CHRISTIANA HOSPITAL
2010 PROJECT

NEWARK, DE

Technical Report #3

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Table of Contents

Executive Summary

Christiana Hospital project is a 299,000 square foot addition to the Christiana Medical Campus which will expand its cardiovascular program along with adding extra beds, operating rooms, catheterization labs, emergency exam rooms, and an education center in partnership with the Delaware Academy of Medicine. The project is two-phase and is expected to be completed in 2007.

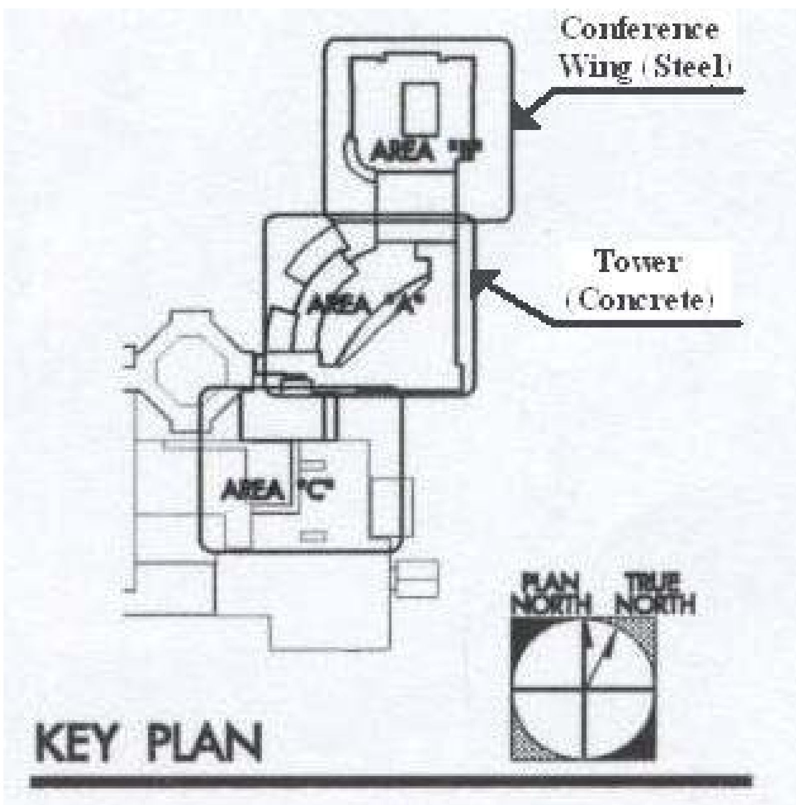
This paper is designed to explain the both the gravity framing system and the lateral systems used in the Christiana Hospital project. These systems are a combination of both concrete and steel construction. In addition to an explanation, spot checks regarding strength, drift, story drift, and overturning will be performed on the lateral systems and gravity systems. To complete this criterion both hand calculations along with a model done in ETABS will be used.

It was discovered that a much more detailed analysis was capable of being performed using ETABS in combination with hand calculations for distributing lateral forces to the lateral system. By using this approach the shear walls and braced frames were able to be reviewed in much finer detail. In one specific case of a shear wall reviewed in Technical Assignment #1 failed when using some general assumptions and distributing forces entirely by hand but when looked at more closely it was observed that it was indeed structurally sound.

Introduction

The Christiana Hospital project is composed of two separate types of framing. The majority of the building is designed using reinforced concrete while the adjacent conference wing is a steel structure. This report is designed to completely analyze this structure's later force resisting system and briefly describe the gravity system. To do this a series of calculations will be performed which will determine both seismic and wind loadings on the building.

When the wind and seismic loads are found the loads will be applied to the building and distributed to each floor based on floor weights. These shear values will then be divided up amongst the shear walls and braced frames using both the direct and torsional shear components based on stiffness. Along the way the story drifts, overturning moment and base shear will be calculated.



Gravity System

Concrete Tower:

The concrete portion of the building stands 8 stories with one level underground and a penthouse roof. The structure contains varying spans which are created using a typical 9½ inch thick two-way flat slab with 5½ inch drops or shear caps. This slab transfers load to 24 inch square columns which in turn take the load down to a 42" thick mat foundation. To prevent rotation and lateral displacement due to wind or seismic loading 12 inch thick shear walls are strategically placed perpendicular to the buildings perimeter.

At the roof level the framing is a combination of concrete shear walls with steel braced frames and columns and metal decking. The decking used is a 1½" deep, wide rib, 20 gage galvanized metal deck. On top of the decking is a one hour fire rated roof construction. This consists of a 45 mill fully adhered roofing membrane on tapered insulation on 5/8" exterior gypsum board. The metal decking is also sprayed with a fireproofing at the soffits.

Steel Conference Wing:

The conference wing is a 3 story structural steel frame with a majority of beams having pinned connections. Here steel girders span between columns in one direction while beams, spanning in the opposite direction, frame into the girders. This steel framework works in composite action with the floor slab placed on top. The slab is constructed of 3¼" lightweight concrete over a 2" deep x 18 gage galvanized composite metal deck. The slab is then reinforced with 6x6-W2.1xW2.1 WWF. The bulk of the spans vary anywhere from 20 to 40 feet, although; running across the middle is a large 63 foot span made possible using W30x90 beams and the composite action. The load in the girders is then transferred to W10 and W12 columns and carried down to 4000 psi concrete spread footings. The roof of this wing is constructed using the same buildup as the tower.

Material Properties	
Applications	**Material**
Steel Columns	ASTM A992, Grade 50
Concrete Columns (Below Third Floor)	4000 psi
Concrete Columns (Above Third Floor)	5000 psi
Footings	4000 psi
Mat Foundation	6000 psi
Grade Beams	4000 psi
Slab-On-Grade	3500 psi

Codes & Loading Cases

Codes Used for Original Design

- International Building Code – 2000
- ASCE 7-98, American Society of Civil Engineers – Minimum Design Loads for Buildings and Other Structures
- ACI 318-99, American Concrete Institute – Building Code Requirements for Structural Concrete
- ACI Manual of Concrete Practice – Parts 1 through 5 – 1997
- Manual of Standard Practice – Concrete Reinforcing Steel Institute
- AISC Manual of Steel Construction – Allowable Stress Design, Ninth Ed., 1989
- AISC Manual of Steel Construction – Volume II Connections – ASD Ninth Ed./LRFD First Ed.
- AISC Detailing for Steel Construction
- American Welding Society – Structural Welding Code ANSI/AWS D1.1-96
- Steel Deck Institute – Design Manual for Floor Decks and Roof Decks
- Drift Criterion – h/400

