = 0.3\ IN^2$

• BM HAS (3)#3 STIRRUPS, $A_S = 0.33\ IN^2 > A_{V\,MIN} = 0.3\ IN^2$ ∴ OK

• CHECK SPACING

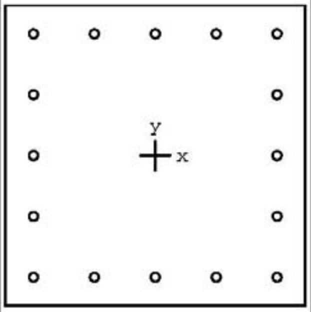
$V_S = A_V f_{yt}\, d/s$

$V_S = -11.9''$ ∴ USE MAX SPACING

$S_{MAX} = 15''$

SPACING ON BM = 9'' ∴ OK

MEMBER CHECK CONTINUED: COLUMN C-5 PENTHOUSE LEVEL



24 x 24 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

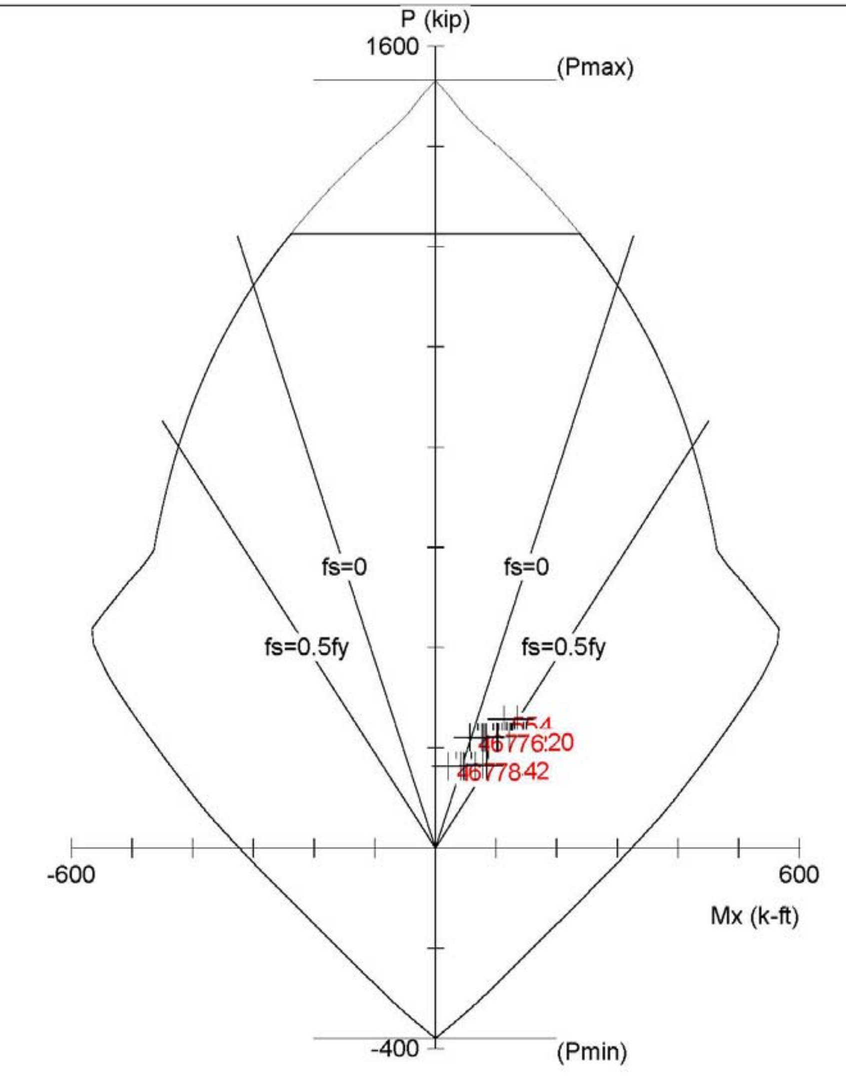
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 16:16:48



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File: G:\thesis stuff\FINAL\PCA\column5-C 6.col

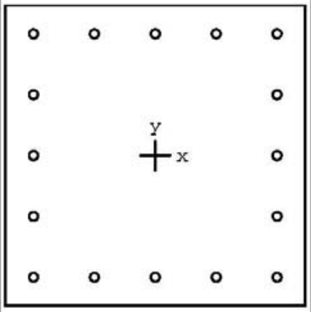
Project:

Column:		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #6 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 7.04 in^2	Rho = 1.22%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 4.13 in	Clear cover = 1.88 in

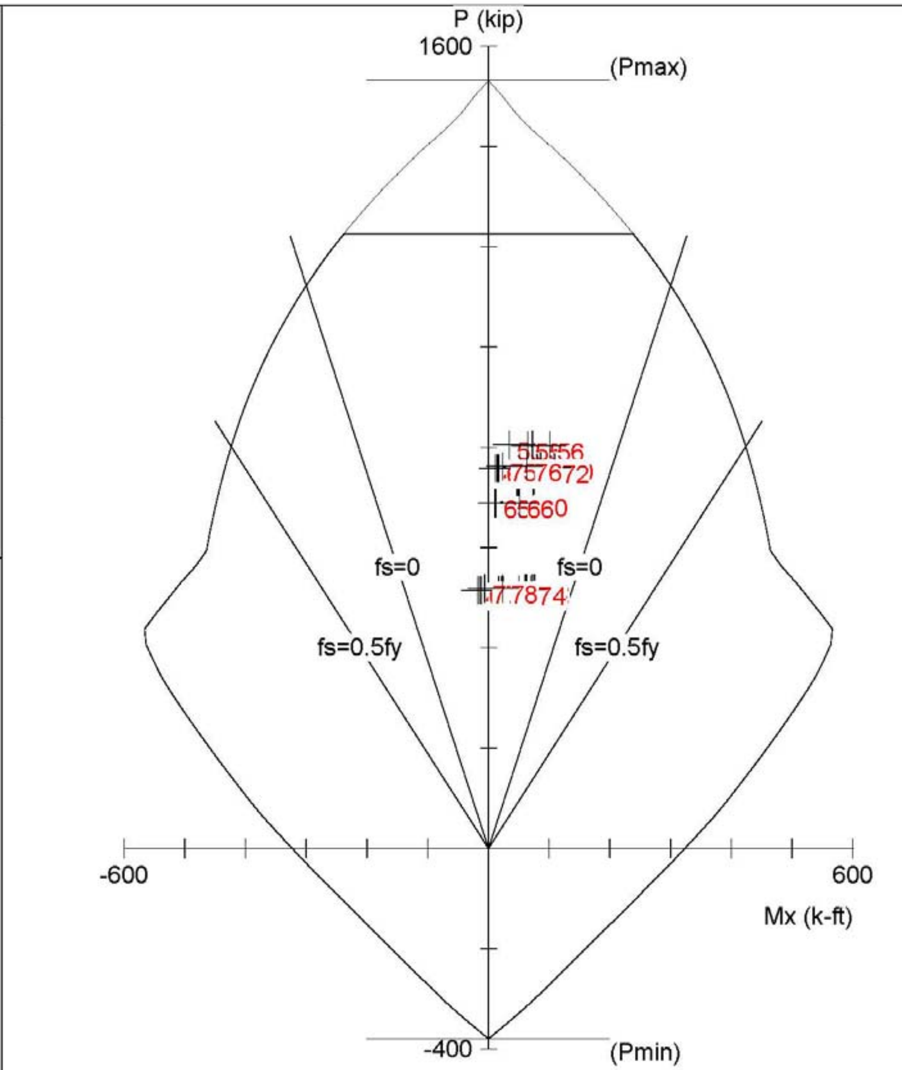
Confinement: Tied phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

kx(braced) = 0.893474, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN C-5 FIFTH FLOOR



24 x 24 in



Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 16:11:45

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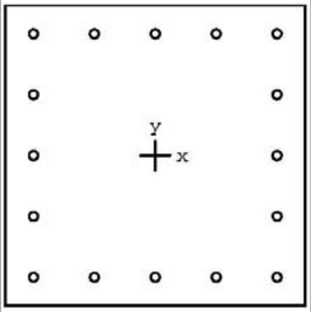
Project:

Column:		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #6 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 7.04 in^2	Rho = 1.22%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 4.13 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.963329, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN C-5 FOURTH FLOOR



24 x 24 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

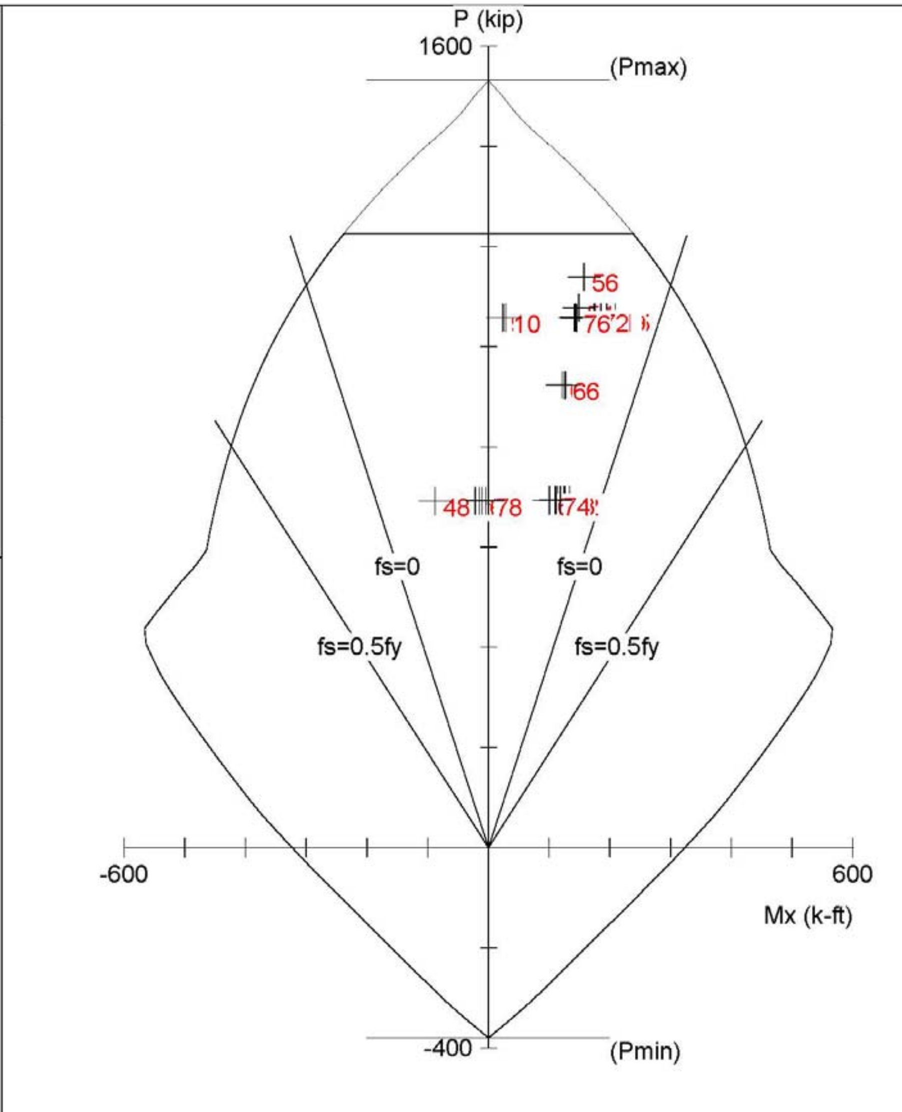
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 16:02:02



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

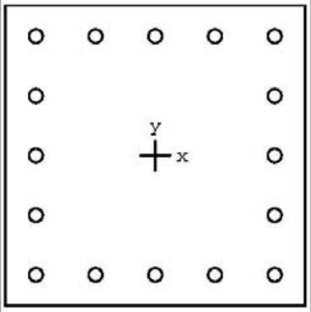
File: G:\thesis stuff\FINAL\PCA\column5-C 4.col

Project:

Column:		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #6 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 7.04 in^2	Rho = 1.22%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 4.13 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.965049, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN C-5 THIRD FLOOR



24 x 24 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

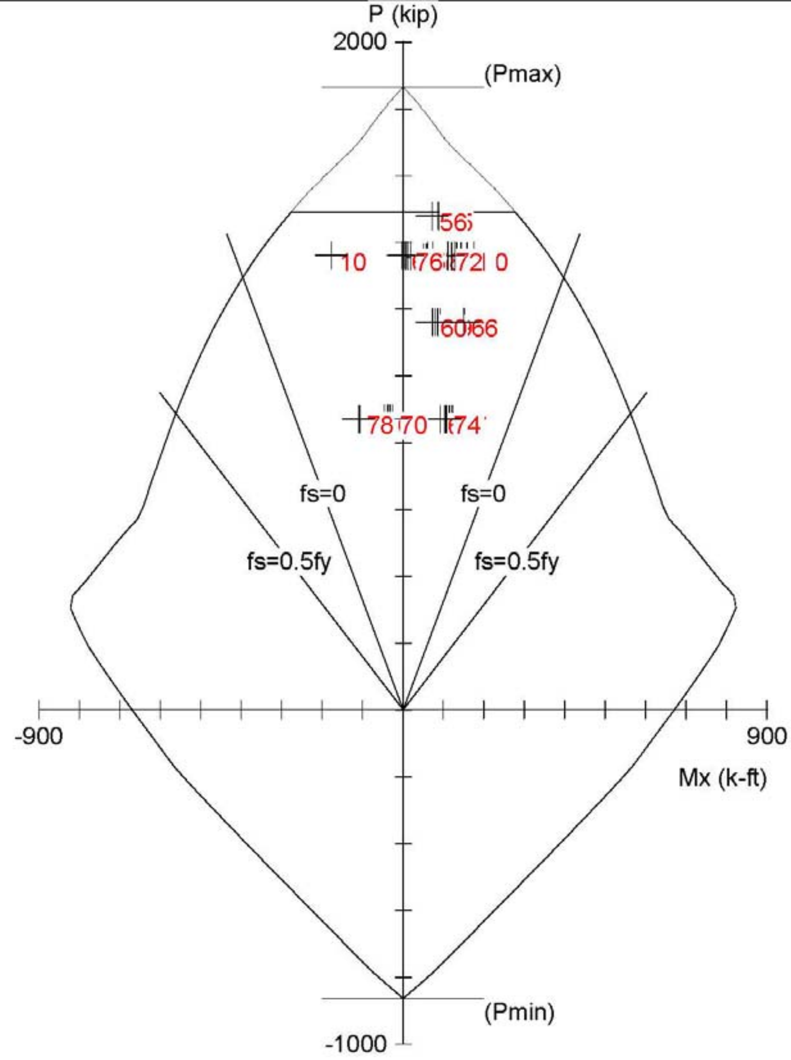
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 15:37:36



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

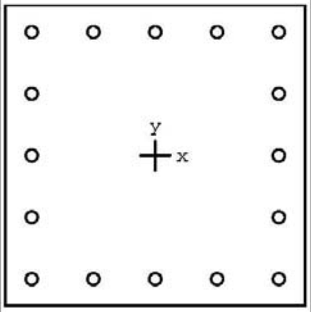
File: G:\thesis stuff\FINAL\PCA\column5-C 3.col

Project:

Column:		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #9 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 16.00 in^2	Rho = 2.78%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 3.65 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.965049, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN C-5 SECOND FLOOR



28 x 28 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

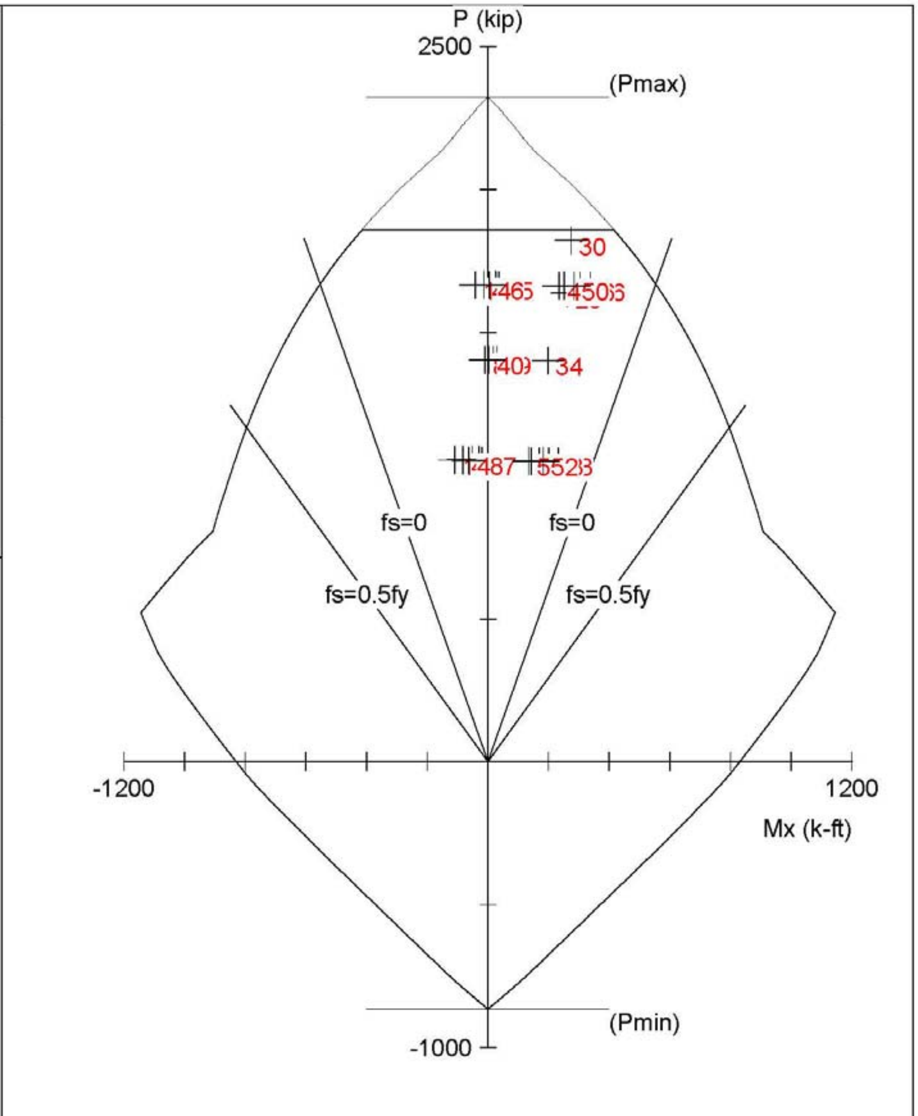
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 15:28:20



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

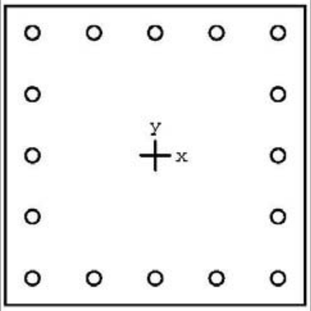
File: G:\thesis stuff\FINAL\PCA\column5-C 2.col

Project:

Column:		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 784 in^2	16 #9 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 16.00 in^2	Rho = 2.04%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 51221.3 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 51221.3 in^4
Beta1 = 0.85		Clear spacing = 4.65 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.990837, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN C-5 FIRST FLOOR