Codes Used for Thesis Design

- International Building Code – 2003
- ETABS Model – International Building Code – 2000
- ETABS Model – ASCE 7-98
- AISC Manual of Steel Construction – Load and Resistance Factor Design, Third Ed., 2005
- Drift Criterion – h/400

Load Cases – Obtained using IBC 2003

- $1.4D$
- $1.2D + 1.6L + 0.5(L_r \text{ or } S)$
- $1.2D + 1.6(L_r \text{ or } S) + (f_1L \text{ or } 0.8W)$
- $1.2D + 1.6\, f_1L + 0.5(L_r \text{ or } S)$
- $1.2D + 1.0E + f_1L + f_2S$
- $0.9D + (1.0E \text{ or } 1.6W)$

D = Dead Load	L = Live Load
L_r = Roof Live Load	f_1 = 1.0 for live loads in excess of 100 psf and 0.5 for all other loads
S = Snow Load	
W = Wind Load	f_2 = 0.2
E = Seismic or Earthquake Loading	

Gravity Loading

Floor Live Loads	
Occupancy or Use	**Uniform Live Load (psf)**
Assembly Space	100
Typical Hospital Floor	60
Corridor	80
Mechanical Rooms	150
Stair	100
Roof	15
Partition	20

Floor Dead Loads	
Occupancy or Use	**Dead Load**
Reinforced Concrete	150 pcf
Steel Members	Varies
Floor Superimposed	15 psf
Roof Superimposed	15 psf

Snow Loading	
Item	**Value**
Ground Snow Load (P_g)	25 psf
Exposure Category	B
Roof Exposure	Partially Exposed
Exposure Factor (C_e)	1.0
Thermal Factor (C_t)	1.0
Occupancy Category	IV
Importance Factor (I_s)	1.2
Flat-Roof Snow Load $P_f = 0.7C_eC_tI_sP_g$	21 psf

Lateral Force Resisting System:

The lateral forces acting on the building are resisted differently in the two areas of the building. In the concrete portion of the building, lateral forces are resisted by eleven reinforced concrete shear walls which are all 12" thick and have varying lengths. Most of the shear walls run the entire height of the building while three stop at the penthouse floor and continue up to the roof as concentrically braced frames. These shear walls are placed in specific areas to also oppose the torsion effect that the lateral loads place on the building due to its L-shape and can be viewed in figure 5 of Appendix A.

In the conference wing lateral loads are taken care of with the use of concentrically braced frames. These frames are constructed using W shapes and rectangular HSS steel. This framing is field welded to gusset plates. These gusset plates are attached in the fabrication shop, by means of a weld, to select beams. Refer to figure 3 and 4 in Appendix A for examples of the frame and its corresponding connections.

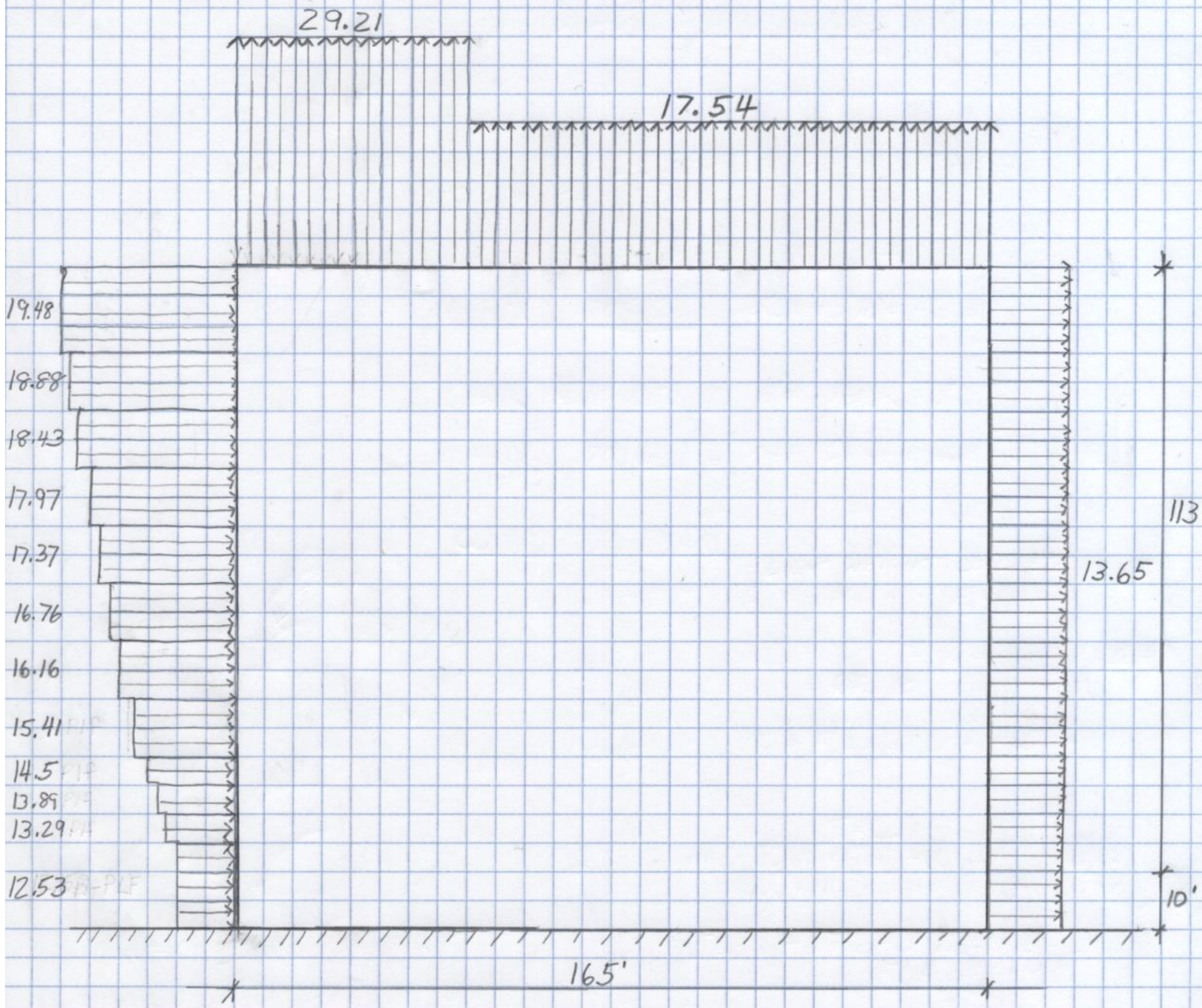
Wind Loading

Assumptions: For the wind loading calculations, only one side of the building was calculated. The side chosen was the plan North face of the building. This was done because it is both the longest and tallest side of the building. By doing this the largest wind loads were found. For simplicity these loads will then be applied to all other faces according to their heights.