30 x 30 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

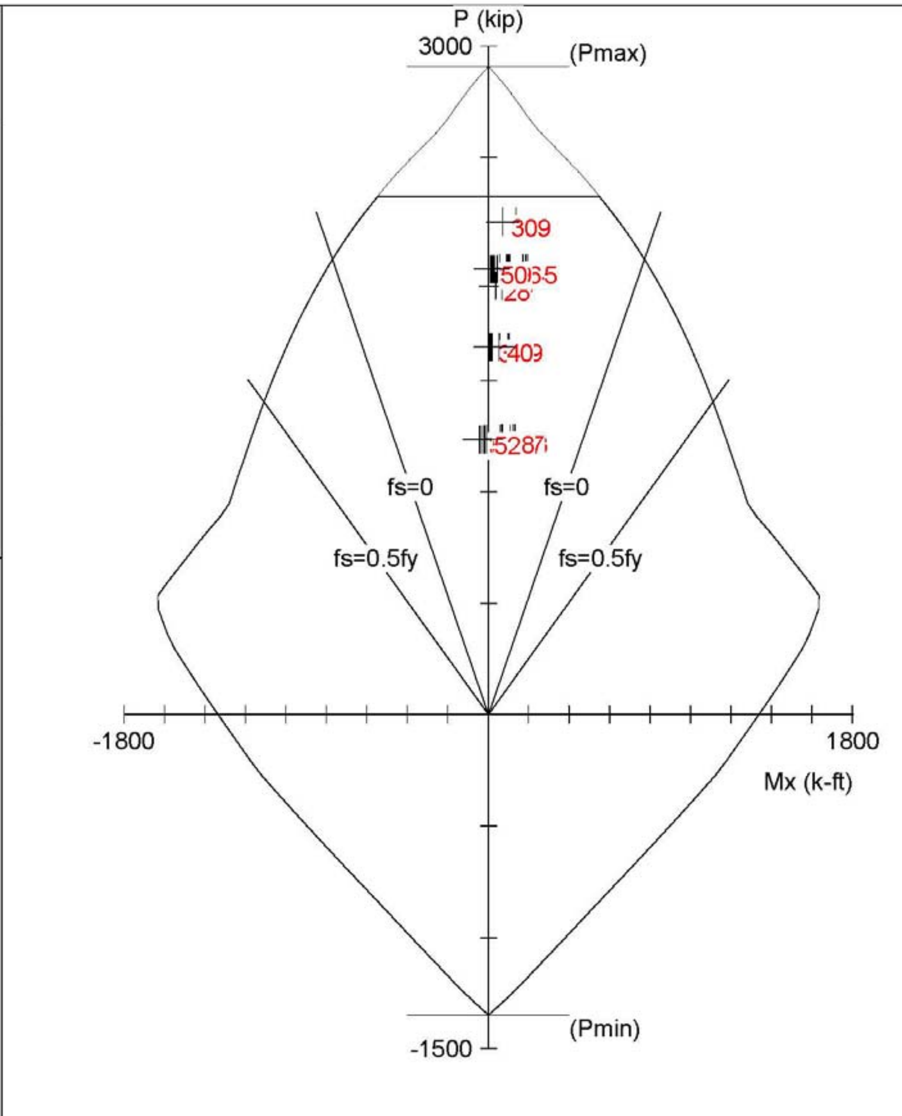
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 15:23:33



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

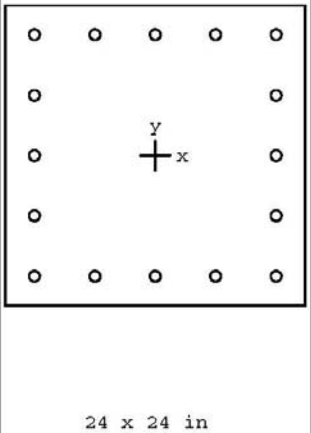
File: G:\thesis stuff\FINAL\PCA\column5-C 1.col

Project:

Column:		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 900 in^2	16 #11 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 24.96 in^2	Rho = 2.77%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 67500 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 67500 in^4
Beta1 = 0.85		Clear spacing = 4.74 in	Clear cover = 2.00 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 1, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN D-7.9 PENTHOUSE FLOOR



Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

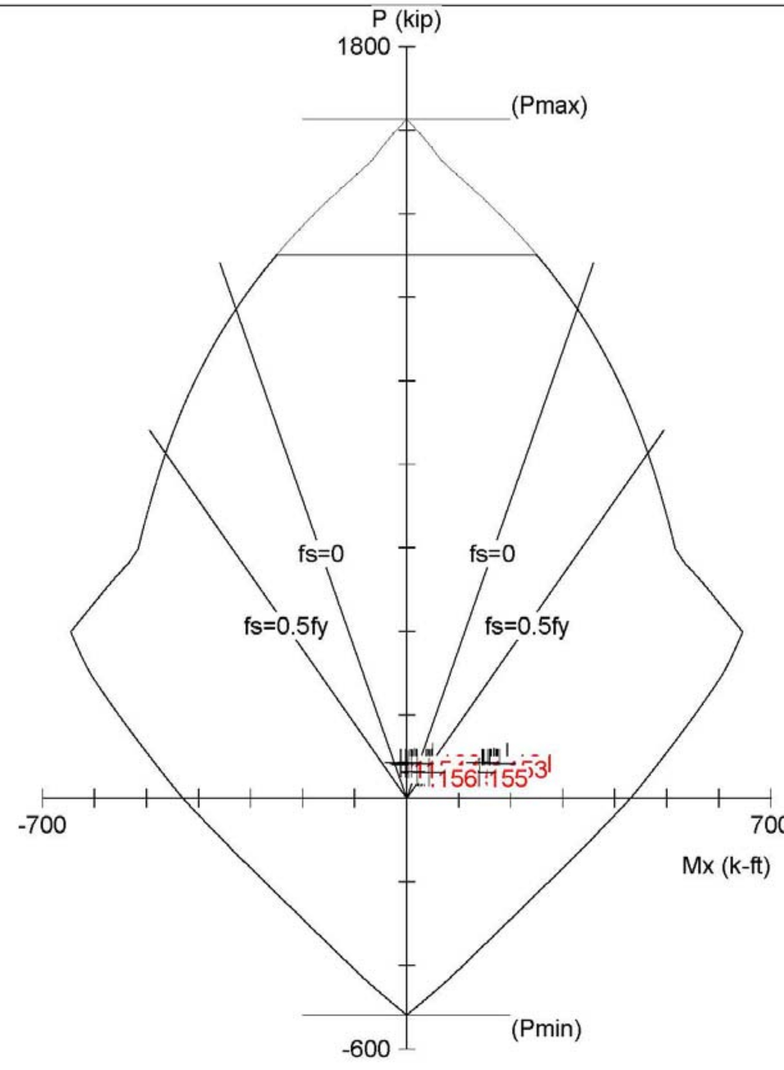
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 17:59:57



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

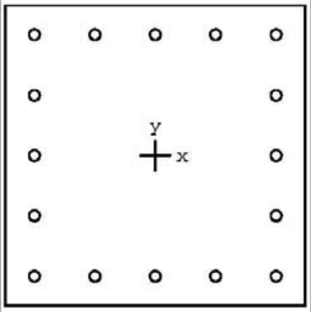
File: G:\thesis stuff\FINAL\PCA\column7.9-D 7.col

Project:

Column: 7.9-D 1		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #7 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 9.60 in^2	Rho = 1.67%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 3.97 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.893474, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN D-7.9 FIFTH FLOOR



24 x 24 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

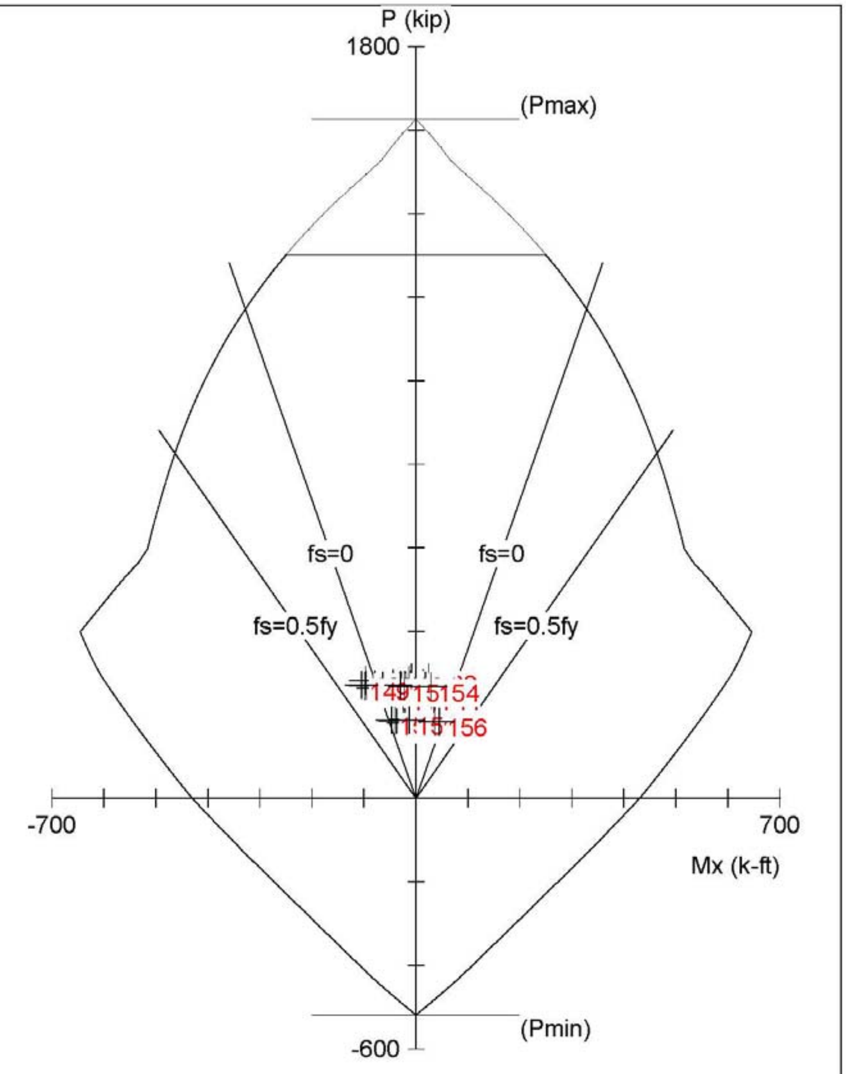
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 17:54:00



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

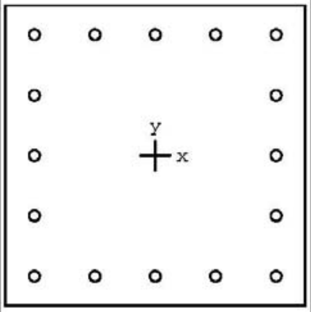
File: G:\thesis stuff\FINAL\PCA\column7.9-D 6.col

Project:

Column: 7.9-D 1		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #7 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 9.60 in^2	Rho = 1.67%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 3.97 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.94993, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN D-7.9 FOURTH FLOOR



24 x 24 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

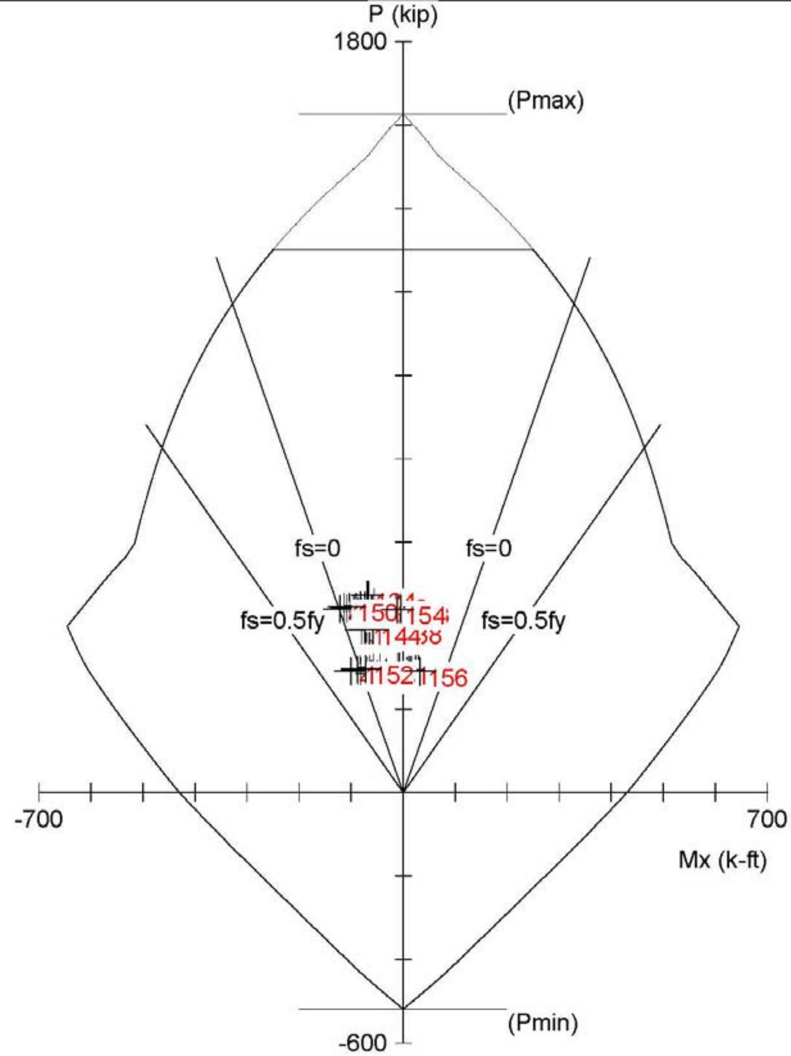
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 17:10:29



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

File: G:\thesis stuff\FINAL\PCA\column7.9-D 5.col

Project:

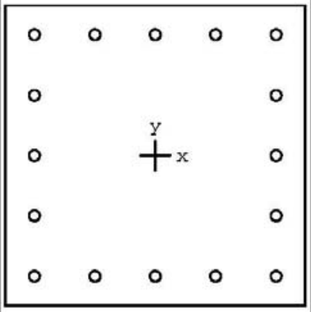
Column: 7.9-D 1 | Engineer:

f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #7 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 9.60 in^2	Rho = 1.67%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 3.97 in	Clear cover = 1.88 in

Confinement: Tied phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

kx(braced) = 0.96297, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN D-7.9 THIRD FLOOR



24 x 24 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

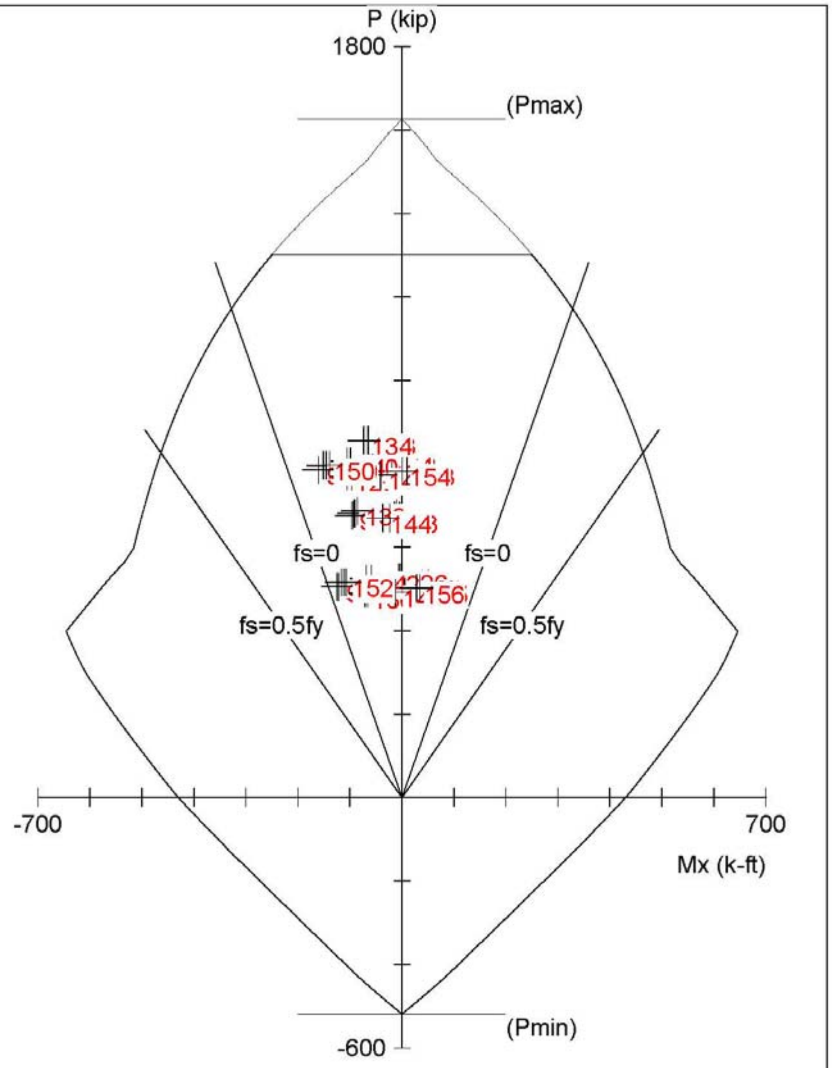
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 16:45:24



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

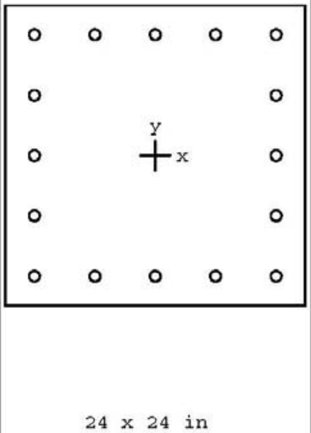
File: G:\thesis stuff\FINAL\PCA\column7.9-D 3.col

Project:

Column: 7.9-D 1		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #7 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 9.60 in^2	Rho = 1.67%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 3.97 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.95165, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN D-7.9 SECOND FLOOR



Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

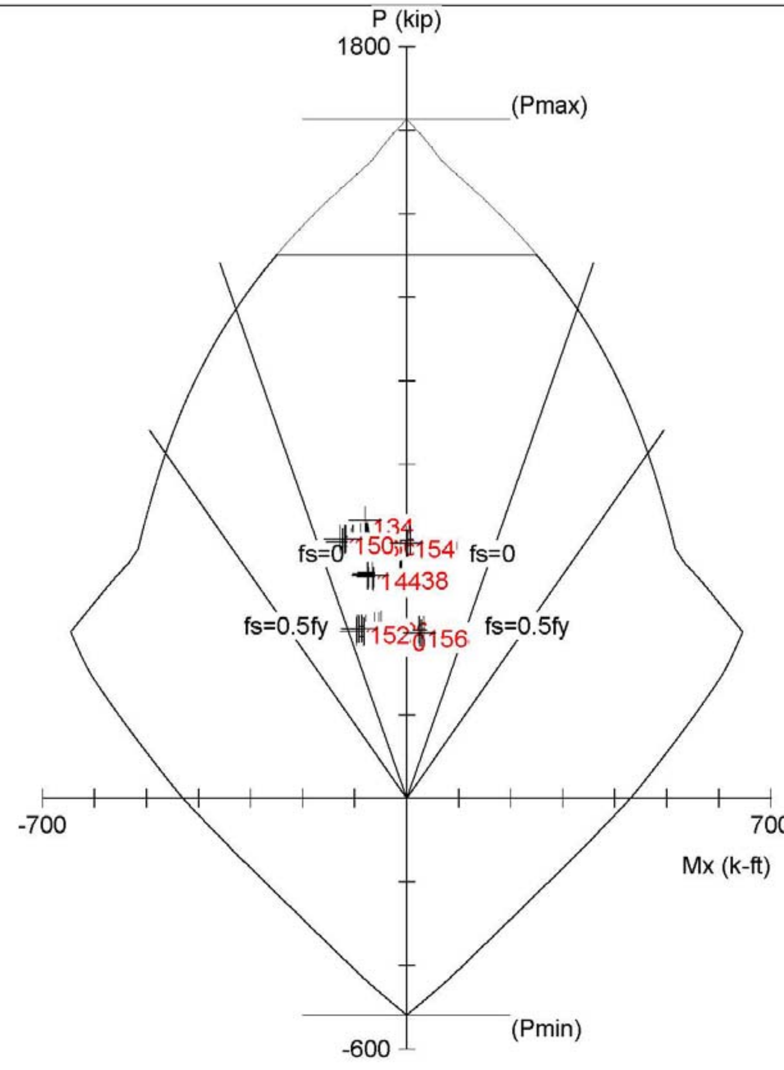
Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 16:52:51