Exposure Category	**K_{zt}**	**K_d**	**I**	**V (mph)**	**h (ft)**	**G**	**GC_{pi} (+/-)**
B	1	0.85	1.2	90	114	0.893	0.18

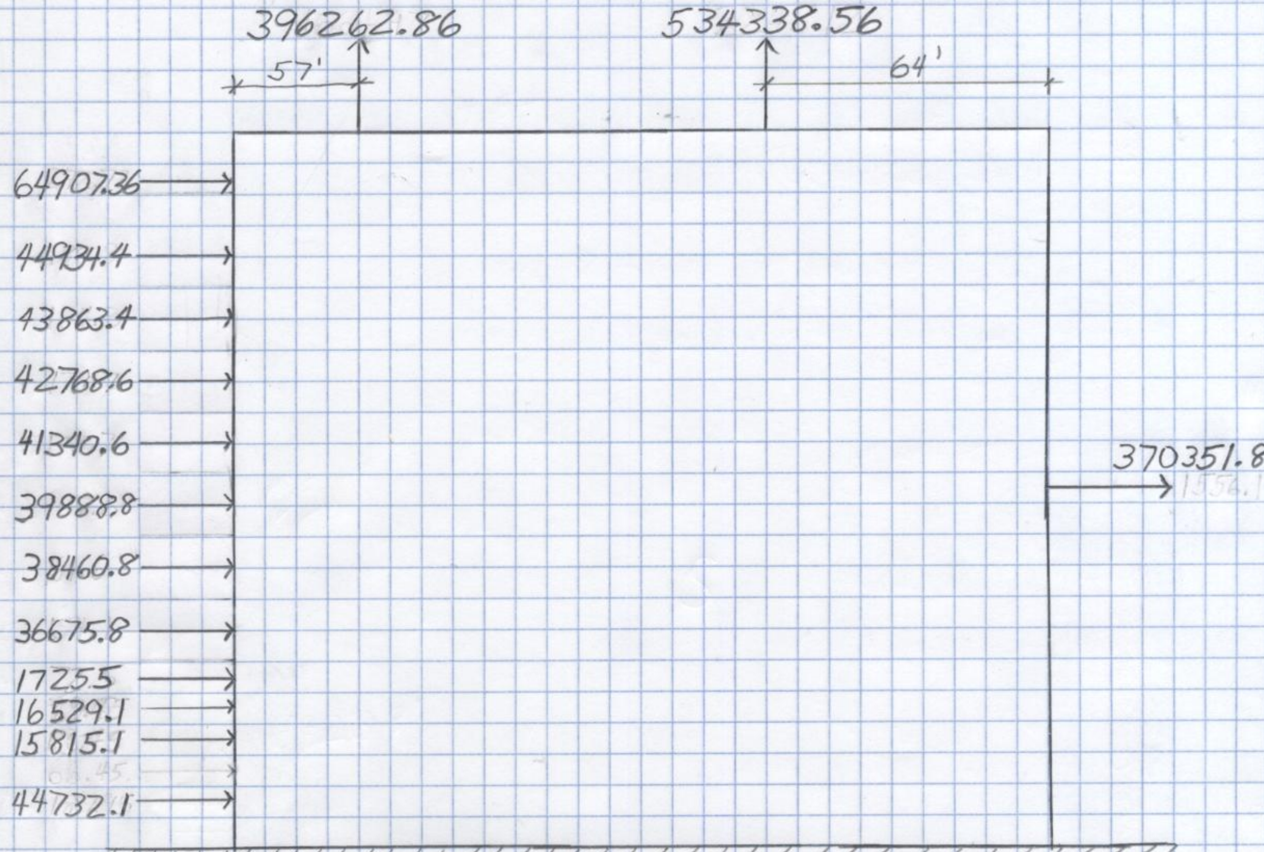
Wind Design Pressures							
			Windward	Leeward	Side Walls	Roof	
						0-57'	>57'
		C_p	0.8	-0.5	-0.7	-1.3	-0.7
h (ft)	K_z	q_z	p (psf)				
0-15	0.57	12.0559	12.53	-13.65	-17.54	-29.21	
20	0.62	13.1134	13.29	-13.65	-17.54	-29.21	
25	0.66	13.9595	13.89	-13.65	-17.54	-29.21	
30	0.7	14.8055	14.5	-13.65	-17.54	-29.21	
40	0.76	16.0745	15.41	-13.65	-17.54	-29.21	
50	0.81	17.1321	16.16	-13.65	-17.54	-29.21	
60	0.85	17.9781	16.76	-13.65	-17.54	-29.21	
70	0.89	18.8241	17.37	-13.65	-17.54		-17.54
80	0.93	19.6702	17.97	-13.65	-17.54		-17.54
90	0.96	20.3047	18.43	-13.65	-17.54		-17.54
100	0.99	20.9392	18.88	-13.65	-17.54		-17.54
114	1.03	21.7852	19.48	-13.65	-17.54		-17.54

WIND PRESSURES (PSF)



B=238'

WIND PRESSURES (lbs.)



BASE SHEAR (V) = 817522.86 lbs = 817.52 kips

OVERTURNING MOMENT (M) = 44.73(7.5') + 15.82(17.5') + 16.53(22.5') + 17.26(27.5') + 36.68(35') + 38.46(45') + 39.89(55') + 41.34(65') + 42.77(75') + 43.86(85') + 44.93(95') + 64.91(107') + 396.26(108') + 534.34(64') + 370.35(57') = 125,606 ft-kips

When computing the wind pressures on the smaller steel portion of the building, the conference wing, the simplified method was used. This was done because this portion of the building met the simplified methods criterion and was less than 60 feet tall.

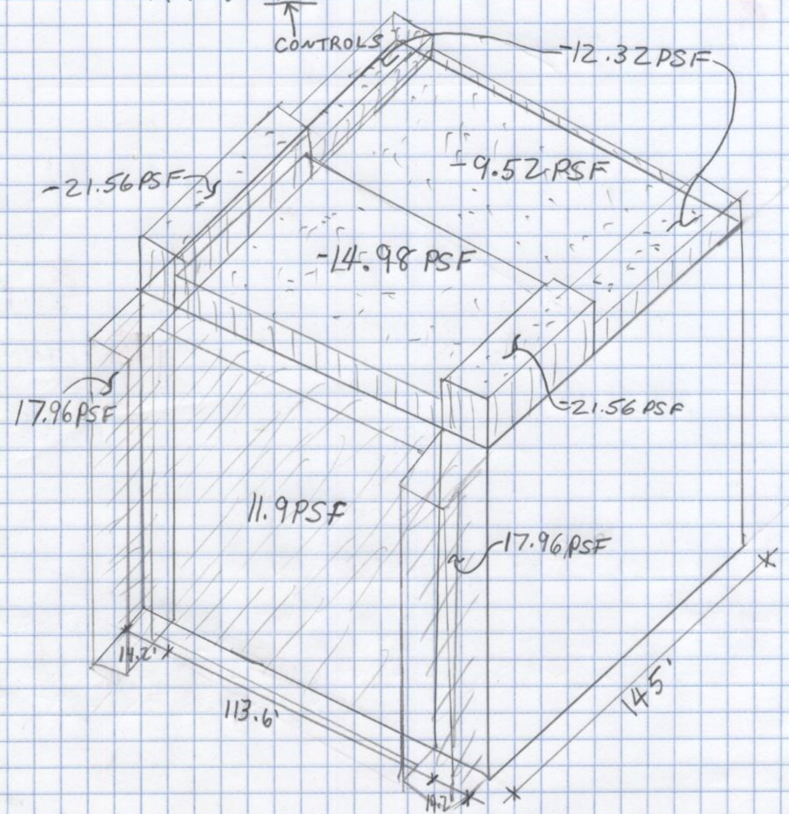
WIND PRESSURES (SIMPLIFIED METHOD)

IMPORTANCE FACTOR (I_w) = 1.15
IMPORTANCE CATEGORY = IV
EXPOSURE CATEGORY = B
HEIGHT + EXPOSURE ADJUSTMENT COEFFICIENT (λ) = 1.22
HEIGHT = 58.3' < 60'
V = 90 mph
ROOF ANGLE = 0-5°

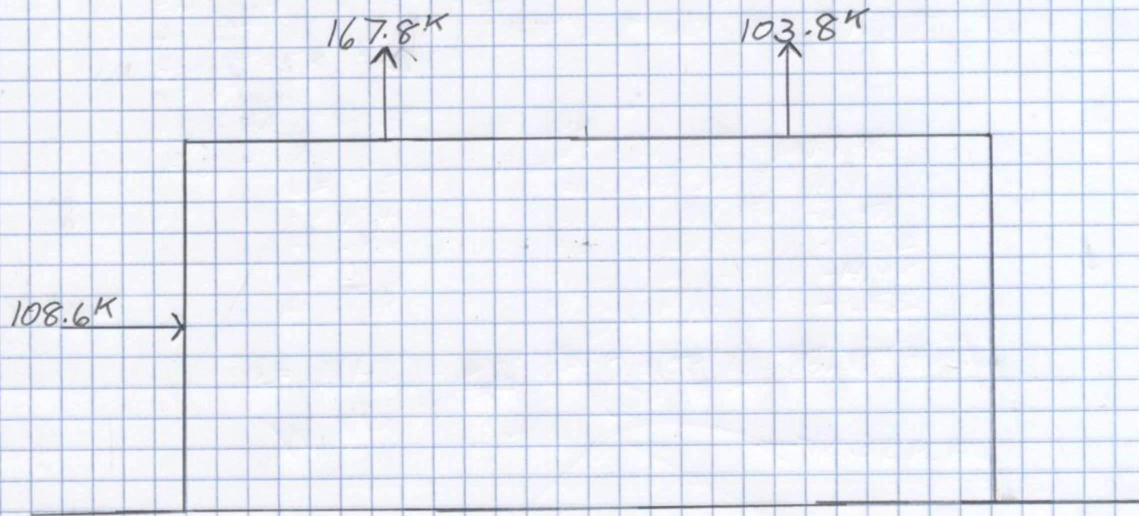
$p_{net} = \lambda I_w p_{net30}$

p_{s30} =	p_{net}
A = 12.8	= 1.22(1.15)(12.8) = 17.96
C = 8.5	= 1.22(1.15)(8.5) = 11.9
E = -15.4	= 1.22(1.15)(-15.4) = -21.56
F = -8.8	= 1.22(1.15)(-8.8) = -12.32
G = -10.7	= 1.22(1.15)(-10.7) = -14.98
H = -6.8	= 1.22(1.15)(-6.8) = -9.52

$a = .1(142') = \underbrace{14.2'}_{\text{CONTROLS}}$ or $0.4(58.3') = 23.32'$



WIND PRESSURES (SIMPLIFIED METHOD) CONT.



$$11.9\,PSF(58.3')(113.6') = 78812.3\,lbs = 78.81\,K$$
$$2(17.96\,PSF)(58.3')(14.2') = 29736.7\,lbs = 29.74\,K$$
$$78.81 + 29.74 = 108.6^K$$

$$-14.98\,PSF(113.6')\left(\frac{145'}{2}\right) = -123375.3\,lbs = -123.4^K$$
$$2(-21.56\,PSF)(14.2')\left(\frac{145'}{2}\right) = -44392\,lbs = -44.4^K$$
$$-123.4 - 44.4 = -167.8^K$$

$$-9.52\,PSF(113.6')\left(\frac{145'}{2}\right) = -78406.7\,lbs = -78.4^K$$
$$2(-12.32\,PSF)(14.2')\left(\frac{145'}{2}\right) = -25366.9\,lbs = -25.4^K$$
$$-78.4 - 25.4 = -103.8^K$$

BASE SHEAR $(V) = 108.6^K$

OVERTURNING MOMENT $(M) = 108.6^K\left(\frac{58.3'}{2}\right) + 167.8^K\left(\frac{72.5'}{2} + 72.5'\right) + 103.8^K\left(\frac{72.5}{2}\right)$
$= 25177\ ft\text{-}K$

Seismic Loading

Seismic Use Group	Importance Factor	Site Class	S_{MS}	S_{M1}	S_{DS}	S_{D1}
III	1.5	D (Stiff Soil)	0.468	0.192	0.312	0.128

Tower (Concrete Area)