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

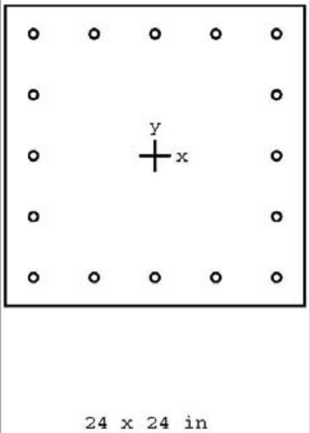
File: G:\thesis stuff\FINAL\PCA\column7.9-D 4.col

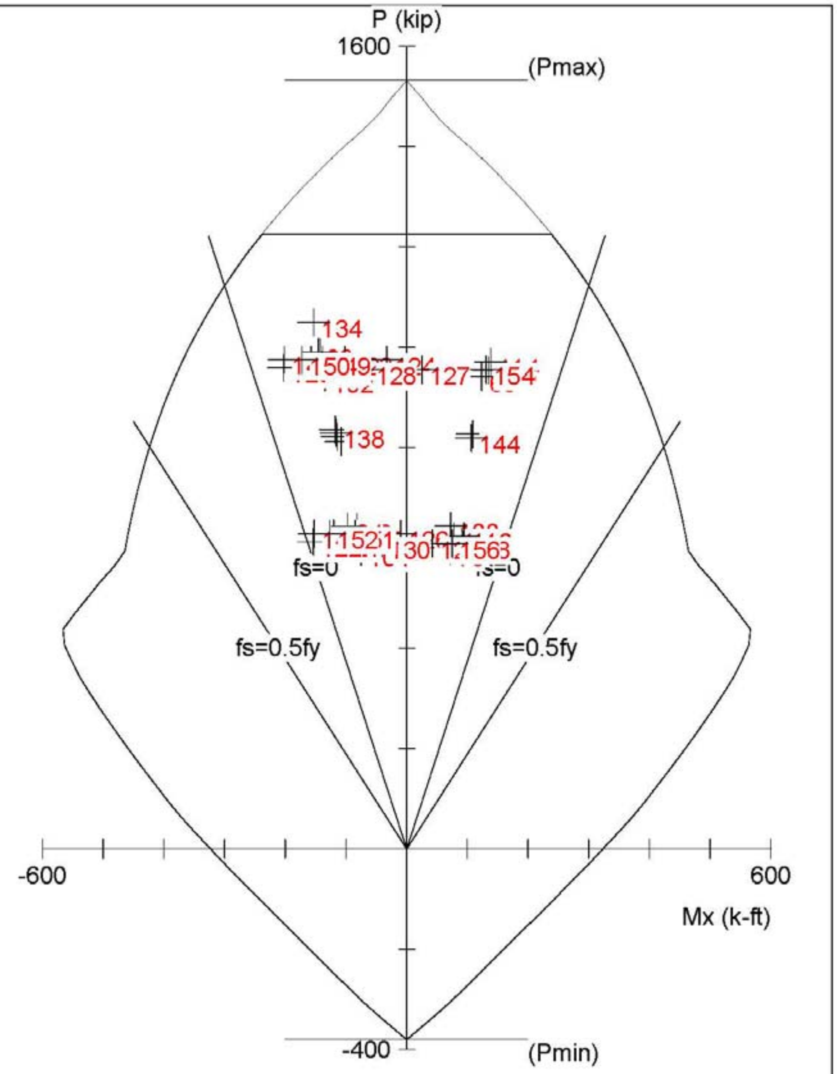
Project:

Column: 7.9-D 1		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #7 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 9.60 in^2	Rho = 1.67%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 3.97 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.965049, kx(sway) = N/A

MEMBER CHECK CONTINUED: COLUMN D-7.9 FIRST FLOOR





Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Investigation

Slenderness: Considered

Column type: Structural

Bars: ASTM A615

Date: 02/28/09

Time: 16:37:43

pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-28F4D

File: G:\thesis stuff\FINAL\PCA\column7.9-D 2.col

Project:

Column: 7.9-D 1		Engineer:	
f'c = 4 ksi	fy = 60 ksi	Ag = 576 in^2	16 #6 bars
Ec = 3605 ksi	Es = 29000 ksi	As = 7.04 in^2	Rho = 1.22%
fc = 3.4 ksi	fc = 3.4 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.85		Clear spacing = 4.13 in	Clear cover = 1.88 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

kx(braced) = 0.94037, kx(sway) = N/A

APPENDIX F: CONSTRUCTION MANAGEMENT BREADTH STUDY

Table 36: Cost Analysis Estimate for Concrete Structure with Green Roof

Detailed Cost Analysis of the Structure									
Level	Description	Amount	Material Price	Material Cost	Labor Price	Labor Cost	Equipment Price	Equipment Cost	Total Cost
Reinforcement	Foundation	58 Ton	$935.00	$54,230	$430.00	$24,940	$30.35	$1,760	$80,930
	Columns	2221 Ton	$935.00	$2,076,635	$430.00	$430.00	$30.35	$67,407	$2,144,472
	Beam/Slabs	572 Ton	$935.00	$534,820	$430.00	$245,960	$30.35	$17,360	$798,140
	SUB-TOTAL	2851	$935.00	$2,665,685	$430.00	$430.00	$30.35	$86,528	$2,752,643
Cast in Place Concrete	Foundations	6100 CY	$109.00	$664,900	$14.90	$90,890	$5.55	$33,855	$789,645
	Columns	1518 CY	$109.00	$165,462	$34.00	$51,612	$16.95	$25,730	$242,804
	Slabs	14192 CY	$109.00	$1,546,928	$18.20	$258,294	$9.15	$129,857	$1,935,079
	Beams	8415 CY	$109.00	$917,235	$26.50	$222,998	$1,320.00	$11,107,800	$12,248,033
	SUB-TOTAL	30225	$109.00	$3,294,525	$23.40	$623,794	$1,352	$11,297,242	$15,215,561
Location Factor: 98.9%	Total Structure Estimate:		$36,077,000			Total Labor Cost:		$896,000	
	Total Material Cost:		$5,961,000			Total Equipment Cost:		$11,384,000	

Table 37: Cost Analysis Estimate for Concrete Structure, No Green Roof

Detailed Cost Analysis of the Structure-No Green Roof									
Level	Description	Amount	Material Price	Material Cost	Labor Price	Labor Cost	Equipment Price	Equipment Cost	Total Cost
Reinforcement	Foundation	58 Ton	$935.00	$54,230	$430.00	$24,940	$30.35	$1,760	$80,930
	Columns	2000 Ton	$935.00	$1,868,972	$430.00	$430.00	$30.35	$60,667	$1,930,068
	Beam/Slabs	544 Ton	$935.00	$470,642	$430.00	$216,445	$30.35	$15,277	$702,363
	SUB-TOTAL	2560	$935.00	$2,393,843	$430.00	$430.00	$30.35	$77,704	$2,471,977
Cast in Place Concrete	Foundations	6100 CY	$109.00	$664,900	$14.90	$90,890	$5.55	$33,855	$789,645
	Columns	1443 CY	$109.00	$157,189	$34.00	$49,031	$16.95	$24,444	$230,664
	Slabs	14192 CY	$109.00	$1,546,928	$18.20	$258,294	$9.15	$129,857	$1,935,079
	Beams	7574 CY	$109.00	$917,235	$26.50	$222,998	$1,320.00	$11,107,800	$12,248,033
	SUB-TOTAL	30149	$109.00	$3,286,252	$23.40	$621,213	$1,352	$11,295,955	$15,203,421
Location Factor: 98.9%	Total Structure Estimate:		$35,440,000			Total Labor Cost:		$864,000	
	Total Material Cost:		$5,681,000			Total Equipment Cost:		$11,374,000	

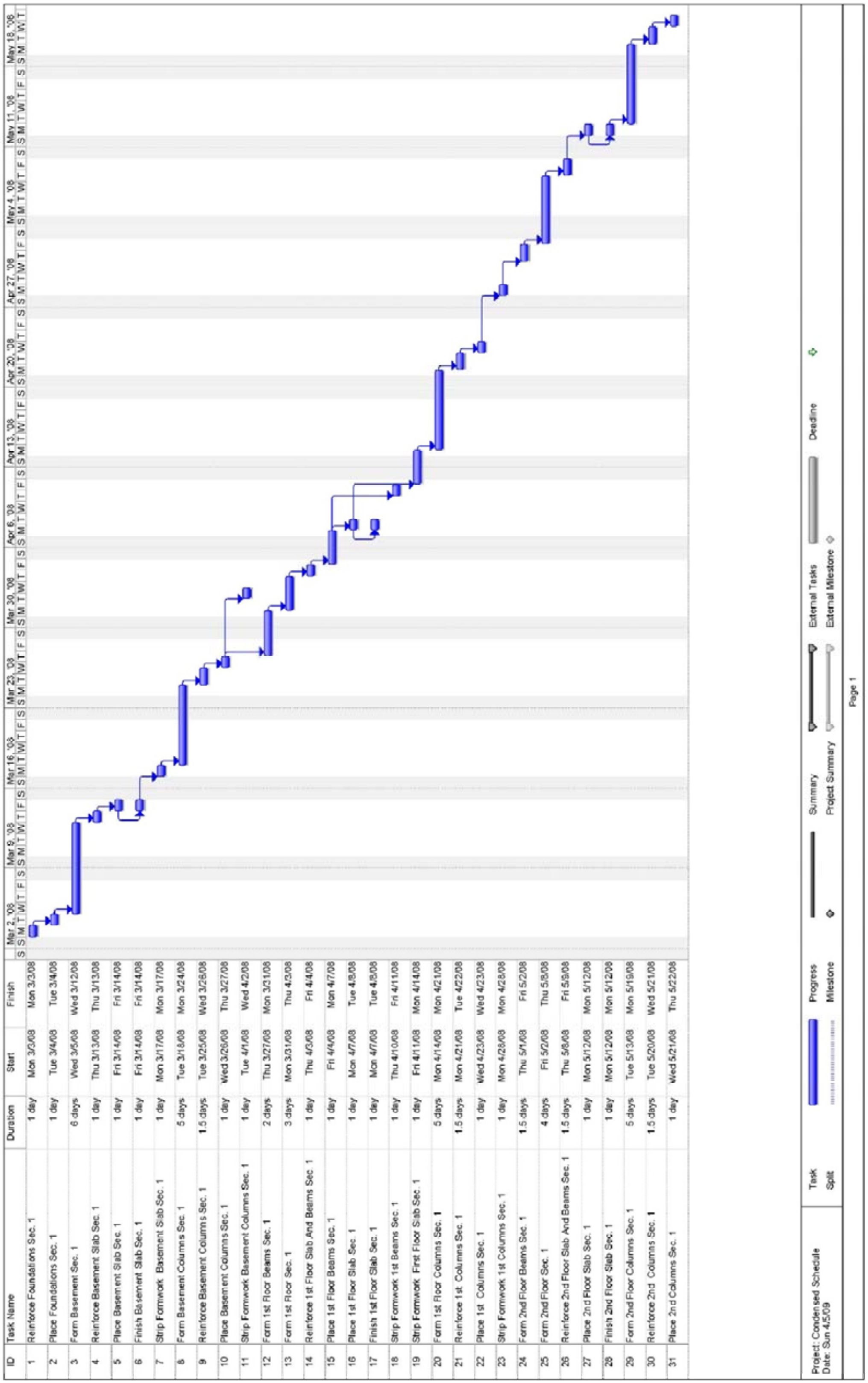


Figure 48: Condensed Gantt Chart

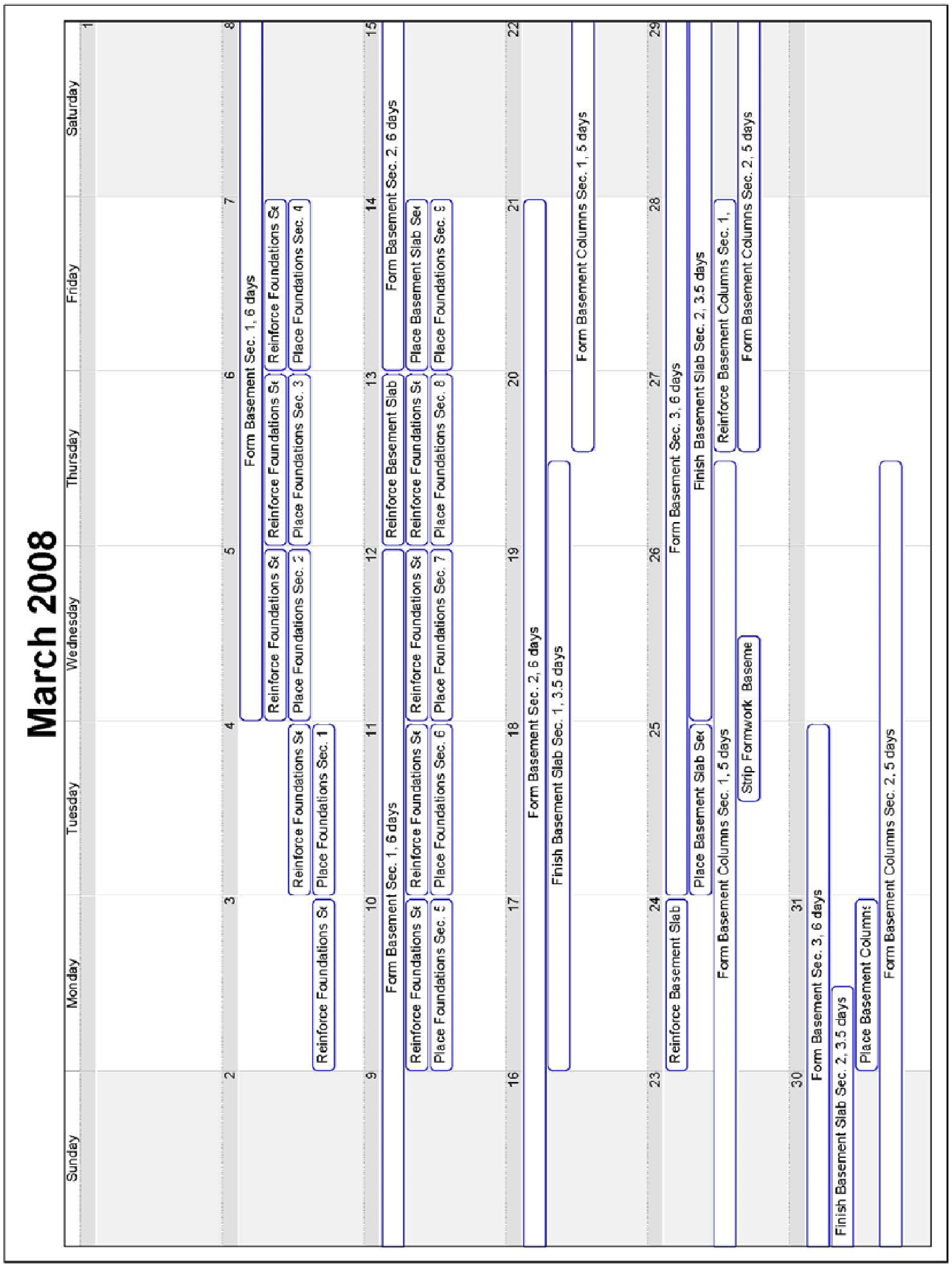


Figure 49: March Schedule Calendar

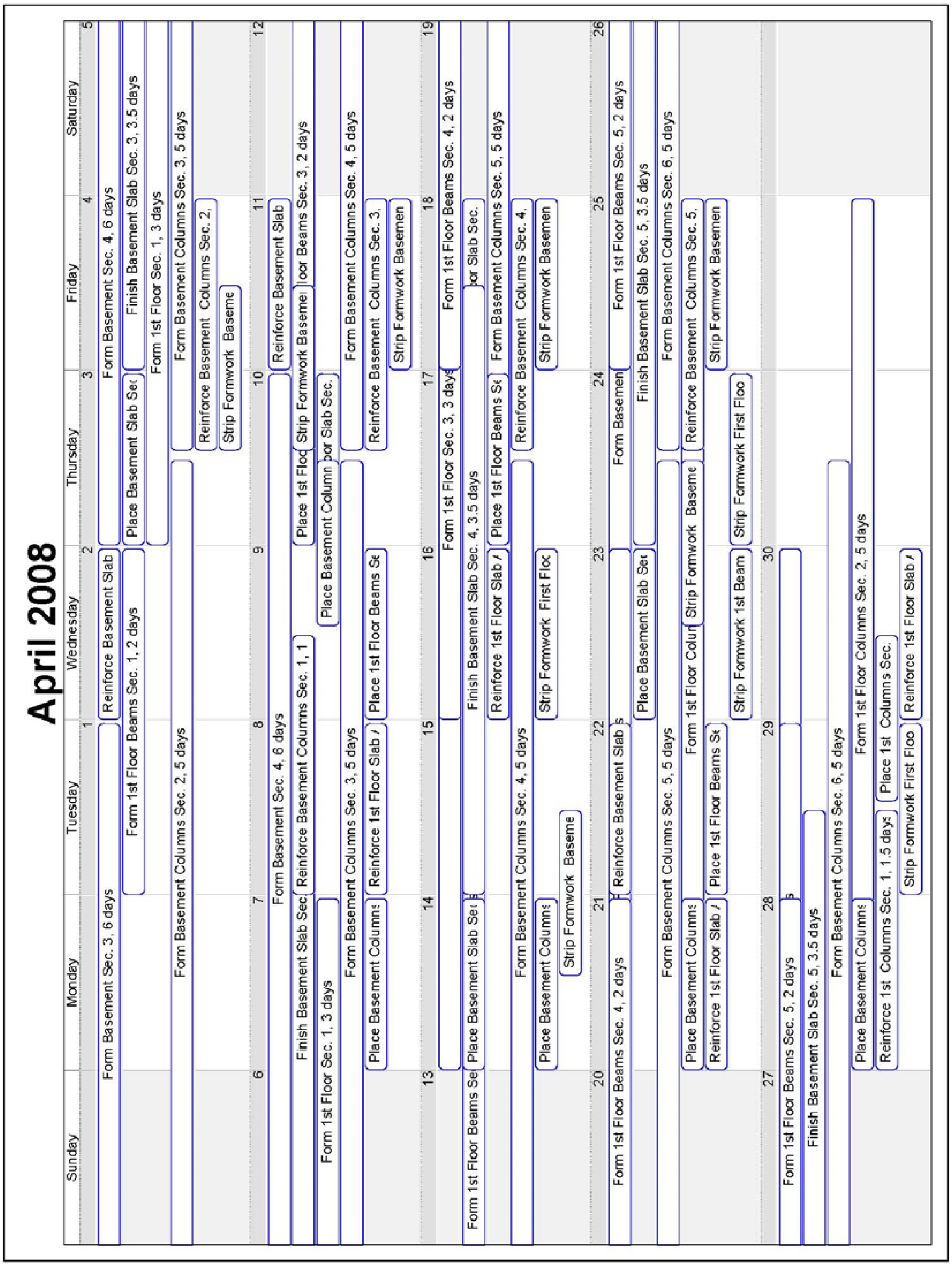


Figure 50: April Schedule Calendar

Overflow Tasks

ID	Name	Start	Finish
498	Place Basement Columns Sec. 1	Fri 4/4/08	Mon 4/7/08
490	Reinforce Basement Columns Sec. 1	Thu 4/3/08	Fri 4/4/08
573	Strip Formwork 1st Beams Sec. 1	Tue 4/15/08	Tue 4/15/08
575	Strip Formwork 1st Beams Sec. 3	Mon 4/28/08	Mon 4/28/08

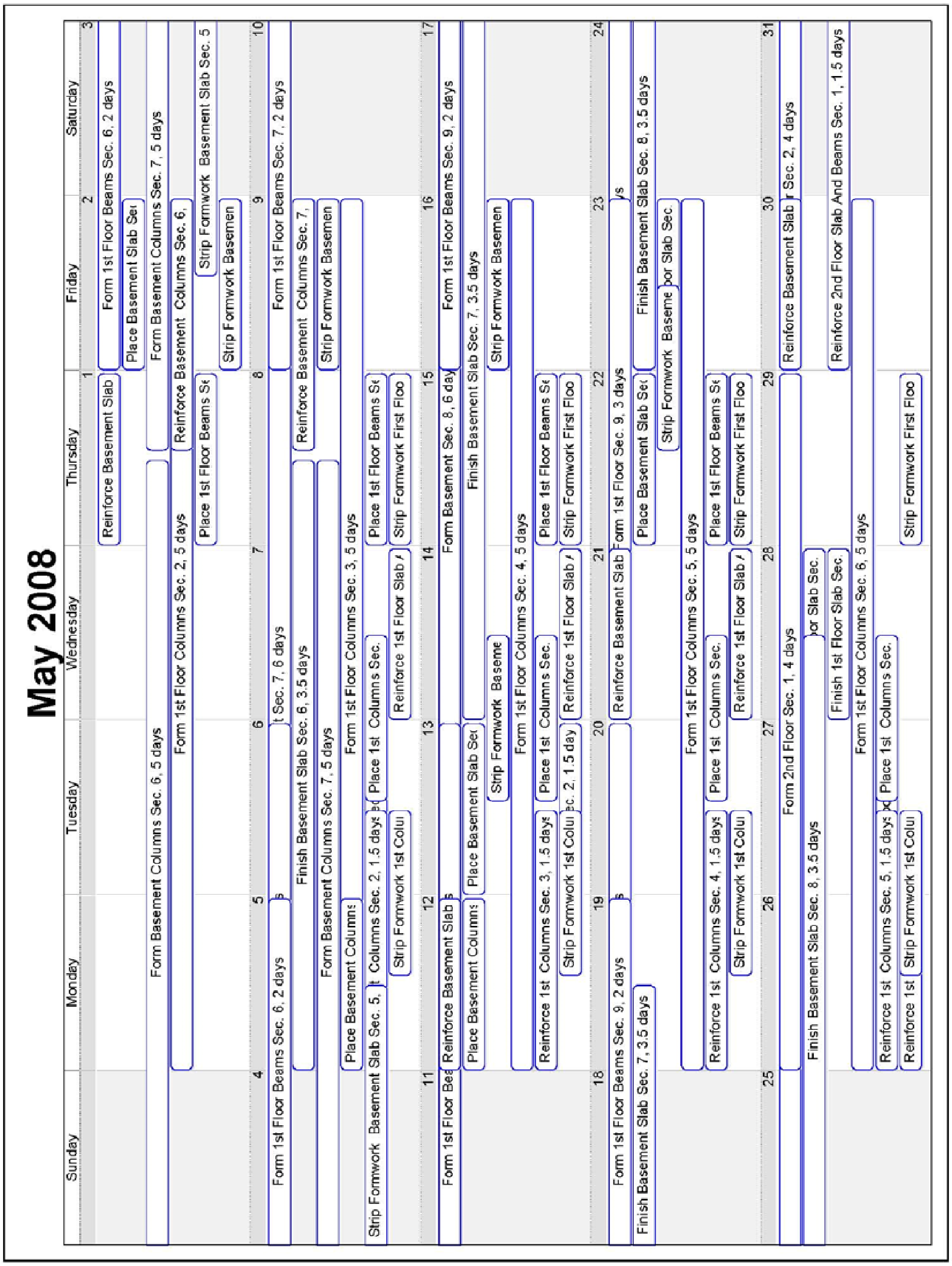


Figure 51: May Schedule Calendar

Overflow Tasks

ID	Name	Start	Finish
576	Strip Formwork 1st Beams Sec. 4	Thu 5/1/08	Thu 5/1/08
577	Strip Formwork 1st Beams Sec. 5	Wed 5/7/08	Wed 5/7/08
578	Strip Formwork 1st Beams Sec. 6	Wed 5/14/08	Wed 5/14/08
206	Form 2nd Floor Beams Sec. 3	Mon 5/19/08	Tue 5/20/08
579	Strip Formwork 1st Beams Sec. 7	Wed 5/21/08	Wed 5/21/08
580	Strip Formwork 1st Beams Sec. 8	Wed 5/28/08	Wed 5/28/08
207	Form 2nd Floor Beams Sec. 4	Mon 5/26/08	Tue 5/27/08

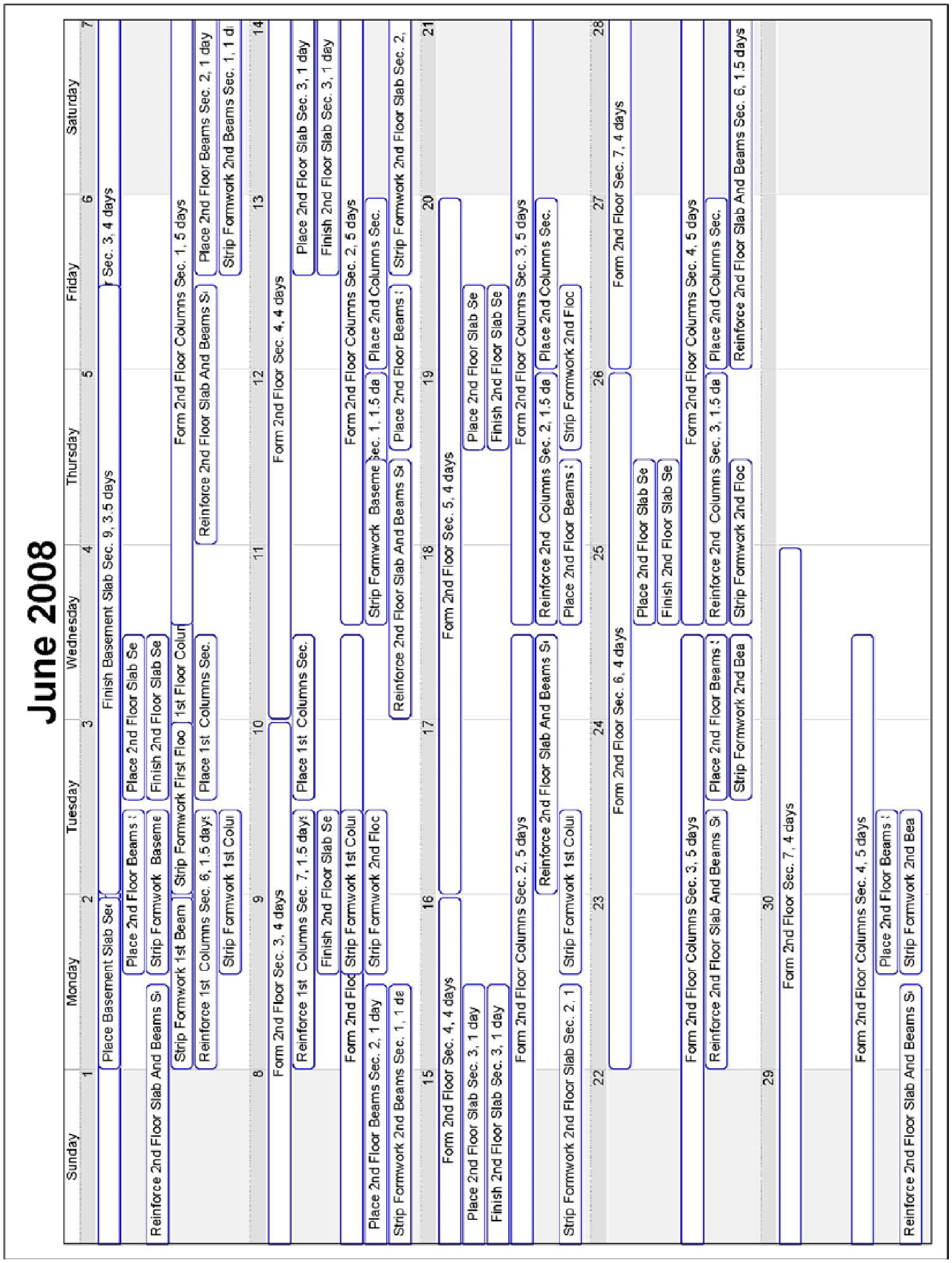


Figure 52: June Schedule Calendar

Overflow Tasks

ID	Name	Start	Finish
208	Form 2nd Floor Beams Sec. 5	Mon 6/2/08	Tue 6/3/08
584	Strip Formwork 2nd Beams Sec. 2	Thu 6/12/08	Fri 6/13/08
209	Form 2nd Floor Beams Sec. 6	Mon 6/9/08	Tue 6/10/08
585	Strip Formwork 2nd Beams Sec. 3	Wed 6/18/08	Thu 6/19/08
645	Strip Formwork 2nd Columns Sec. 1	Thu 6/19/08	Thu 6/19/08
210	Form 2nd Floor Beams Sec. 7	Mon 6/16/08	Tue 6/17/08
211	Form 3rd Floor Beams Sec. 1	Thu 6/19/08	Fri 6/20/08
646	Strip Formwork 2nd Columns Sec. 2	Thu 6/26/08	Thu 6/26/08
212	Form 3rd Floor Beams Sec. 2	Thu 6/26/08	Fri 6/27/08
213	Form 3rd Floor Beams Sec. 3	Fri 6/27/08	Mon 6/30/08

Final Report

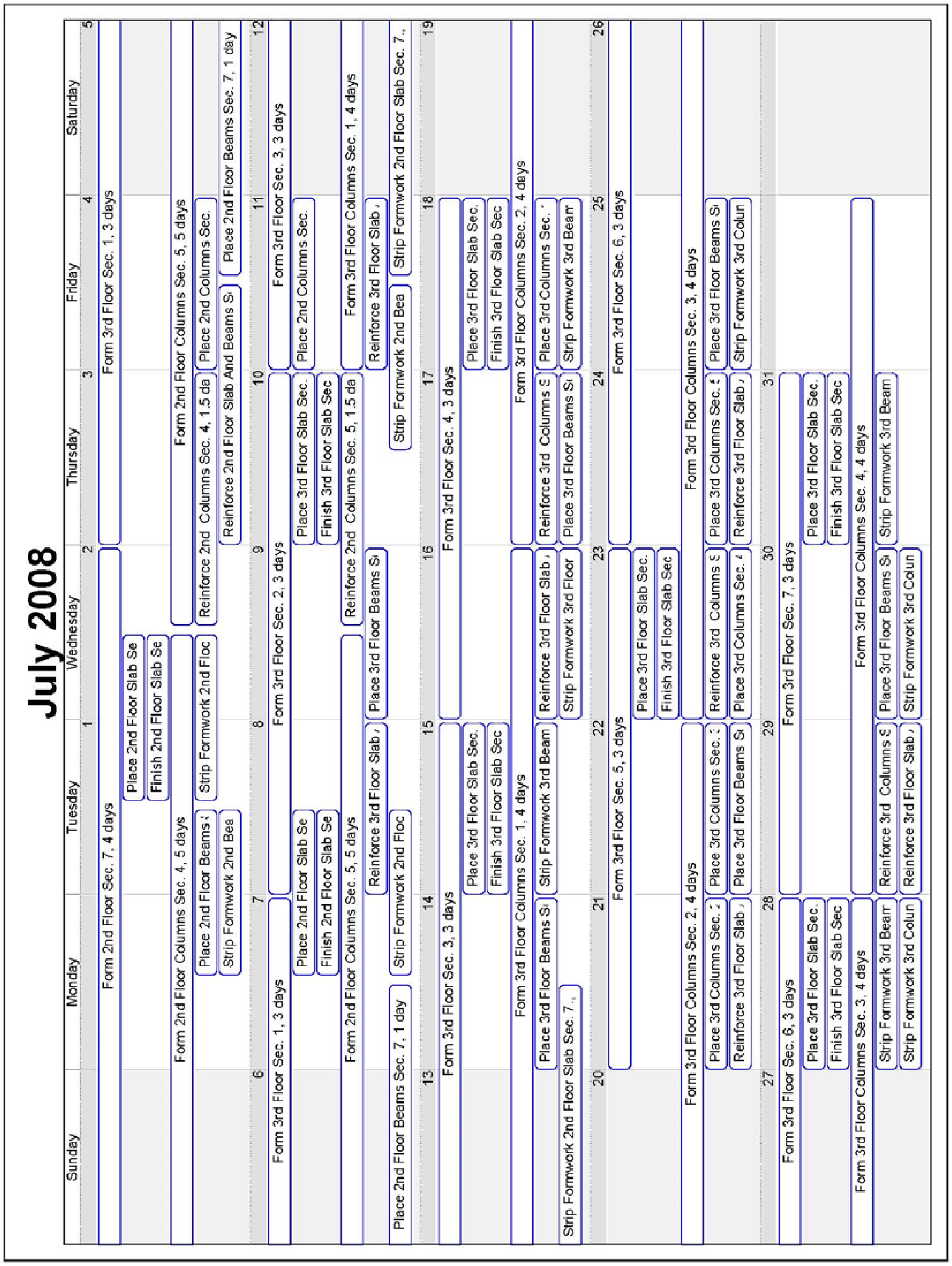


Figure 53: July Schedule Calendar

JULY OVERFLOW TASKS

Overflow Tasks

ID	Name	Start	Finish
588	Strip Formwork 2nd Beams Sec. 6	Fri 7/4/08	Mon 7/7/08
647	Strip Formwork 2nd Columns Sec. 3	Thu 7/3/08	Thu 7/3/08
214	Form 3rd Floor Beams Sec. 4	Thu 7/3/08	Fri 7/4/08
215	Form 3rd Floor Beams Sec. 5	Fri 7/4/08	Mon 7/7/08
648	Strip Formwork 2nd Columns Sec. 4	Thu 7/10/08	Thu 7/10/08
216	Form 3rd Floor Beams Sec. 6	Thu 7/10/08	Fri 7/11/08
217	Form 3rd Floor Beams Sec. 7	Fri 7/11/08	Mon 7/14/08
649	Strip Formwork 2nd Columns Sec. 5	Thu 7/17/08	Thu 7/17/08
218	Form 3rd Floor Beams Sec. 8	Thu 7/17/08	Fri 7/18/08
219	Form 3rd Floor Beams Sec. 9	Fri 7/18/08	Mon 7/21/08
535	Strip Formwork 3rd Floor Slab Sec. 2	Mon 7/21/08	Mon 7/21/08
536	Strip Formwork 3rd Floor Slab Sec. 3	Thu 7/24/08	Thu 7/24/08
593	Strip Formwork 3rd Beams Sec. 3	Wed 7/23/08	Wed 7/23/08
651	Strip Formwork 3rd Columns Sec. 1	Thu 7/24/08	Thu 7/24/08
220	Form 4th Floor Beams Sec. 1	Tue 7/22/08	Wed 7/23/08
221	Form 4th Floor Beams Sec. 2	Thu 7/24/08	Fri 7/25/08
537	Strip Formwork 3rd Floor Slab Sec. 4	Tue 7/29/08	Tue 7/29/08
654	Strip Formwork 3rd Columns Sec. 4	Tue 7/29/08	Tue 7/29/08
222	Form 4th Floor Beams Sec. 3	Mon 7/28/08	Tue 7/29/08
223	Form 4th Floor Beams Sec. 4	Wed 7/30/08	Thu 7/31/08

AUGUST OVERFLOW TASKS

Overflow Tasks

ID	Name	Start	Finish
538	Strip Formwork 3rd Floor Slab Sec. 5	Fri 8/1/08	Fri 8/1/08
224	Form 4th Floor Beams Sec. 5	Fri 8/1/08	Mon 8/4/08
468	Place 3rd Floor Beams Sec. 7	Mon 8/4/08	Mon 8/4/08
539	Strip Formwork 3rd Floor Slab Sec. 6	Wed 8/6/08	Wed 8/6/08
225	Form 4th Floor Beams Sec. 6	Tue 8/5/08	Wed 8/6/08
226	Form 4th Floor Beams Sec. 7	Thu 8/7/08	Fri 8/8/08
227	Form 5th Floor Beams Sec. 1	Mon 8/11/08	Tue 8/12/08
228	Form 5th Floor Beams Sec. 2	Wed 8/13/08	Thu 8/14/08
229	Form 5th Floor Beams Sec. 3	Fri 8/15/08	Mon 8/18/08
230	Form 5th Floor Beams Sec. 4	Tue 8/19/08	Wed 8/20/08
231	Form 5th Floor Beams Sec. 5	Thu 8/21/08	Fri 8/22/08
232	Form 5th Floor Beams Sec. 6	Mon 8/25/08	Tue 8/26/08
233	Form 5th Floor Beams Sec. 7	Wed 8/27/08	Thu 8/28/08
234	Form Roof Beams Sec. 1	Fri 8/29/08	Mon 9/1/08