$R = 5$ $C_s = 0.0589$ $k = 1.08$

$C_d = 2.5$ $T = 0.651$

Level	Height (ft)	w_x (k)	$h_x^k w_x$	C_{vx}	F_x (k)	M_x (ft-k)
B	0	0	0	0	0	0
1	14	5331	92177.93	0.029637	68.56384	959.8938
2	29.33	5163	198426.3	0.063799	147.5935	4328.919
3	40.66	4858	265679.6	0.085423	197.618	8035.147
4	52	4858	346530.2	0.111418	257.7563	13403.33
5	63.33	4858	428741.7	0.137851	318.9069	20196.38
6	74.66	4858	512144.5	0.164667	380.9436	28441.25
7	87.33	4932	615856.6	0.198013	458.0868	40004.72
8	100	3999	578031.4	0.185851	429.9516	42995.16
R	118	420	72590.85	0.02334	53.99457	6371.359
∑		39277	3110179			

Base Shear: V (kips) = 2313.4153
Overturning Moment: M (ft-kips) = 164736.162

Conference Center (Steel Area)

$R = 3$ | $C_s = 0.156$ | $k = 1$

$C_d = 2$ | $T = 0.355$

Level	**Height (ft)**	**w_x (k)**	**$h_x^k w_x$**	**C_{vx}**	**F_x (k)**	**M_x (ft-k)**
B	0	0	0	0	0	0
1	32	2344	75008	0.44911	1038.99	33247.5
2	29.33	2355	69072.2	0.41357	956.764	28061.9
R	46.33	495	22933.4	0.13731	317.665	14717.4
∑		5194	167014			

Base Shear: V (kips) = 810.264

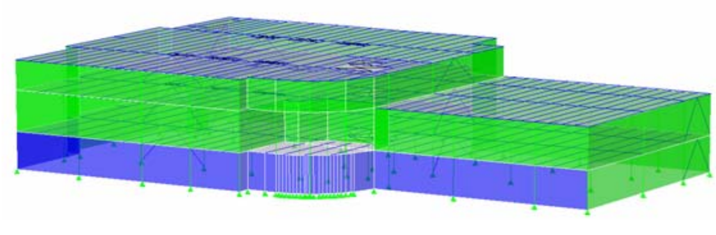
Overturning Moment: M (ft-kips) = 76026.8698

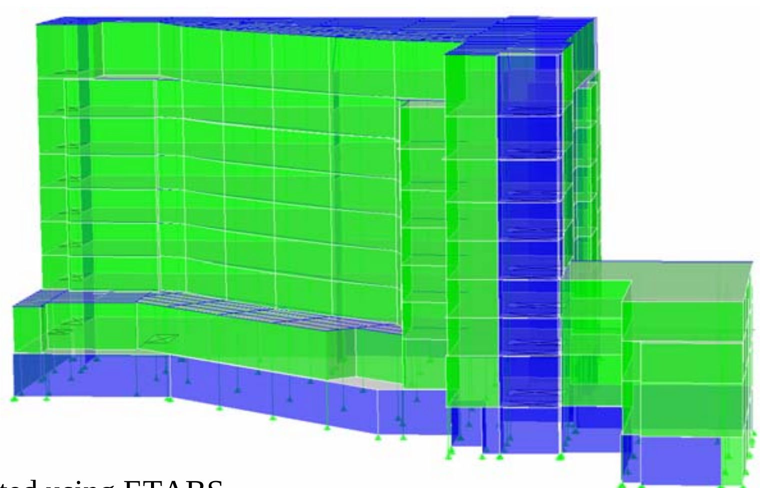
Distribution of Lateral Forces

To distribute forces more accurately a model was created using ETABS. This model was used to find the centers of rigidity (CR) and the centers of mass (CM) for each of the floors of the Christiana Hospital. After obtaining these points, the seismic and wind forces acquired in the previous sections were placed on their respective shear walls or braced frames based on relative stiffness and a torsional analysis. Both the concrete tower and steel conference center were modeled separately.

In this particular building it was observed that seismic had controlled for all but the top floor of the concrete tower. This is believed to have occurred do to the fact that wind loads become more intense as a function of elevation and that the steel framed roof is much lighter than the rest of the building creating lower seismic loads at this level.

In my torsional analysis the shear forces on the walls were obtained using a combination of a direct shear component and a torsional shear component. The torsional shear was derived by the method of applying the seismic load to the center of mass creating a moment about the centers of rigidity of each floor. The load was applied in both the X and Y directions and the largest total load was taken as the design value for each wall. The wind loads were applied to the buildings center of geometry (CG) and then analyzed in the same manner. On the following pages the spreadsheets used for the calculations can be viewed. Data regarding ETABS output such as story drifts and base shear can be viewed in Appendix B.





Models created using ETABS.

Concrete Tower:

Shear Wall #	Length (ft)	Thickness (in)	Orientation (axis)	Distance from Origin (ft)
1	12.67	12	X	169.3
2	19.5	12	Y	236.1
3	12.67	12	X	187.9
4	24.5	12	Y	145.5
5	19.58	12	Y	59
6	20.67	12	Y	1
7	10.75	12	X	185.1
8	20.67	12	Y	1
9	27.17	12	X	155.1
10	19.42	12	X	96.6
11	21.67	12	X	10.1

	Distance from CS (ft)								
	Floor								
Shear Wall #	1	2	3	4	5	6	7	8	Roof
1	27.23375	56.54375	61.716	63.35733333	63.83275	63.80591667	63.4205	62.63475	59.88158333
2	134.7235	145.0349167	143.1249167	140.9261667	139.0455833	137.3014167	135.3405833	133.1169167	127.7203333
3	45.83375	75.14375	80.316	81.95733333	82.43275	82.40591667	82.0205	81.23475	78.48158333
4	44.1235	54.43491667	52.52491667	50.32616667	48.44558333	46.70141667	44.74058333	42.51691667	NA
5	42.3765	32.06508333	33.97508333	36.17383333	38.05441667	39.79858333	41.75941667	43.98308333	49.37966667
6	100.3765	90.06508333	91.97508333	94.17383333	96.05441667	97.79858333	99.75941667	101.9830833	107.3796667
7	43.03375	72.34375	77.516	79.15733333	79.63275	79.60591667	79.2205	78.43475	75.68158333
8	100.3765	90.06508333	91.97508333	94.17383333	96.05441667	97.79858333	99.75941667	101.9830833	107.3796667
9	13.03375	42.34375	47.516	49.15733333	49.63275	49.60591667	49.2205	48.43475	45.68158333
10	45.46625	16.15625	10.984	9.342666667	8.86725	8.894083333	9.2795	10.06525	12.81841667
11	131.96625	102.65625	97.484	95.84266667	95.36725	95.39408333	95.7795	96.56525	99.31841667