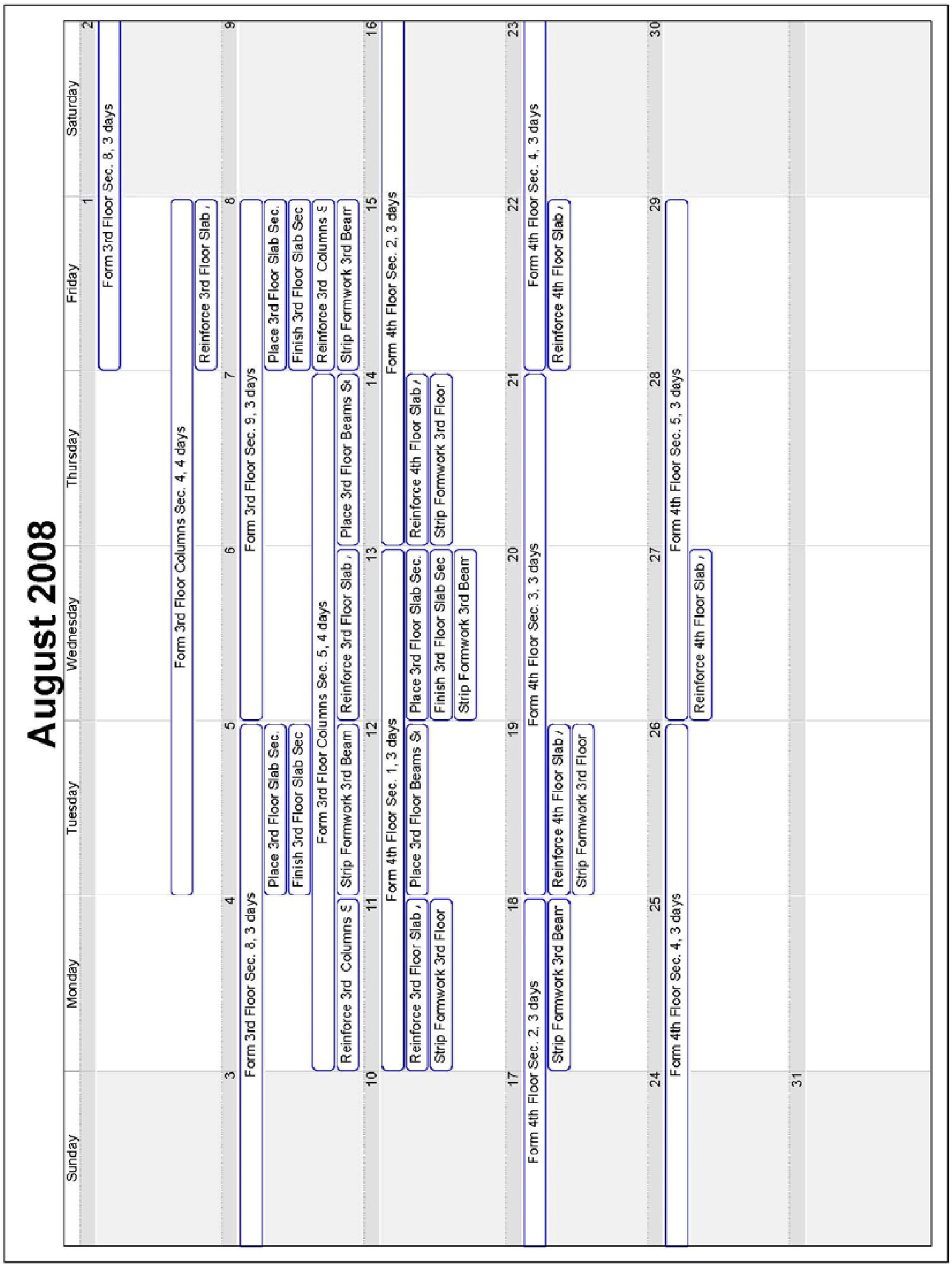


Figure 54: August Schedule Calendar

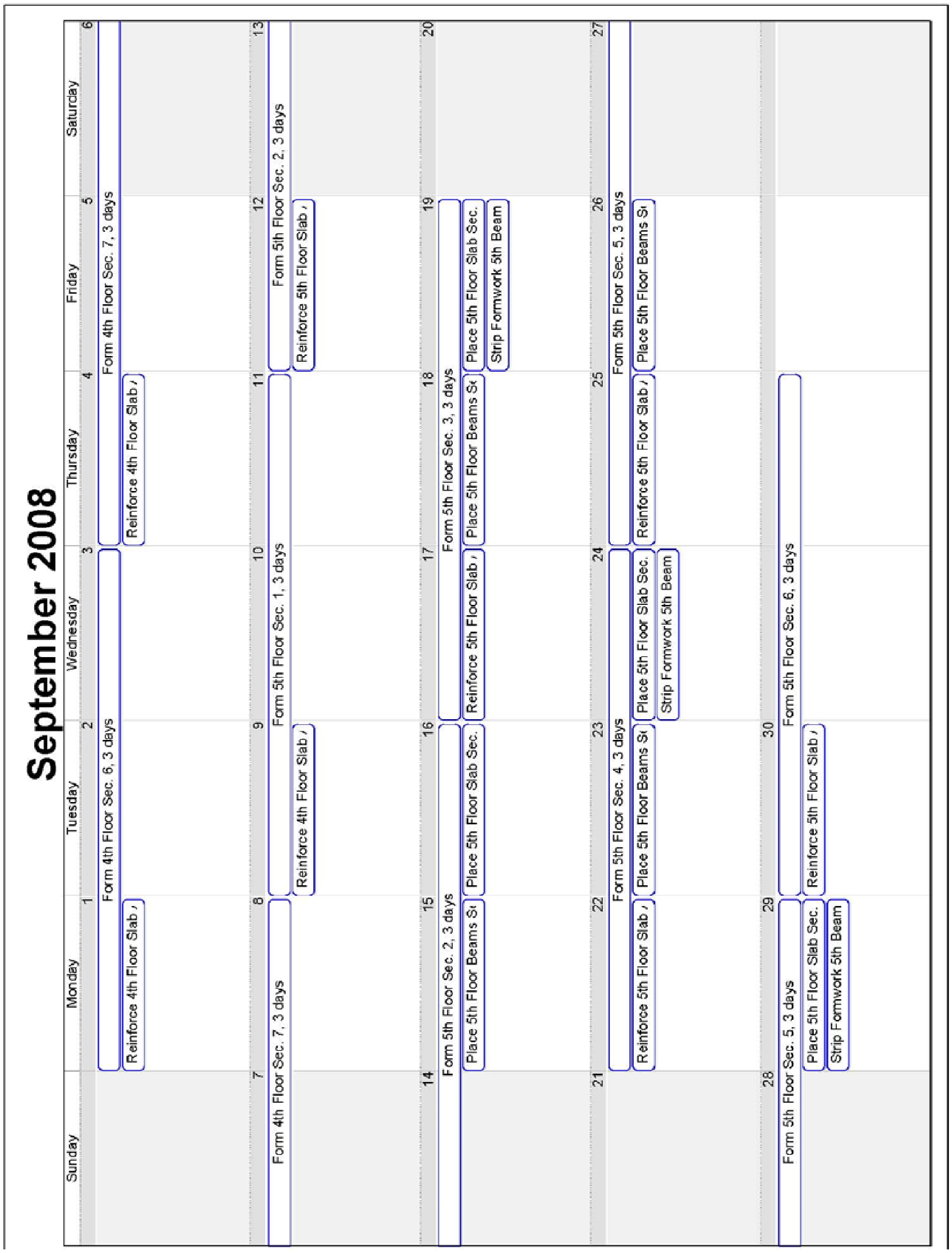


Figure 55: September Schedule Calendar

Overflow Tasks

ID	Name	Start	Finish
234	Form Roof Beams Sec. 1	Fri 8/29/08	Mon 9/1/08
235	Form Roof Beams Sec. 2	Mon 9/1/08	Tue 9/2/08
236	Form Roof Beams Sec. 3	Wed 9/3/08	Thu 9/4/08
237	Form Roof Beams Sec. 4	Thu 9/4/08	Fri 9/5/08
238	Form Roof Beams Sec. 5	Mon 9/8/08	Tue 9/9/08
239	Form Roof Beams Sec. 6	Tue 9/9/08	Wed 9/10/08
240	Form Roof Beams Sec. 7	Thu 9/11/08	Fri 9/12/08
241	Form Penthouse Beams Sec. 1	Fri 9/12/08	Tue 9/16/08
242	Form Penthouse Beams Sec. 2	Tue 9/16/08	Thu 9/18/08
243	Form Penthouse Beams Sec. 3	Thu 9/18/08	Mon 9/22/08
244	Form Penthouse Beams Sec. 4	Mon 9/22/08	Wed 9/24/08

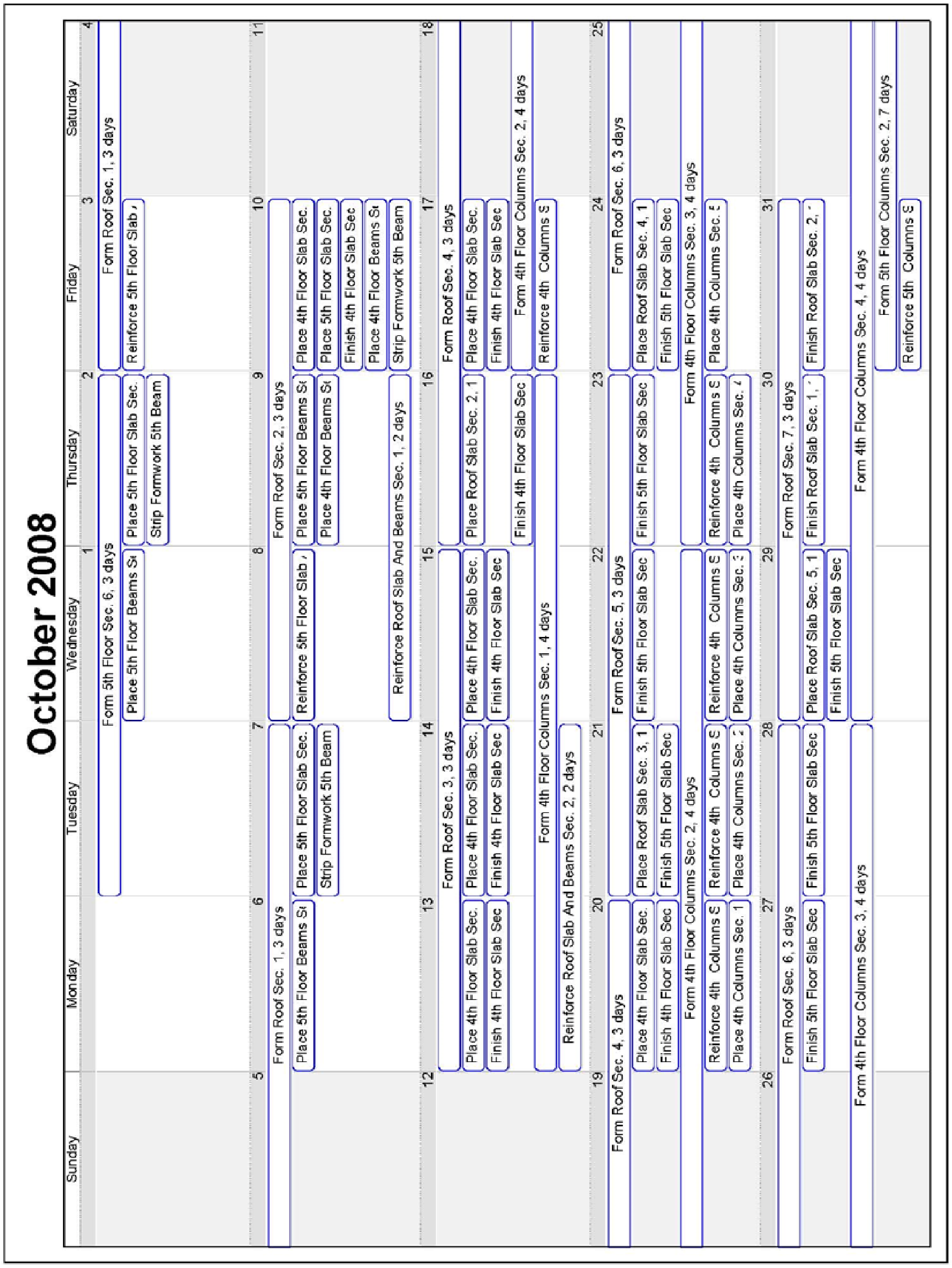


Figure 56: October Schedule Calendar

October Overflow Tasks

Overflow Tasks

ID	Name	Start	Finish
439	Place Roof Beams Sec. 2	Wed 10/15/08	Wed 10/15/08
456	Place 4th Floor Beams Sec. 3	Mon 10/13/08	Mon 10/13/08
457	Place 4th Floor Beams Sec. 4	Tue 10/14/08	Tue 10/14/08
458	Place 4th Floor Beams Sec. 5	Wed 10/15/08	Wed 10/15/08
459	Place 4th Floor Beams Sec. 6	Thu 10/16/08	Thu 10/16/08
460	Place 4th Floor Beams Sec. 7	Fri 10/17/08	Fri 10/17/08
422	Reinforce Roof Slab And Beams Sec. 3	Thu 10/16/08	Fri 10/17/08
544	Strip Formwork 4th Floor Slab Sec. 1	Thu 10/16/08	Thu 10/16/08
545	Strip Formwork 4th Floor Slab Sec. 2	Fri 10/17/08	Fri 10/17/08
601	Strip Formwork 4th Beams Sec. 1	Wed 10/15/08	Wed 10/15/08
602	Strip Formwork 4th Beams Sec. 2	Thu 10/16/08	Thu 10/16/08
603	Strip Formwork 4th Beams Sec. 3	Fri 10/17/08	Fri 10/17/08
615	Strip Formwork 5th Beams Sec. 7	Wed 10/15/08	Wed 10/15/08
617	Strip Formwork Roof Beams Sec. 1	Thu 10/16/08	Thu 10/16/08
331	Form 5th Floor Columns Sec. 1	Wed 10/22/08	Thu 10/30/08
423	Reinforce Roof Slab And Beams Sec. 4	Tue 10/21/08	Wed 10/22/08
424	Reinforce Roof Slab And Beams Sec. 5	Fri 10/24/08	Mon 10/27/08
440	Place Roof Beams Sec. 3	Mon 10/20/08	Mon 10/20/08
441	Place Roof Beams Sec. 4	Thu 10/23/08	Thu 10/23/08
546	Strip Formwork 4th Floor Slab Sec. 3	Mon 10/20/08	Mon 10/20/08
547	Strip Formwork 4th Floor Slab Sec. 4	Tue 10/21/08	Tue 10/21/08
548	Strip Formwork 4th Floor Slab Sec. 5	Wed 10/22/08	Wed 10/22/08
549	Strip Formwork 4th Floor Slab Sec. 6	Thu 10/23/08	Thu 10/23/08
550	Strip Formwork 4th Floor Slab Sec. 7.	Fri 10/24/08	Fri 10/24/08
604	Strip Formwork 4th Beams Sec. 4	Mon 10/20/08	Mon 10/20/08
605	Strip Formwork 4th Beams Sec. 5	Tue 10/21/08	Tue 10/21/08
606	Strip Formwork 4th Beams Sec. 6	Wed 10/22/08	Wed 10/22/08
607	Strip Formwork 4th Beams Sec. 7	Thu 10/23/08	Thu 10/23/08
618	Strip Formwork Roof Beams Sec. 2	Tue 10/21/08	Tue 10/21/08
619	Strip Formwork Roof Beams Sec. 3	Fri 10/24/08	Fri 10/24/08
657	Strip Formwork 4th Columns Sec. 1	Fri 10/24/08	Fri 10/24/08
346	Form Roof Columns Sec. 1	Fri 10/31/08	Wed 11/5/08
425	Reinforce Roof Slab And Beams Sec. 6	Wed 10/29/08	Thu 10/30/08
442	Place Roof Beams Sec. 5	Tue 10/28/08	Tue 10/28/08
443	Place Roof Beams Sec. 6	Fri 10/31/08	Fri 10/31/08
552	Strip Formwork 5th Floor Slab Sec. 1	Mon 10/27/08	Mon 10/27/08
553	Strip Formwork 5th Floor Slab Sec. 2	Tue 10/28/08	Tue 10/28/08
554	Strip Formwork 5th Floor Slab Sec. 3	Wed 10/29/08	Wed 10/29/08
555	Strip Formwork 5th Floor Slab Sec. 4	Thu 10/30/08	Thu 10/30/08
556	Strip Formwork 5th Floor Slab Sec. 5	Fri 10/31/08	Fri 10/31/08
620	Strip Formwork Roof Beams Sec. 4	Wed 10/29/08	Wed 10/29/08
658	Strip Formwork 4th Columns Sec. 2	Mon 10/27/08	Mon 10/27/08
659	Strip Formwork 4th Columns Sec. 3	Tue 10/28/08	Tue 10/28/08
661	Strip Formwork 4th Columns Sec. 5	Thu 10/30/08	Thu 10/30/08
660	Strip Formwork 4th Columns Sec. 4	Wed 10/29/08	Wed 10/29/08

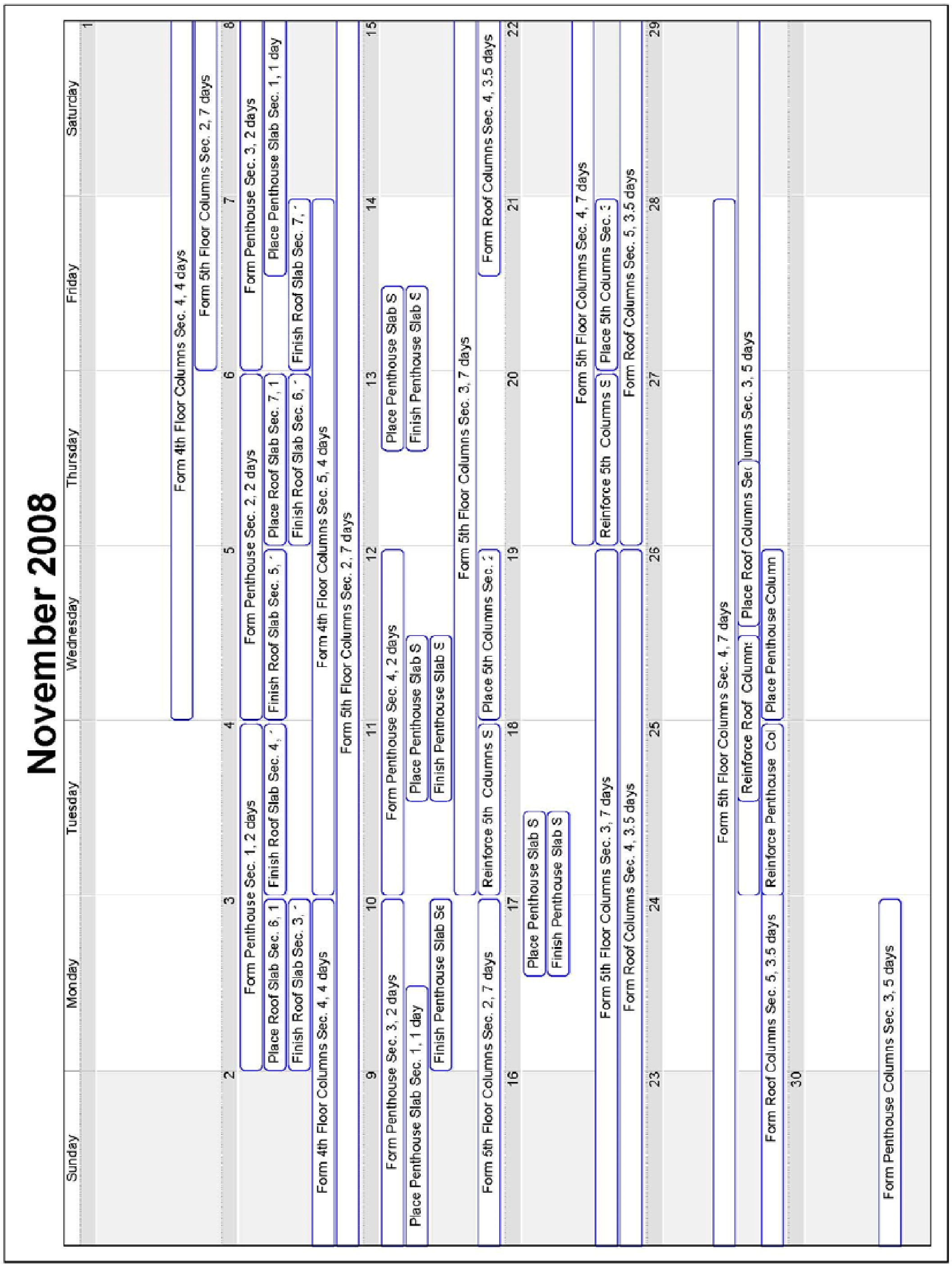


Figure 57: November Schedule Calendar

NOVEMBER OVERFLOW TASKS

Overflow Tasks

ID	Name	Start	Finish
346	Form Roof Columns Sec. 1	Fri 10/31/08	Wed 11/5/08
347	Form Roof Columns Sec. 2	Wed 11/5/08	Mon 11/10/08
341	Place 5th Columns Sec. 1	Mon 11/3/08	Mon 11/3/08
352	Reinforce Roof Columns Sec. 1	Wed 11/5/08	Thu 11/6/08
358	Place Roof Columns Sec. 1	Thu 11/6/08	Fri 11/7/08
426	Reinforce Roof Slab And Beams Sec. 7	Mon 11/3/08	Tue 11/4/08
428	Reinforce Pent Slab And Beams Sec. 1	Wed 11/5/08	Thu 11/6/08
429	Reinforce Pent Slab And Beams Sec. 2	Fri 11/7/08	Mon 11/10/08
433	Place Penthouse Beams Sec. 1	Thu 11/6/08	Fri 11/7/08
444	Place Roof Beams Sec. 7	Wed 11/5/08	Wed 11/5/08
557	Strip Formwork 5th Floor Slab Sec. 6	Mon 11/3/08	Mon 11/3/08
558	Strip Formwork 5th Floor Slab Sec. 7.	Tue 11/4/08	Tue 11/4/08
560	Strip Formwork Roof Slab Sec. 1	Wed 11/5/08	Wed 11/5/08
561	Strip Formwork Roof Slab Sec. 2	Thu 11/6/08	Thu 11/6/08
562	Strip Formwork Roof Slab Sec. 3	Fri 11/7/08	Fri 11/7/08
621	Strip Formwork Roof Beams Sec. 5	Mon 11/3/08	Mon 11/3/08
663	Strip Formwork 5th Columns Sec. 1	Fri 11/7/08	Fri 11/7/08
622	Strip Formwork Roof Beams Sec. 6	Thu 11/6/08	Thu 11/6/08
348	Form Roof Columns Sec. 3	Tue 11/11/08	Fri 11/14/08
354	Reinforce Roof Columns Sec. 3	Fri 11/14/08	Mon 11/17/08
364	Form Penthouse Columns Sec. 1	Tue 11/11/08	Mon 11/17/08
353	Reinforce Roof Columns Sec. 2	Tue 11/11/08	Tue 11/11/08
359	Place Roof Columns Sec. 2	Wed 11/12/08	Wed 11/12/08
430	Reinforce Pent Slab And Beams Sec. 3	Tue 11/11/08	Wed 11/12/08
431	Reinforce Pent Slab And Beams Sec. 4	Thu 11/13/08	Fri 11/14/08
436	Place Penthouse Beams Sec. 4	Fri 11/14/08	Mon 11/17/08
434	Place Penthouse Beams Sec. 2	Mon 11/10/08	Tue 11/11/08
435	Place Penthouse Beams Sec. 3	Wed 11/12/08	Thu 11/13/08
568	Strip Formwork Penthouse Slab Sec. 1	Fri 11/14/08	Fri 11/14/08
563	Strip Formwork Roof Slab Sec. 4	Mon 11/10/08	Mon 11/10/08
564	Strip Formwork Roof Slab Sec. 5	Tue 11/11/08	Tue 11/11/08
565	Strip FormworkRoof Slab Sec. 6	Wed 11/12/08	Wed 11/12/08
566	Strip Formwork Roof Slab Sec. 7.	Thu 11/13/08	Thu 11/13/08
623	Strip Formwork Roof Beams Sec. 7	Tue 11/11/08	Tue 11/11/08
626	Strip Formwork Penthouse Beams Sec. 2	Thu 11/13/08	Fri 11/14/08
625	Strip Formwork Penthouse Beams Sec. 1	Tue 11/11/08	Wed 11/12/08
668	Strip Formwork Roof Columns Sec. 1	Wed 11/12/08	Thu 11/13/08
355	Reinforce Roof Columns Sec. 4	Thu 11/20/08	Thu 11/20/08
360	Place Roof Columns Sec. 3	Mon 11/17/08	Tue 11/18/08
361	Place Roof Columns Sec. 4	Fri 11/21/08	Fri 11/21/08
365	Form Penthouse Columns Sec. 2	Tue 11/18/08	Mon 11/24/08
372	Place Penthouse Columns Sec. 1	Wed 11/19/08	Wed 11/19/08
368	Reinforce Penthouse Columns Sec. 1	Tue 11/18/08	Tue 11/18/08
570	Strip Formwork Penthouse Slab Sec. 3	Wed 11/19/08	Thu 11/20/08
571	Strip Formwork Penthouse Slab Sec. 4	Fri 11/21/08	Mon 11/24/08
569	Strip Formwork Penthouse Slab Sec. 2	Mon 11/17/08	Tue 11/18/08
628	Strip Formwork Penthouse Beams Sec. 4	Wed 11/19/08	Thu 11/20/08
670	Strip Formwork Roof Columns Sec. 3	Fri 11/21/08	Mon 11/24/08
627	Strip Formwork Penthouse Beams Sec. 3	Mon 11/17/08	Tue 11/18/08
664	Strip Formwork 5th Columns Sec. 2	Tue 11/18/08	Tue 11/18/08
669	Strip Formwork Roof Columns Sec. 2	Tue 11/18/08	Tue 11/18/08
665	Strip Formwork 5th Columns Sec. 3	Thu 11/27/08	Thu 11/27/08
671	Strip Formwork Roof Columns Sec. 4	Thu 11/27/08	Thu 11/27/08
674	Strip Formwork Penthouse Columns Sec. 1	Tue 11/25/08	Tue 11/25/08

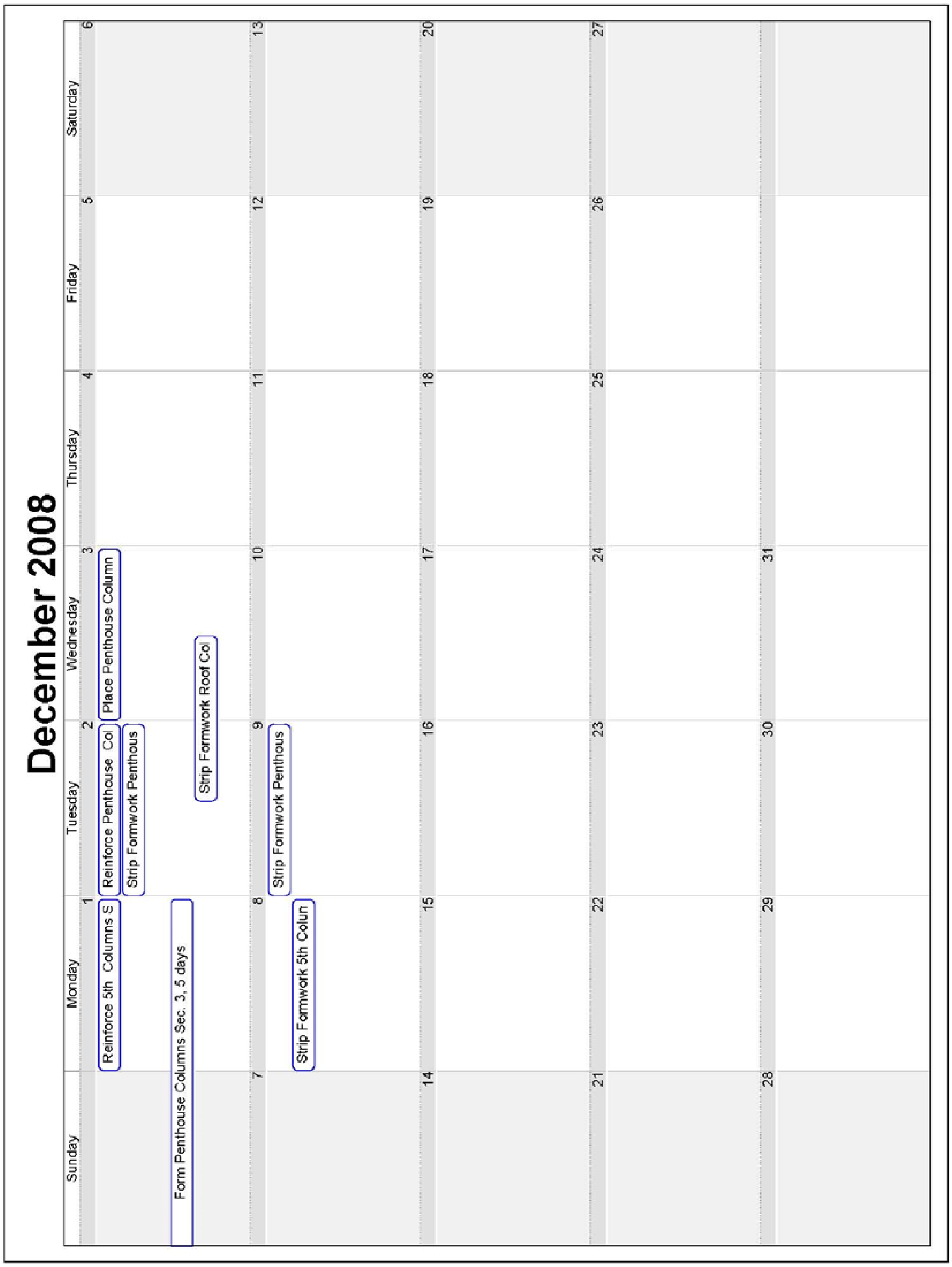


Figure 58: December Schedule Calendar

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	Plan Start	Plan Finish	Fin Var
Building 1							
Construction - Structure/Enclosure							
-							
0006	Start Construction	0	11FEB08A		21JAN08*		-15
0092	Temp Weather Tight Close in of Shell	0		03NOV08A		01SEP08*	-45
0122	Natural Gas to Building	0		14NOV08A	13AUG08	22AUG08	-60
0402	Temporary Heat	0		14NOV08A			0
0132	Water to Building	0		05JAN09A	01OCT08	10OCT08	-61
0392	Fire Protection Water to Building	0		05JAN09A			0
Mobilization							
0002	Mobilization	1*	11FEB08A	11FEB08A	21JAN08	25JAN08	-11
0032	Mobilization - Caissons	5	11FEB08A	11FEB08A	21JAN08	25JAN08	-11
0062	Mobilization - Excavator	5	11FEB08A	11FEB08A	21JAN08	25JAN08	-11
0072	Mobilization - Foundations	5	11FEB08A	11FEB08A	21JAN08	25JAN08	-11
Initial Sitework/Excavation							
0007	Temporary Construction Roads/Fence/Binder	79*	12FEB08A	30MAY08A	28JAN08	20FEB08	-72
0557	Trumbull Work Complete	0		11APR08A			0
0017	Install Access Road	10	12FEB08A	14APR08A	28JAN08	08FEB08	-46
0097S	Install Construction Ramps	10	13FEB08A	24MAR08A			0
0067	Build Laydown Area - Parking Lot	10	31MAR08A	04APR08A	28JAN08	07MAR08	-20
0207	Install Fence & Double-Wide Gate	5	27MAY08A	30MAY08A	14FEB08	20FEB08	-72
Caissons							
0076	Layout Baselines - Turner	5	08FEB08A	11FEB08A	14JAN08*	18JAN08	-16
0016	Caissons: E-BLDG	5	11FEB08A	14FEB08A	04FEB08	08FEB08	-4
0014	Caissons: W-BLDG	5	11FEB08A	19FEB08A	11FEB08	15FEB08	-2
0084	Elevator Jack Hole - W	3	20MAY08A	20MAY08A	11FEB08	13FEB08	-69
Grade Beams							
0040	Wall Footers (0.7-3): E-BLDG	8	11FEB08A	27FEB08A			0
0080	Wall Footers (3-7): E-BLDG	8	11FEB08A	28FEB08A			0
0020	Grade Beams: E-BLDG	59*	11FEB08A	01MAY08A	21FEB08	12MAR08	-36
0299	Wall Footers (N 7-21): C-BLDG	3	26FEB08A	29FEB08A			0
0019	Grade Beams: C-BLDG	61*	26FEB08A	20MAY08A	25FEB08	14MAR08	-47
0269	Wall Footers (S 15-20): C-BLDG	4	28FEB08A	05MAR08A			0
0259	Wall Footers (S 9-15): C-BLDG	4	29FEB08A	03MAR08A			0
0279	Wall Footers (S 7-9): C-BLDG	4	03MAR08A	06MAR08A			0
0289	Wall Footers (S 20-22): C-BLDG	2	05MAR08A	13MAR08A			0
0309	Interior Spread Footers (S 9-20 / A-B):	3	07MAR08A	12MAR08A			0
0298	Wall Footers (S 22-25): W-BLDG	3	10MAR08A	14MAR08A			0
0308	Wall Footers (N 22-26): W-BLDG	3	10MAR08A	14MAR08A			0
0018	Grade Beams: W-BLDG	20*	10MAR08A	04APR08A	10MAR08	28MAR08	-5
0328	Wall Footers (S 25-31): W-BLDG	3	20MAR08A	28MAR08A			0
0348	Interior Spread Footers (C-D): C-BLDG	8	17MAR08A	20MAY08A			0
0358	Interior Spread Footers: W-BLDG	5	24MAR08A	04APR08A			0
0338	Interior Spread Footers: E-BLDG	10	07APR08A	01MAY08A			0
0119	Elevator Pits: C-BLDG	10	09APR08A	01MAY08A	25FEB08	07MAR08	-39
0028	Elevator Pits: W-BLDG	5	13MAY08A	27MAY08A	10MAR08	14MAR08	-52
0010X	Trench Drain: Excavation to Swale (NOT	5	17MAR08A	09APR08A			0
0030X	Trench Drain: C-BLDG	5	24MAR08A	08APR08A			0
0020X	Trench Drain: E-BLDG	4	24MAR08A	09APR08A			0
0040X	Trench Drain: W-BLDG	4	31MAR08A	03APR08A			0
Foundation Walls							
-							
0024	Foundation Walls: E-BLDG	30*	03MAR08A	11APR08A	28FEB08	07MAY08	18
0023	Foundation Walls: C-BLDG	17*	10APR08A	02MAY08A	06MAR08	14MAY08	8
0022	Foundation Walls: W-BLDG	24*	17APR08A	20MAY08A	07APR08	13JUN08	18
North Elevation							
2450	Form (E / 0.7-3): E-BLDG	3	03MAR08A	06MAR08A			0
2460	Resteel / MEPs (E / 0.7-3): E-BLDG	3	06MAR08A	25MAR08A			0
2470	Pour (E / 0.7-3): E-BLDG	1	03APR08A	03APR08A			0
2480	Form (E / 3-7): E-BLDG	2	04APR08A	08APR08A			0
2490	Resteel / MEPs (E / 3-7): E-BLDG	2	07APR08A	08APR08A			0
2500	Pour (E / 3-7): E-BLDG	1	09APR08A	09APR08A			0
2510	Form (E / 7-16): C-BLDG	2	10APR08A	11APR08A			0
2520	Resteel / MEPs (E / 7-16): C-BLDG	2	14APR08A	15APR08A			0
2530	Pour (E / 7-16): C-BLDG	1	16APR08A	16APR08A			0
0322	Form (E / 16-25): W-BLDG	2	17APR08A	18APR08A			0
0332	Resteel / MEPs (E / 16-25): W-BLDG	2	18APR08A	24APR08A			0
0360	Resteel / MEPs (E / 25-29): W-BLDG	2	28APR08A	30APR08A			0
0350	Form (E / 25-29): W-BLDG	2	28APR08A	01MAY08A			0
0342	Pour (E / 16-25): W-BLDG	1	29APR08A	29APR08A			0
0375	Form (E / 29-31, E-D / 31): W-BLDG	2	01MAY08A	14MAY08A			0
0370	Pour (E / 25-29): W-BLDG	1	02MAY08A	02MAY08A			0
0385	Resteel / MEPs (E / 29-31, E-D / 31):	2	09MAY08A	13MAY08A			0
0395	Pour (E / 29-31, E-D / 31): W-BLDG	1	20MAY08A	20MAY08A			0
0400	Form (D-C / 31, C / 28-31): W-BLDG	2	08MAY08A	08MAY08A			0
0410	Resteel / MEPs (D-C / 31, C / 28-31):	2	09MAY08A	09MAY08A			0
0420	Pour (D-C / 31, C / 28-31): W-BLDG	1	16MAY08A	16MAY08A			0
South Elevation							
0034	Form (B-D / 0.7-4): E-BLDG	3	03MAR08A	06MAR08A			0
0044	Resteel / MEPs (B-D / 0.7-4): E-BLDG	3	06MAR08A	19MAR08A	24JAN08	27FEB08	-15
0074	Pour (B-D / 0.7-4): E-BLDG	1	20MAR08A	20MAR08A	25JUN08	01JUL08	73
0194	Form (B / 4-7): E-BLDG	2	03APR08A	08APR08A			0
0224	Form (B / 7-9): E-BLDG	2	04APR08A	11APR08A			0

Start Date 01OCT07
Finish Date 16JUN09
Data Date 13JAN09
Early Bar
Progress Bar
WH31
TCCO
Sheet 1 of 4