	Dist. of CS from CM (ft)		Dist of CS from CG		Force (kips)	Moment (ft-kips)		Controlling Factor	J (in^3)
Floor	X	Y	X	Y		X eccentricty	Y eccentricity		
1	2.718916667	7.125333333	10.6235	14.26625	68.5	186.2457917	488.0853333	Seismic	1308380.654
2	1.34325	16.28216667	20.93491667	15.04375	147.6	198.2637	2403.2478	Seismic	1295513.017
3	3.073083333	25.01391667	19.02491667	20.216	197.7	607.548575	4945.251325	Seismic	1306702.176
4	8.1555	24.11691667	19.02491667	20.216	257.7	2101.67235	6214.929425	Seismic	1313581.108
5	17.9285	17.3225	14.94558333	22.33275	318.9	5717.39865	5524.14525	Seismic	1317765.955
6	19.98583333	17.68583333	13.20141667	22.30591667	380.9	7612.603917	6736.533917	Seismic	1320852.379
7	22.23408333	17.65858333	11.24058333	21.9205	458.1	10185.43358	8089.397025	Seismic	1323978.137
8	23.68808333	17.34016667	9.016916667	21.13475	429.9	10183.50703	7454.53765	Seismic	1327531.737
Roof	13.83058333	30.57208333	3.620333333	18.38158333	64.91	234.9958367	1193.148574	Wind	1305472.076

	Direct Shear Component								
	Floor								
Shear Wall #	1	2	3	4	5	6	7	8	Roof
1	8.317153809	17.92134164	24.00439866	31.28949689	38.72029708	46.24823191	55.62172496	52.1977288	7.881262099
2	12.73112848	27.43232939	36.74370949	47.89506291	59.26944339	70.79250858	85.1405833	79.8994472	12.06390583
3	8.317153809	17.92134164	24.00439866	31.28949689	38.72029708	46.24823191	55.62172496	52.1977288	7.881262099
4	15.9955204	34.46626001	46.16517347	60.17584827	74.46673656	88.94443385	106.9715021	100.3864849	15.15721502
5	12.78335875	27.54487228	36.89445292	48.09155547	59.51260008	71.08293938	85.489878	80.2272398	12.11339878
6	13.49499619	29.07826916	38.94833206	50.76876668	62.82560999	75.04005909	90.2490183	84.69341403	12.78774018
7	7.056780067	15.20555822	20.36679444	26.54791567	32.85265932	39.23981792	47.19286057	44.28773359	6.68694298
8	13.49499619	29.07826916	38.94833206	50.76876668	62.82560999	75.04005909	90.2490183	84.69341403	12.78774018
9	17.83560134	38.43116435	51.47588884	67.09831337	83.03318639	99.17635841	119.2772113	111.9346718	16.90085961
10	12.74815525	27.46901773	36.79285098	47.95911835	59.34871107	70.88718735	85.25445137	80.0063057	12.08004025
11	14.22515573	30.65157643	41.05566842	53.51565884	66.22484907	79.1001725	95.13202683	89.27583134	13.47963297

	Torsional Component Due to X eccentricity of Load (kips)								
	Floor								
Shear Wall #	1	2	3	4	5	6	7	8	Roof
1	0.049117518	0.10963839	0.363562246	1.28434477	3.508975706	4.659255416	6.18165814	6.087576308	0.136572252
2	0.373964453	0.432821282	1.297640079	4.396776271	11.76391835	15.43080493	20.30305367	19.91224907	0.448319094
3	0.082663609	0.145703809	0.473132824	1.661393669	4.531443767	6.017470378	7.994618325	7.895341476	0.178993373
4	0.153882202	0.204100972	0.598323208	1.972731834	5.149682642	6.594397022	8.4326958	7.990616748	NA
5	0.11811094	0.096082985	0.309298355	1.133222889	3.232793381	4.491167496	6.290219756	6.606186251	0.174041743
6	0.295341774	0.284903876	0.883924271	3.114431923	8.614260625	11.65069926	15.86328347	16.17041142	0.399535257
7	0.065852158	0.119017523	0.387439781	1.361468935	3.714157957	4.932110106	6.551560423	6.467991431	0.146450634
8	0.295341774	0.284903876	0.883924271	3.114431923	8.614260625	11.65069926	15.86328347	16.17041142	0.399535257
9	0.050409383	0.17606798	0.600252399	2.13690921	5.850839287	7.767872154	10.28808081	10.0948334	0.223420679
10	0.125687103	0.048016579	0.099177725	0.290287407	0.747133776	0.995472739	1.386348794	1.499430176	0.044810129
11	0.407074728	0.340444038	0.98219257	3.322966148	8.96640523	11.9140468	15.96725217	16.052114	0.387419325

	Torsional Component Due to Y eccentricity of Load (kips)								
	Floor								
Shear Wall #	1	2	3	4	5	6	7	8	Roof
1	0.128719903	0.10963839	0.363562246	1.28434477	3.508975706	4.659255416	6.18165814	6.087576308	0.136572252
2	0.980030545	0.432821282	1.297640079	4.396776271	11.76391835	15.43080493	20.30305367	19.91224907	0.448319094
3	0.216632519	0.145703809	0.473132824	1.661393669	4.531443767	6.017470378	7.994618325	7.895341476	0.178993373
4	0.403271641	0.204100972	0.598323208	1.972731834	5.149682642	6.594397022	8.4326958	7.990616748	NA
5	0.309527625	0.096082985	0.309298355	1.133222889	3.232793381	4.491167496	6.290219756	6.606186251	0.174041743
6	0.773987895	0.284903876	0.883924271	3.114431923	8.614260625	11.65069926	15.86328347	16.17041142	0.399535257
7	0.172575564	0.119017523	0.387439781	1.361468935	3.714157957	4.932110106	6.551560423	6.467991431	0.146450634
8	0.773987895	0.284903876	0.883924271	3.114431923	8.614260625	11.65069926	15.86328347	16.17041142	0.399535257
9	0.13210543	0.17606798	0.600252399	2.13690921	5.850839287	7.767872154	10.28808081	10.0948334	0.223420679
10	0.329382108	0.048016579	0.099177725	0.290287407	0.747133776	0.995472739	1.386348794	1.499430176	0.044810129
11	1.066801041	0.340444038	0.98219257	3.322966148	8.96640523	11.9140468	15.96725217	16.052114	0.387419325

	Total Shear Loaded in X Direction (kips)									
	Floor									
Shear Wall #	1	2	3	4	5	6	7	8	Roof	Total
1	8.366271328	18.03098003	24.3679609	32.57384166	42.22927278	50.90748733	61.8033831	58.28530511	8.017834351	304.5823366
2	0.373964453	0.432821282	1.297640079	4.396776271	11.76391835	15.43080493	20.30305367	19.91224907	0.448319094	74.3595472
3	8.399817418	18.06704545	24.47753148	32.95089055	43.25174084	52.26570229	63.61634329	60.09307027	8.060255472	311.1823971
4	0.153882202	0.204100972	0.598323208	1.972731834	5.149682642	6.594397022	8.4326958	7.990616748	NA	31.09643043
5	0.11811094	0.096082985	0.309298355	1.133222889	3.232793381	4.491167496	6.290219756	6.606186251	0.174041743	22.45112379
6	0.295341774	0.284903876	0.883924271	3.114431923	8.614260625	11.65069926	15.86328347	16.17041142	0.399535257	57.27679188
7	7.122632225	15.32457574	20.75423422	27.9093846	36.56681728	44.17192803	53.74442099	50.75572502	6.833393614	263.1831117
8	0.295341774	0.284903876	0.883924271	3.114431923	8.614260625	11.65069926	15.86328347	16.17041142	0.399535257	57.27679188
9	17.88601072	38.60723233	52.07614123	69.23522258	88.88402568	106.9442306	129.5652921	122.0295052	17.12428029	642.3519407
10	12.87384235	27.51703431	36.89202871	48.24940576	60.09584484	71.88266009	86.64080016	81.50573588	12.12485038	437.7822025
11	14.63223045	30.99202046	42.03786099	56.83862499	75.1912543	91.0142193	111.099279	105.3279453	13.86705229	541.0004871

	Total Shear Loaded in Y Direction (kips)									
	Floor									
Shear Wall #	1	2	3	4	5	6	7	8	Roof	Total
1	0.128719903	0.10963839	0.363562246	1.28434477	3.508975706	4.659255416	6.18165814	6.087576308	0.136572252	22.46030313
2	13.71115902	27.86515068	38.04134957	52.29183918	71.03336173	86.22331351	105.443637	99.81169627	12.51222493	506.9337319
3	0.216632519	0.145703809	0.473132824	1.661393669	4.531443767	6.017470378	7.994618325	7.895341476	0.178993373	29.11473014
4	16.39879204	34.67036098	46.76349667	62.1485801	79.6164192	95.53883088	115.4041979	108.3771017	NA	558.9177795
5	13.09288637	27.64095527	37.20375127	49.22477836	62.74539346	75.57410688	91.78009776	86.83342605	12.28744052	456.3828359
6	14.26898408	29.36317303	39.83225633	53.8831986	71.43987061	86.69075835	106.1123018	100.8638255	13.18727544	515.6416437
7	0.172575564	0.119017523	0.387439781	1.361468935	3.714157957	4.932110106	6.551560423	6.467991431	0.146450634	23.85277235
8	14.26898408	29.36317303	39.83225633	53.8831986	71.43987061	86.69075835	106.1123018	100.8638255	13.18727544	515.6416437
9	0.13210543	0.17606798	0.600252399	2.13690921	5.850839287	7.767872154	10.28808081	10.0948334	0.223420679	37.27038135
10	0.329382108	0.048016579	0.099177725	0.290287407	0.747133776	0.995472739	1.386348794	1.499430176	0.044810129	5.440059434
11	1.066801041	0.340444038	0.98219257	3.322966148	8.96640523	11.9140468	15.96725217	16.052114	0.387419325	58.99964133

	Max Total Shear Loaded (kips)									
	Floor									
Shear Wall #	1	2	3	4	5	6	7	8	Roof	Total
1	8.366271328	18.03098003	24.3679609	32.57384166	42.22927278	50.90748733	61.8033831	58.28530511	8.017834351	304.5823366
2	13.71115902	27.86515068	38.04134957	52.29183918	71.03336173	86.22331351	105.443637	99.81169627	12.51222493	506.9337319
3	8.399817418	18.06704545	24.47753148	32.95089055	43.25174084	52.26570229	63.61634329	60.09307027	8.060255472	311.1823971
4	16.39879204	34.67036098	46.76349667	62.1485801	79.6164192	95.53883088	115.4041979	108.3771017	NA	558.9177795
5	13.09288637	27.64095527	37.20375127	49.22477836	62.74539346	75.57410688	91.78009776	86.83342605	12.28744052	456.3828359
6	14.26898408	29.36317303	39.83225633	53.8831986	71.43987061	86.69075835	106.1123018	100.8638255	13.18727544	515.6416437
7	7.122632225	15.32457574	20.75423422	27.9093846	36.56681728	44.17192803	53.74442099	50.75572502	6.833393614	263.1831117
8	14.26898408	29.36317303	39.83225633	53.8831986	71.43987061	86.69075835	106.1123018	100.8638255	13.18727544	515.6416437
9	17.88601072	38.60723233	52.07614123	69.23522258	88.88402568	106.9442306	129.5652921	122.0295052	17.12428029	642.3519407
10	12.87384235	27.51703431	36.89202871	48.24940576	60.09584484	71.88266009	86.64080016	81.50573588	12.12485038	437.7822025
11	14.63223045	30.99202046	42.03786099	56.83862499	75.1912543	91.0142193	111.099279	105.3279453	13.86705229	541.0004871

Steel Conference Wing:

Braced Frame #	Stiffness	Orientation (axis)	Distance from Origin (ft)
1	79225	X	12.67
2	508929	Y	30.33
3	508929	Y	105.17
4	133809	X	138.17
5	46824	X	224.33

	Distance from CS (ft)		
	Floor		
Braced Frame #	1	2	3
1	36.35983333	92.50016667	83.79558333
2	106.1771667	45.45525	43.222
3	56.14016667	0.000166667	8.704416667
4	1.662833333	62.38475	64.618
5	87.82283333	148.54475	

	Dist. of CS from CM (ft)		Dist of CS from CG		Force (kips)	Moment (ft-kips)		Controlling Factor	J (in^3)
Floor	X	Y	X	Y		X eccentricty	Y eccentricity		
1	57.34708333	48.01658333	24.50716667	78.77016667	1038	59526.2725	49841.2135	Seismic	7807712996
2	6.137583333	35.33216667	36.21475	22.62983333	956	5867.529667	33777.55133	Seismic	3283372616
3	2.258833333	37.99783333	38.448	31.33441667	317	716.0501667	12045.31317	Seismic	2104322994