Date	Revision	Checked	Approved

Figure 59: Turner Construction Schedule 1/4

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	Plan Start	Plan Finish	Fin Var
0204	Resteel / MEPs (B / 4-7): E-BLDG	2	07APR08A	07APR08A			0
0214	Pour (B / 4-7): E-BLDG	1	09APR08A	09APR08A			0
0234	Resteel / MEPs (B / 7-9): E-BLDG	2	09APR08A	10APR08A			0
0244	Pour (B / 7-9): E-BLDG	1	14APR08A	11APR08A			0
0033	Form (A-Line, A / 9-12): C-BLDG	2	10APR08A	17APR08A			0
0103	Form (A / 12-16): C-BLDG	2	11APR08A	22APR08A	13AUG08	19AUG08	85
0073	Resteel / MEPs (A-Line, A / 9-12): C-BLDG	2	14APR08A	16APR08A	10SEP08	16SEP08	109
0143	Form (A / 16-20, A-A.4): C-BLDG	2	17APR08A	24APR08A	16OCT08	20OCT08	127
0193	Resteel / MEPs (A / 16-20, A-A.4): C-BLDG	2	17APR08A	24APR08A			0
0093	Pour (A-Line, A / 9-12): C-BLDG	1	18APR08A	18APR08A	16JUL08	22JUL08	67
0123	Resteel / MEPs (A / 12-16): C-BLDG	2	18APR08A	21APR08A	01OCT08	07OCT08	121
0133	Pour (A / 12-16): C-BLDG	1	23APR08A	23APR08A	28AUG08	01SEP08	93
00921	Form (A.4-B, B / 20-24): C-BLDG	2	23APR08A	01MAY08A			0
0203	Pour (A / 16-20, A-A.4): C-BLDG	1	25APR08A	25APR08A			0
0192	Resteel / MEPs (A.4-B, B / 20-23): C-BLDG	2	25APR08A	29APR08A		01SEP08*	89
0282	Pour (A.4-B, B / 20-23): C-BLDG	1	02MAY08A	02MAY08A			0
0292	Form (B / 23-28): W-BLDG	2	23APR08A	07MAY08A			0
0302	Resteel / MEPs (B / 23-28): W-BLDG	2	01MAY08A	07MAY08A			0
0312	Pour (B / 23-28): W-BLDG	1	08MAY08A	08MAY08A			0
Foundation Waterproofing							
0030	Waterproof: C-BLDG (A-Line)	2	01MAY08A	22JUL08A	07JUL08	08JUL08	-10
0121	Waterproof: C-BLDG (E-Line)	2	01MAY08A	23JUL08A	22APR08	23APR08	-65
0099	Waterproof: E-BLDG (B-Line)	2	30APR08A	01AUG08A	04AUG08	05AUG08	2
0031	Waterproof: E-BLDG (E-Line)	2	01MAY08A	01AUG08A	22APR08	23APR08	-72
0131	Waterproof: W-BLDG (E-Line)	2	13MAY08A	01AUG08A	13MAY08	14MAY08	-57
0029	Waterproof: W-BLDG (B-Line)	2	19MAY08A	01AUG08A	22SEP08	23SEP08	37
U.G. Utilities							
0113E	Elec Main Feeders UG: E-BLDG	5	21APR08A	28APR08A			0
0223	UG Sanitary Mechanical Rm: E-BLDG	5	22APR08A	01MAY08A			0
0213	Elec UG Mechanical Rm: E-BLDG	5	29APR08A	08MAY08A			0
0233	UG Sanitary: E-BLDG	5	09MAY08A	19AUG08A			0
0243	UG Sanitary: C-BLDG	5	05MAY08A	17JUL08A			0
0253	UG Sanitary: W-BLDG	5	05MAY08A	19AUG08A			0
0058	UG Utilites (Crane Path): E-BLDG	5	15AUG08A	19AUG08A	16JUN08	11JUL08	-27
0052	UG Utilites (Crane Path): W-BLDG	5	25AUG08A	29AUG08A	13MAR08	09APR08	-102
SOG							
0046	SOG: C-BLDG	35*	22JUL08A	08SEP08A	14APR08	02MAY08	-91
0045	SOG: W-BLDG	13*	21AUG08A	08SEP08A	28APR08	06MAY08	-89
0047	SOG: E-BLDG	25*	02SEP08A	06OCT08A	10APR08	18APR08	-121
Elevator Pits							
EP100-11	Excavate (EP 1-2)	1	02MAY08A	02MAY08A			0
EP100-01	Form Bottom (Elevator Pit 1-2)	2	15MAY08A	16MAY08A			0
EP110-01	Pre-Proof Waterproofing (EP 1-2)	2	20MAY08A	20MAY08A			0
EP120-01	Place Footing (EP 1-2)	2	20MAY08A	21MAY08A			0
EP130-01	Place Walls (EP 1-2)	2	22MAY08A	27MAY08A			0
EP140-01	Cure Period (7 Days)	7	27MAY08A	02JUN08A			0
EP150-01	Bituthene Waterproof (EP 1-2)	2	03JUN08A	03JUN08A			0
EP160-01	Backfill (EP 1-2)	2	03JUN08A	04JUN08A			0
EP095-03	Excavate (EP 3-4)	1	02MAY08A	02MAY08A			0
EP100-03	Form Bottom (Elevator Pit 3-4)	2	19MAY08A	19MAY08A			0
EP110-03	Pre-Proof Waterproofing (EP 3-4)	2	20MAY08A	20MAY08A			0
EP120-03	Place Footing (EP 3-4)	2	21MAY08A	21MAY08A			0
EP130-03	Place Walls (EP 3-4)	2	23MAY08A	28MAY08A			0
EP140-03	Cure Period (7 Days)	7	28MAY08A	04JUN08A			0
EP150-03	Bituthene Waterproof (EP 3-4)	2	08JUL08A	09JUL08A			0
EP160-03	Backfill (EP 3-4)	2	10JUL08A	11JUL08A			0
EP095-05	Excavate (EP-5)	1	12MAY08A	13MAY08A			0
EP100-05	Form Bottom (Elevator Pit 5)	2	20MAY08A	21MAY08A			0
EP110-05	Pre-Proof Waterproofing (EP 5)	2	21MAY08A	21MAY08A			0
EP120-05	Place Footing (EP 5)	2	22MAY08A	27MAY08A			0
EP130-05	Place Walls (EP 5)	2	28MAY08A	29MAY08A			0
EP140-05	Cure Period (7 Days)	7	30MAY08A	06JUN08A			0
EP150-05	Bituthene Waterproof (EP 5)	2	23JUN08A	20JUN08A			0
EP160-05	Backfill (EP 5)	2	08JUL08A	09JUL08A			0
EP095-06	Excavate (EP 6)	1	09APR08A	09APR08A			0
EP100-06	Form Bottom (Elevator Pit 6)	2	16JUN08A	16JUN08A			0
EP110-06	Pre-Proof Waterproofing (EP 6)	2	19JUN08A	19JUN08A			0
EP120-06	Place Footing (EP 6)	2	20JUN08A	20JUN08A			0
EP130-06	Place Walls (EP 6)	2	26JUN08A	26JUN08A			0
EP140-06	Cure Period (7 Days)	7	27JUN08A	03JUL08A			0
EP150-06	Bituthene Waterproof (EP 6)	2	08JUL08A	09JUL08A			0
EP160-06	Backfill (EP 6)	2	10JUL08A	11JUL08A			0
EP100-07	Form Bottom (Elevator Pit 7)	2	13JUN08A	13JUN08A			0
EP120-07	Place Footing (EP 7)	2	13JUN08A	13JUN08A			0
EP110-07	Pre-Proof Waterproofing (EP 7)	2	23JUN08A	20JUN08A			0
EP130-07	Place Walls (EP 7)	2	01AUG08A	01AUG08A			0
EP140-07	Cure Period (7 Days)	7	02AUG08A	08AUG08A			0
EP150-07	Bituthene Waterproof (EP 7)	2	08AUG08A	08AUG08A			0
EP160-07	Backfill (EP 7)	2	11AUG08A	11AUG08A			0
SG110	Place Stone & Underdrain (D.5 / 3-20)	2	28MAY08A	29MAY08A			0
SG120	Form, Vapor Barrier & Mesh (D.5 / 3-20)	2	30MAY08A	02JUN08A			0
SG130	Waterproof (D.5 / 3-20)	1	02JUN08A	02JUN08A			0
SG150	Place Concrete (D.5 / 3-20)	1	02JUL08A	02JUL08A			0
SG160	Strip Forms (D.5 / 3-20)	1	07JUL08A	07JUL08A			0
SG110-02	Place Stone & Underdrain (C-D / 1-0.7)	2	12JUN08A	13JUN08A			0
SG120-02	Form, Vapor Barrier & Mesh (C-D / 1-0.7)	1	14JUL08A	14JUL08A			0
SG130-02	Waterproof (C-D / 1-0.7)	1	16JUL08A	16JUL08A			0
SG140-02	Place Concrete (C-D / 1-0.7) - Electrical Rm	1	18JUL08A	18JUL08A			0
SG150-02	Strip Forms (C-D / 1-0.7)	1	21JUL08A	21JUL08A			0

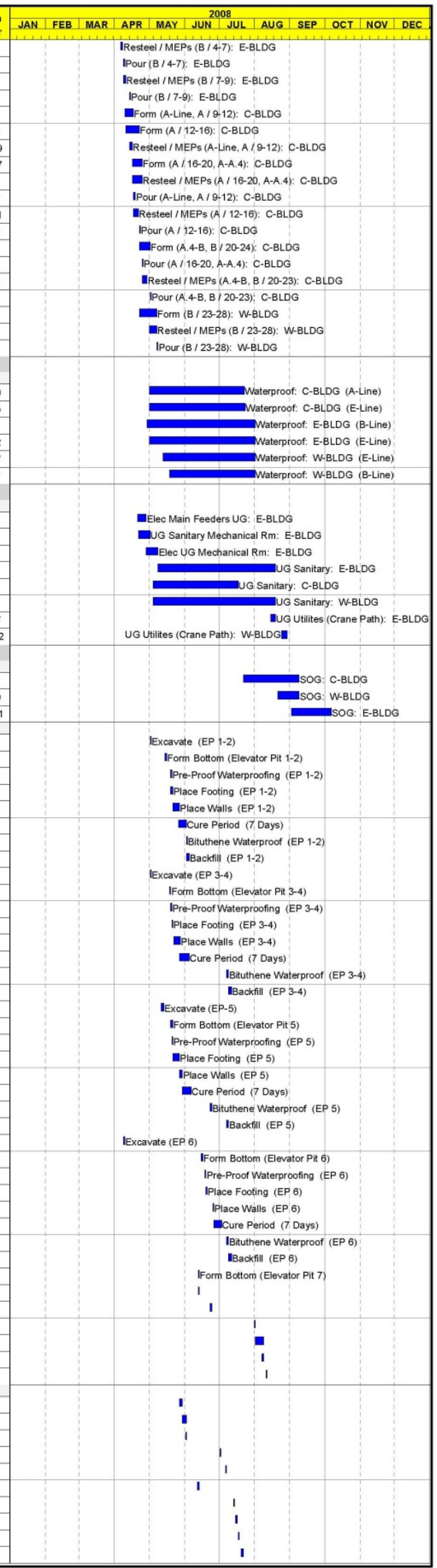


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Figure 60: Turner Construction Schedule 2/4

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	Plan Start	Plan Finish	Fin Var
SG110-05	Place Stone & Underdrain (C-E / 28-31)	2	19AUG08A	20AUG08A			0
SG120-05	Form, Vapor Barrier & Mesh (C-E / 27-31)	2	02SEP08A	16SEP08A			0
SG130-05	Waterproof (C-E / 27-31)	1	16SEP08A	16SEP08A			0
SG150-05	Strip Forms (C-E / 27-31)	1	18SEP08A	18SEP08A			0
SG140-05	Place Concrete (C-E / 27-31)	1	26SEP08A	26SEP08A			0
SG110-06	Place Stone & Underdrain (A-B / 9-20) [1]	2	22JUL08A	05AUG08A			0
SG130-06	Waterproof (A-B / 9-20) [1]	1	18AUG08A	18AUG08A			0
SG120-06	Form, Vapor Barrier & Mesh (A-B / 9-20) [1]	2	18AUG08A	26AUG08A			0
SG140-06	Place Concrete (A-B / 9-20) [1]	1	27AUG08A	27AUG08A			0
SG150-06	Strip Forms (A-B / 9-20) [1]	1	28AUG08A	28AUG08A			0
SG110-11	Place Stone & Underdrain (B-D / 15-21) [2]	2	02SEP08A	03SEP08A			0
SG120-11	Form, Vapor Barrier & Mesh (B-D / 15-21) [2]	2	04SEP08A	05SEP08A			0
SG130-11	Waterproof (B-D / 15-21) [2]	1	05SEP08A	05SEP08A			0
SG140-11	Place Concrete (B-D / 15-21) [2]	1	08SEP08A	08SEP08A			0
SG150-11	Strip Forms (B-D / 15-21) [2]	1	09SEP08A	09SEP08A			0
SG110-09	Place Stone & Underdrain (C-D.5 / 5-15) [3]	2	02SEP08A	03SEP08A			0
SG120-09	Form, Vapor Barrier & Mesh (C-D.5 / 5-15) [3]	2	04SEP08A	05SEP08A			0
SG130-09	Waterproof (C-D.5 / 5-15) [3]	1	05SEP08A	05SEP08A			0
SG140-09	Place Concrete (C-D.5 / 5-15) [3]	1	08SEP08A	08SEP08A			0
SG150-09	Strip Forms (C-D.5 / 5-15) [3]	1	09SEP08A	09SEP08A			0
SG110-04	Place Stone & Underdrain (B-C / 5-14) [4]	2	20AUG08A	21AUG08A			0
SG120-04	Waterproof (B-C / 5-14) [4]	3	22AUG08A	22AUG08A			0
SG130-04	Form & Mesh (B-C / 5-14) [4]	1	23AUG08A	24AUG08A			0
SG140-04	Place Concrete (B-C / 5-14) [4]	1	02SEP08A	02SEP08A			0
SG150-04	Strip Forms (B-C / 5-14) [4]	1	09SEP08A	09SEP08A			0
SG110-07	Place Stone & Underdrain (B-D / 21-25) [5]	2	19AUG08A	20AUG08A			0
SG120-07	Form, Vapor Barrier & Mesh (B-D / 21-25) [5]	2	21AUG08A	22AUG08A			0
SG130-07	Waterproof (B-D / 21-25) [5]	1	22AUG08A	22AUG08A			0
SG140-07	Place Concrete (C-D / 21-25) [5]	1	29AUG08A	29AUG08A			0
SG150-07	Strip Forms (C-D / 21-25) [5]	1	02SEP08A	02SEP08A			0
SG150-17	Place Concrete (B-C / 21-26)	1	03SEP08A	03SEP08A			0
SG110-03	Place Stone & Underdrain (B-C / 1-5) [7]	2	02SEP08A	03SEP08A			0
SG120-03	Form, Vapor Barrier & Mesh (B-C / 1-5) [7]	2	04SEP08A	05SEP08A			0
SG130-03	Waterproof (B-C / 1-5) [7]	1	05SEP08A	05SEP08A			0
SG140-03	Place Concrete (B-C / 1-5) [7]	1	08SEP08A	08SEP08A			0
SG150-03	Strip Forms (B-C / 1-5) [7]	1	09SEP08A	09SEP08A			0
SG105-12B	Complete Foundation Wall: 0.7 Line	4	02SEP08A	29SEP08A			0
SG110-10	Place Stone & Underdrain (C-E / 0.7-3) [8]	2	01OCT08A	01OCT08A			0
SG120-10	Form, Vapor Barrier & Mesh (C-E / 0.7-3) [8]	2	01OCT08A	03OCT08A			0
SG130-10	Waterproof (C-E / 0.7-3) [8]	1	02OCT08A	02OCT08A			0
SG140-10	Place Concrete (C-E / 0.7-3) [8]	1	06OCT08A	06OCT08A			0
SG150-10	Strip Forms (C-E / 0.7-3) [8]	1	07OCT08A	07OCT08A			0
SG110-12A	Place Stone & Underdrain (B-C / 24-28) [10]	2	02SEP08A	03SEP08A			0
SG120-12A	Form, Vapor Barrier & Mesh (B-C / 24-28)	2	04SEP08A	05SEP08A			0
SG130-12A	Waterproof (B-C / 24-28) [10]	1	05SEP08A	05SEP08A			0
SG140-12A	Place Concrete (B-C / 24-28) [10]	1	08SEP08A	08SEP08A			0
SG150-12A	Strip Forms (B-C / 24-28) [10]	1	09SEP08A	09SEP08A			0
SG105-12A	Complete Foundation Wall: 28-Line	4	02SEP08A	02OCT08A			0
SG105-20	Complete Foundation Walls @ 0.7, 01 Line	10	15SEP08A	29SEP08A			0
Backfill/Wall Bracing							
North Elevation							
0397	Backfill: F-Line, C-BLDG	2	16MAY08A	31JUL08A	07MAY08	08MAY08	-60
0577	Caissons: F-Line, C-BLDG	3	22MAY08A	23MAY08A			0
0327	Piers: F-Line, C-BLDG	2	10JUN08A	13JUN08A	30APR08	01MAY08	-31
0317	Footings: F-Line, C-BLDG	2	16JUN08A	17JUN08A	28APR08	29APR08	-35
0227	Wall Bracing: F-Line, C-BLDG	3	07JUL08A	09JUL08A	21APR08	23APR08	-55
0367	Masonry: F-Line, C-BLDG	3	16SEP08A	07NOV08A	02MAY08	06MAY08	-133
0587	Caissons: F-Line, E-BLDG	2	28MAY08A	30MAY08A			0
0297	Footings: F-Line, E-BLDG	2	18JUN08A	20JUN08A	28APR08	29APR08	-38
0217	Wall Bracing: F-Line, E-BLDG	3	07JUL08A	09JUL08A	21APR08	23APR08	-55
0307	Piers: F-Line, E-BLDG	4	25AUG08A	28AUG08A	30APR08	01MAY08	-85
0387	Backfill: F-Line, E-BLDG	2	22SEP08A	07NOV08A	08MAY08	09MAY08	-130
0357	Masonry: F-Line, E-BLDG	4	24SEP08A	07NOV08A	02MAY08	07MAY08	-132
0597	Caissons: F-Line, W-BLDG	2	26MAY08A	28MAY08A			0
0337	Footings: F-Line, W-BLDG	2	20JUN08A	23JUN08A	19MAY08	20MAY08	-24
0347	Piers: F-Line, W-BLDG	2	30JUN08A	07JUL08A	21MAY08	22MAY08	-32
0237	Wall Bracing: F-Line, W-BLDG	3	07JUL08A	10JUL08A	12MAY08	14MAY08	-41
0407	Backfill: F-Line, W-BLDG	2	10JUL08A	25JUL08A	29MAY08	30MAY08	-40
0377	Masonry: F-Line, W-BLDG	4	18NOV08A	28NOV08A	23MAY08	28MAY08	-132
South Elevation							
0177	Backfill Foundations: B-Line, E-BLDG	5	01MAY08A	15SEP08A	06AUG08	12AUG08	-24
0267	Backfill Foundations: A-Line, C-BLDG	5	07MAY08A	31JUL08A	09JUL08	15JUL08	-12
0197	Backfill Foundations: B-Line, W-BLDG	5	09MAY08A	04AUG08A	24SEP08	30SEP08	41
East Elevation							
0277	Backfill Foundations: 0.7-1 Lines, E-BLDG	3	18SEP08A	22SEP08A	25AUG08	27AUG08	-18
West Elevation							
0287	Backfill Foundations: 28-31 Lines, W-BLDG	3	18SEP08A	23OCT08A	13OCT08	15OCT08	-6
Structural Steel							
-							
0036	Steel Start	0	09JUN08A		14MAY08		-18
0048	Structural Steel: C-BLDG	71*	09JUN08A	15SEP08A	14MAY08	29JUL08	-34
0037	Structural Steel: W-BLDG	54*	17JUL08A	30SEP08A	30JUL08	14OCT08	10
0038	Structural Steel: E-BLDG	42*	18JUL08A	15SEP08A	11JUN08	26AUG08	-14
0039	Steel Erection Complete	0		23SEP08A		14OCT08	15
Crane 1							
0329	Erect: 13-15 / A-E (Seq 1-7)	19	09JUN08A	27JUN08A			0
0419	Detail: 13-15 / A-E (Seq 1-7)	32	18JUN08A	17JUL08A			0
0339	Erect: 15-21 / A-E (Seq 8-19)	22	30JUN08A	14JUL08A			0
0429	Detail: 15-21 / A-E (Seq 8-19)	35	02JUL08A	21JUL08A			0
0349	Erect: 21-25 / B-E (Seq 20-31)	23	17JUL08A	07AUG08A			0
0439	Detail: 21-25 / B-E (Seq 20-31)	38	22JUL08A	30SEP08A			0
0379	Erect: 25-31 / A-E (Seq 32-45)	16	19AUG08A	29AUG08A			0
0469	Detail: 25-31 / A-E (Seq 32-45)	30	20AUG08A	30SEP08A			0

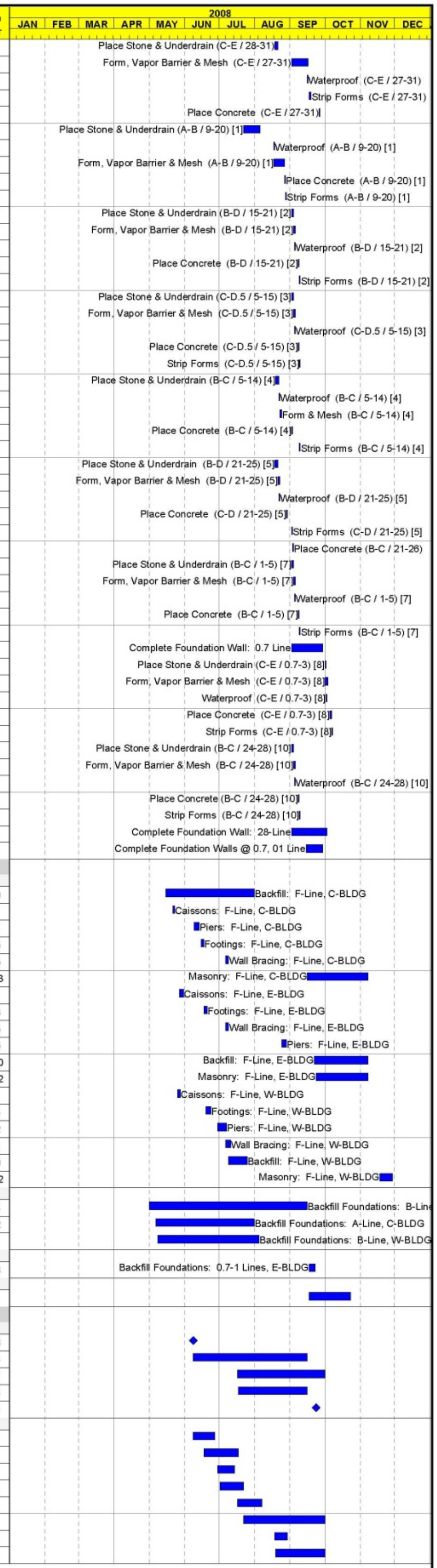

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Figure 61: Turner Construction Schedule 3/4

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	Plan Start	Plan Finish	Fin Var
0489	Stair C1	15	21JUL08A	12AUG08A			0
0499	Stair W2	15	22JUL08A	08AUG08A			0
0509	Stair W1	15	18AUG08A	05SEP08A			0
Crane 2							
0359	Erect: 13-8 / A-E (Seq 101-112)	13	08JUL08A	18JUL08A			0
0449	Detail: 13-8 / A-E (Seq 101-112)	28	17JUL08A	15SEP08A			0
0369	Erect: 8-4 / A-E (Seq 113-124)	25	18JUL08A	05AUG08A			0
0459	Detail: 8-4 / A-E (Seq 113-124)	39	22JUL08A	15SEP08A			0
0389	Erect: 4-0.07 / A-E (Seq 125-131)	18	05AUG08A	28AUG08A			0
0479	Detail: 4-0.07 / A-E (Seq 125-131)	31	06AUG08A	15SEP08A			0
0519	Stair E1	15	04AUG08A	20AUG08A			0
0529	Stair E2	10	06AUG08A	20AUG08A			0
SOD							
.							
0050	SOD: C-BLDG	33*	23JUL08A	06SEP08A	25JUN08	12AUG08	-18
0049	SOD: W-BLDG	32*	25AUG08A	07OCT08A	10SEP08	28OCT08	15
0051	SOD: E-BLDG	22*	26AUG08A	24SEP08A	23JUL08	09SEP08	-11
08 - 21							
0281B	MEP Hangers/Slab RI: 8-21 / A-E (1st Flr)	5	14JUL08A	18JUL08A			0
0291B	SOD: 8-21 / A-E (1st Flr)	5	23JUL08A	28JUL08A			0
0381B	MEP Hangers/Slab RI: 8-21 / A-E (5th Flr)	5	14AUG08A	15AUG08A			0
0391B	SOD: 8-21 / A-E (5th Flr)	5	15AUG08A	18AUG08A			0
0321B	MEP Hangers/Slab RI: 8-21 / A-E (2nd Flr)	5	24JUL08A	30JUL08A			0
0331B	SOD: 8-21 / A-E (2rd Flr)	5	31JUL08A	04AUG08A			0
0341B	MEP Hangers/Slab RI: 8-21 / A-E (3rd Flr)	5	25JUL08A	30JUL08A			0
0351B	SOD: 8-21 / A-E (3rd Flr)	5	31JUL08A	12AUG08A			0
0361B	MEP Hangers/Slab RI: 8-21 / A-E (4th Flr)	5	11AUG08A	12AUG08A			0
0371B	SOD: 8-21 / A-E (4th Flr)	5	13AUG08A	14AUG08A			0
0401D	MEP Hangers/Slab RI: 8-21 (Penthouse)	5	26AUG08A	02SEP08A			0
0411D	SOD: 8-21 (Penthouse)	5	29AUG08A	06SEP08A			0
08 - 04							
0281F	MEP Hangers/Slab RI: 8-4 / A-E (1st Flr)	4	25AUG08A	02SEP08A			0
0291F	SOD: 8-4 / A-E (1st Flr)	4	26AUG08A	04SEP08A			0
0321F	MEP Hangers/Slab RI: 8-4 / A-E (2nd Flr)	4	29AUG08A	04SEP08A			0
0331F	SOD: 8-4 / A-E (2rd Flr)	4	29AUG08A	08SEP08A			0
0341F	MEP Hangers/Slab RI: 8-4 / B-E (3rd Flr)	4	11SEP08A	16SEP08A			0
0351F	SOD: 8-4 / B-E (3rd Flr)	4	12SEP08A	17SEP08A			0
0361F	MEP Hangers/Slab RI: 8-4 / B-E (4th Flr)	4	12SEP08A	17SEP08A			0
0371F	SOD: 8-4 / B-E (4th Flr)	4	15SEP08A	18SEP08A			0
0381F	MEP Hangers/Slab RI: 8-4 / B-E (5th Flr)	4	16SEP08A	19SEP08A			0
0391F	SOD: 8-4 / B-E (5th Flr)	4	17SEP08A	22SEP08A			0
04 - 01							
0281H	MEP Hangers/Slab RI: 4-1 / A-E (1st Flr)	4	02SEP08A	08SEP08A			0
0291H	SOD: 4-1 / A-E (1st Flr)	4	03SEP08A	10SEP08A			0
0412H	Complete SOD: 0.7-01 (1st Flr)	4	06OCT08A	06OCT08A			0
0321H	MEP Hangers/Slab RI: 4-1 / A-E (2nd Flr)	4	03SEP08A	09SEP08A			0
0331H	SOD: 4-1 / A-E (2rd Flr)	4	05SEP08A	11SEP08A			0
0341H	MEP Hangers/Slab RI: 4-1 / B-E (3rd Flr)	4	15SEP08A	17SEP08A			0
0351H	SOD: 4-1 / B-E (3rd Flr)	4	16SEP08A	18SEP08A			0
0361H	MEP Hangers/Slab RI: 4-1 / B-E (4th Flr)	4	15SEP08A	18SEP08A			0
0371H	SOD: 4-1 / B-E (4th Flr)	4	17SEP08A	19SEP08A			0
0381H	MEP Hangers/Slab RI: 4-1 / B-E (5th Flr)	4	18SEP08A	22SEP08A			0
0391H	SOD: 4-1 / B-E (5th Flr)	4	19SEP08A	23SEP08A			0
0401H	MEP Hangers/Slab RI: 8-1 (Penthouse)	4	16SEP08A	19SEP08A			0
0411H	SOD: 8-1 (Penthouse)	4	18SEP08A	24SEP08A			0
0411H10	Pour Curbs: 8-1 (Penthouse)	5	24SEP08A	30SEP08A			0
01 - 0.7							
0281DL	MEP Hangers/Slab RI: 1-0.07 / A-E (1st Flr)	2	04SEP08A	05SEP08A			0
0291DL	SOD: 1-0.07 / A-E (1st Flr)	2	08SEP08A	10SEP08A			0
21 - 25							
0281C	MEP Hangers/Slab RI: 21-25 / B-E (1st Flr)	4	22AUG08A	22AUG08A			0
0291C	SOD: 21-25 / B-E (1st Flr)	4	25AUG08A	25AUG08A			0
0321C	MEP Hangers/Slab RI: 21-25 / B-E (2nd Flr)	4	25AUG08A	28AUG08A			0
0331C	SOD: 21-25 / B-E (2rd Flr)	4	26AUG08A	29AUG08A			0
0341C	MEP Hangers/Slab RI: 21-25 / B-E (3rd Flr)	4	26SEP08A	30SEP08A			0
0351C	SOD: 21-25 / B-E (3rd Flr)	4	29SEP08A	01OCT08A			0
0361C	MEP Hangers/Slab RI: 21-25 / B-E (4th Flr)	4	26SEP08A	30SEP08A			0
0371C	SOD: 21-25 / B-E (4th Flr)	4	01OCT08A	03OCT08A			0
0381C	MEP Hangers/Slab RI: 21-25 / B-E (5th Flr)	4	30SEP08A	03OCT08A			0
0391C	SOD: 21-25 / B-E (5th Flr)	4	01OCT08A	06OCT08A			0
25 - 28							
0281I	MEP Hangers/Slab RI: 25-28 / B-E (1st Flr)	4	17SEP08A	22SEP08A			0
0291I	SOD: 25-28 / B-E (1st Flr)	4	19SEP08A	25SEP08A			0
0321I	MEP Hangers/Slab RI: 25-28 / B-E (2nd Flr)	4	16SEP08A	19SEP08A			0
0331I	SOD: 25-28 / B-E (2rd Flr)	4	22SEP08A	30SEP08A			0
0341I	MEP Hangers/Slab RI: 25-28 / B-E (3rd Flr)	4	29SEP08A	01OCT08A			0
0351I	SOD: 25-28 / B-E (3rd Flr)	4	30SEP08A	02OCT08A			0
0361I	MEP Hangers/Slab RI: 25-28 / B-E (4th Flr)	4	30SEP08A	03OCT08A			0
0371I	SOD: 25-28 / B-E (4th Flr)	4	01OCT08A	04OCT08A			0
0381I	MEP Hangers/Slab RI: 25-28 / B-E (5th Flr)	4	07OCT08A	09OCT08A			0
0391I	SOD: 25-28 / B-E (5th Flr)	4	08OCT08A	10OCT08A			0
0401I	MEP Hangers/Slab RI: 21-28 (Penthouse)	4	01OCT08A	06OCT08A			0
0411I	SOD: 21-28 (Penthouse)	4	02OCT08A	07OCT08A			0
0411I10	Pour Curbs: 21-28 (Penthouse)	3	10OCT08A	10OCT08A			0
28 - 31							
0281K	MEP Hangers/Slab RI: 28-31 / B-E (1st Flr)	2	14OCT08A	15OCT08A			0
0291K	SOD: 28-31 / B-E (1st Flr)	2	15OCT08A	17OCT08A			0

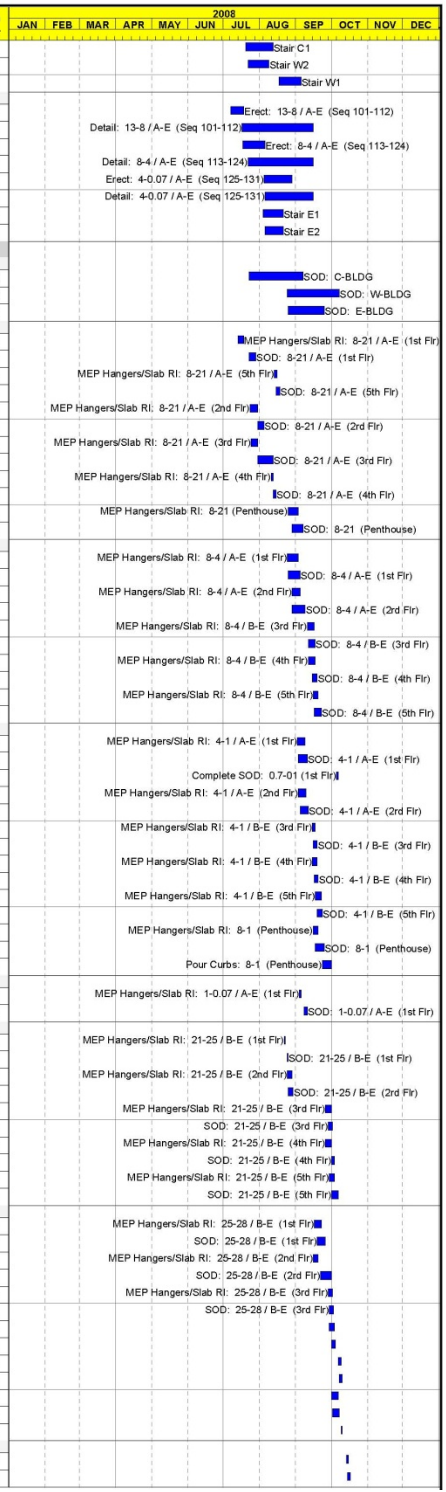

Figure 62: Turner Construction Schedule 4/4

APPENDIX G: SUSTAINABLE ARCHITECTURE BREADTH STUDY

LEED for New Construction v 2.2
Registered Project Checklist

Project Name: Westinghouse Electric Company Corporate Headquarters

Project Address: 1000 Westinghouse Drive, Cranberry Township, PA 16066

Yes	?	No		
28	5	33	Project Totals (Pre-Certification Estimates)	69 Points
CERTIFIED			**Certified:** 26-32 points **Silver:** 33-38 points **Gold:** 39-51 points **Platinum:** 52-69 points	

Yes	?	No			
8	3	3	Sustainable Sites		14 Points
Yes			Prereq 1	**Construction Activity Pollution Prevention**	Required
1	0	0	Credit 1	**Site Selection**	1
0	0	1	Credit 2	**Development Density & Community Connectivity**	1
0	0	1	Credit 3	**Brownfield Redevelopment**	1
1	0	0	Credit 4.1	**Alternative Transportation**, Public Transportation	1
1	0	0	Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
0	0	1	Credit 4.3	**Alternative Transportation**, Low-Emitting & Fuel Efficient Vehicles	1
1	0	0	Credit 4.4	**Alternative Transportation**, Parking Capacity	1
1	0	0	Credit 5.1	**Site Development**, Protect or Restore Habitat	1
1	0	0	Credit 5.2	**Site Development**, Maximize Open Space	1
1	0	0	Credit 6.1	**Stormwater Design**, Quantity Control	1
	1		Credit 6.2	**Stormwater Design**, Quality Control	1
	1		Credit 7.1	**Heat Island Effect**, Non-Roof	1
1	0	0	Credit 7.2	**Heat Island Effect**, Roof	1
	1		Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
2	0	0	Water Efficiency		5 Points
1	0	0	Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1	0	0	Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
			Credit 2	**Innovative Wastewater Technologies**	1
			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

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Figure 63: LEED Checklist from http://www.usgbc.org/showfile.aspx?documentid=3998 1/4

LEED for New Construction v 2.2
Registered Project Checklist

Yes	?	No			
2	0	15	Energy & Atmosphere		17 Points
Yes			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Yes			Prereq 1	**Minimum Energy Performance**	Required
Yes			Prereq 1	**Fundamental Refrigerant Management**	Required

***Note for EAc1:** All LEED for New Construction projects registered after June 26, 2007 are required to achieve at least two (2) points.

Yes	?	No				
2	0	8	Credit 1	**Optimize Energy Performance**		1 to 10
				Credit 1.1	10.5% New Buildings / 3.5% Existing Building Renovations	1
			-->	Credit 1.2	14% New Buildings / 7% Existing Building Renovations	2
				Credit 1.3	17.5% New Buildings / 10.5% Existing Building Renovations	3
				Credit 1.4	21% New Buildings / 14% Existing Building Renovations	4
				Credit 1.5	24.5% New Buildings / 17.5% Existing Building Renovations	5
				Credit 1.6	28% New Buildings / 21% Existing Building Renovations	6
				Credit 1.7	31.5% New Buildings / 24.5% Existing Building Renovations	7
				Credit 1.8	35% New Buildings / 28% Existing Building Renovations	8
				Credit 1.9	38.5% New Buildings / 31.5% Existing Building Renovations	9
				Credit 1.10	42% New Buildings / 35% Existing Building Renovations	10
0	0	3	Credit 2	**On-Site Renewable Energy**		1 to 3
				Credit 2.1	2.5% Renewable Energy	1
				Credit 2.2	7.5% Renewable Energy	2
				Credit 2.3	12.5% Renewable Energy	3
0	0	1	Credit 3	**Enhanced Commissioning**		1
0	0	1	Credit 4	**Enhanced Refrigerant Management**		1
0	0	1	Credit 5	**Measurement & Verification**		1
0	0	1	Credit 6	**Green Power**		1

Figure 64: LEED Checklist from http://www.usgbc.org/showfile.aspx?documentid=3998 2/4

LEED for New Construction v 2.2
Registered Project Checklist

Yes	?	No			
5	0	8	**Materials & Resources**		13 Points
Yes			Prereq 1	**Storage & Collection of Recyclables**	Required
0	0	1	Credit 1.1	**Building Reuse,** Maintain 75% of Existing Walls, Floors & Roof	1
0	0	1	Credit 1.2	**Building Reuse,** Maintain 95% of Existing Walls, Floors & Roof	1
0	0	1	Credit 1.3	**Building Reuse,** Maintain 50% of Interior Non-Structural Elements	1
1	0	0	Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
0	0	1	Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
1	0	0	Credit 3.1	**Materials Reuse**, 5%	1
1	0	0	Credit 3.2	**Materials Reuse**, 10%	1
0	0	1	Credit 4.1	**Recycled Content**, 10% (post-consumer + 1/2 pre-consumer)	1
0	0	1	Credit 4.2	**Recycled Content**, 20% (post-consumer + 1/2 pre-consumer)	1
1	0	0	Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured	1
1	0	0	Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured	1
0	0	1	Credit 6	**Rapidly Renewable Materials**	1
0	0	1	Credit 7	**Certified Wood**	1

Yes	?	No			
10	2	3	**Indoor Environmental Quality**		15 Points
Yes			Prereq 1	**Minimum IAQ Performance**	Required
Yes			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
1	0	0	Credit 1	**Outdoor Air Delivery Monitoring**	1
1	0	0	Credit 2	**Increased Ventilation**	1
	1		Credit 3.1	**Construction IAQ Management Plan,** During Construction	1
	1		Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1	0	0	Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1	0	0	Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1	0	0	Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
0	0	1	Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
0	0	1	Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1	0	0	Credit 6.1	**Controllability of Systems**, Lighting	1
1	0	0	Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
1	0	0	Credit 7.1	**Thermal Comfort,** Design	1
1	0	0	Credit 7.2	**Thermal Comfort,** Verification	1
1	0	0	Credit 8.1	**Daylight & Views,** Daylight 75% of Spaces	1
0	0	1	Credit 8.2	**Daylight & Views,** Views for 90% of Spaces	1

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Figure 65: LEED Checklist from http://www.usgbc.org/showfile.aspx?documentid=3998 3/4

LEED for New Construction v 2.2
Registered Project Checklist

Yes	?	No			
1	0	4	**Innovation & Design Process**		5 Points
0	0	1	Credit 1.1	**Innovation in Design:** Provide Specific Title	1
0	0	1	Credit 1.2	**Innovation in Design:** Provide Specific Title	1
0	0	1	Credit 1.3	**Innovation in Design:** Provide Specific Title	1
0	0	1	Credit 1.4	**Innovation in Design:** Provide Specific Title	1
1	0	0	Credit 2	**LEED® Accredited Professional**	1

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Figure 66: LEED Checklist from http://www.usgbc.org/showfile.aspx?documentid=3998 4/4

Appendix H: References

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