	Direct Shear Component		
	Floor		
Braced Frame #	1	2	3
1	139.8197581	128.7742666	42.70025368
2	766.092537	705.5727027	233.960823
3	898.1802419	827.2257334	274.2997463
4	201.4231382	185.5110983	61.51361734
5	70.48432483	64.91619898	

	Torsional Component Due to X eccentricity of Load (kips)		
	Floor		
Braced Frame #	1	2	3
1	21.96185294	13.09603676	2.258990611
2	411.9771968	41.34056157	7.485022447
3	217.8290231	0.00015158	1.507397949
4	1.696363402	14.91759755	2.942184386
5	31.35167892	12.42970841	

Torsional Component Due to Y eccentricity of Load (kips)			
	Floor		
Braced Frame #	1	2	3
1	18.38860986	13.09603676	2.258990611
2	344.9475762	41.34056157	7.485022447
3	182.387749	0.00015158	1.507397949
4	1.420361245	14.91759755	2.942184386
5	26.25068994	12.42970841	

	Total Shear Loaded in X Direction (kips)			
	Floor			
Braced Frame #	1	2	3	Total
1	161.781611	141.8703034	44.95924429	348.6111587
2	411.9771968	41.34056157	7.485022447	460.8027808
3	217.8290231	0.00015158	1.507397949	219.3365726
4	203.1195016	200.4286959	64.45580173	468.0039992
5	101.8360037	77.34590739		179.1819111

	Total Shear Loaded in Y Direction (kips)			
	Floor			
Braced Frame #	1	2	3	Total
1	18.38860986	13.09603676	2.258990611	33.74363723
2	1111.040113	746.9132642	241.4458454	2099.399223
3	1080.567991	827.225885	275.8071443	2183.60102
4	1.420361245	14.91759755	2.942184386	19.28014318
5	26.25068994	12.42970841		38.68039835

	Max Total Shear Loaded (kips)			
	Floor			
Braced Frame #	1	2	3	Total
1	161.781611	141.8703034	44.95924429	348.6111587
2	1111.040113	746.9132642	241.4458454	2099.399223
3	1080.567991	827.225885	275.8071443	2183.60102
4	203.1195016	200.4286959	64.45580173	468.0039992
5	101.8360037	77.34590739		179.1819111

Building Drift

To account for drift a criterion of h/400 was used. With the main building being 118' tall and the conference wing being around 46'-4" it allowed for a drift of 3.54 in and 1.39 in respectively. This criterion was met although the results found are under question. Below are the drifts obtained using ETABS compared to the allowable. As you can see these values are extremely small which can be accredited to one of two things. The first being that the concrete and shear wall give the building a very stiff diaphragm and does not allow for much drift. On the other hand, it is possible that an error may have resulted in the running of the ETABS model.

Building Drifts			
Main Tower		Conference Wing	
Allowable (h/400)	Calculated	Allowable (h/400)	Calculated
3.54 in	0.0038 in	1.39 in	0.0017 in

Center of Mass, Rigidity, and Geometry

In the following calculation the Center of Mass (CM) and the Center of Stiffness or Rigidity (CS) were found. This method was used in Technical Assignment #1 and is now being used to check the solution provided by ETABS. The assumptions taken into account for this calculation were as follows:

- The Center of Mass could be considered the same as the Center of Geometry because of the fairly uniform column spacing and the consistency of the slab depth.
- A simplified floor plan would be considered in substitution for every individual floor plan.

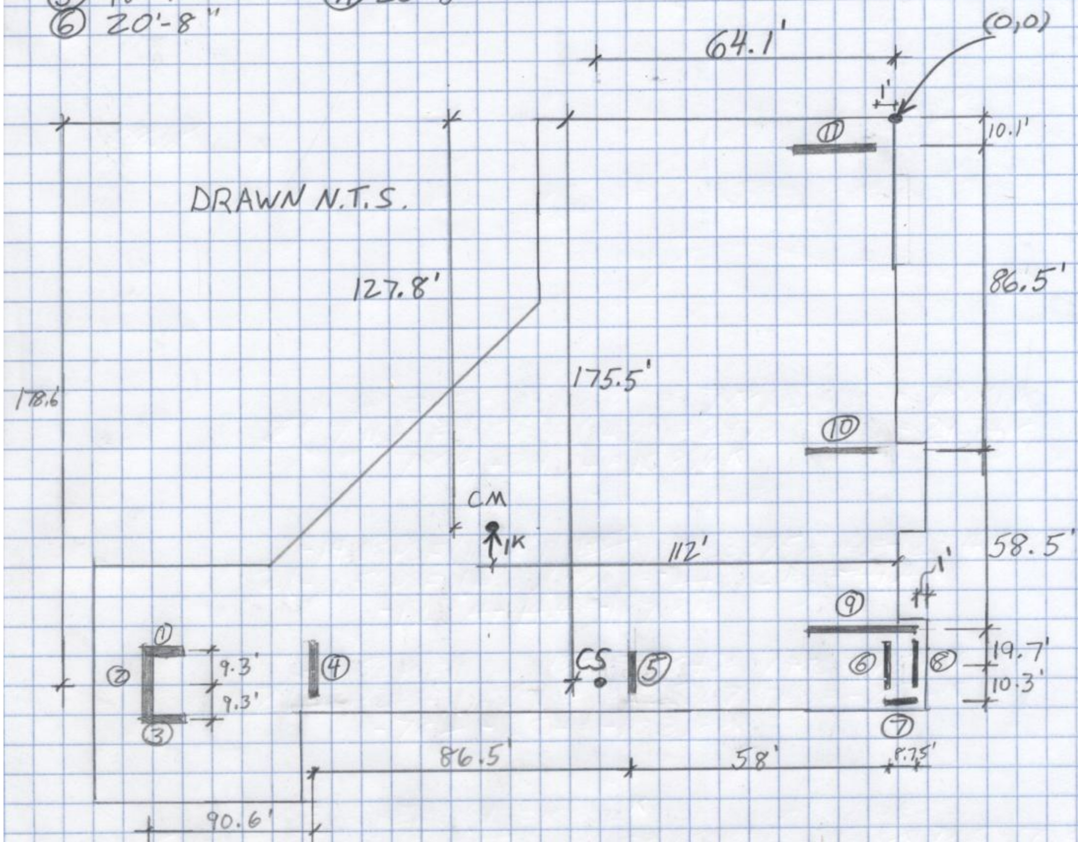
It was concluded that ETABS provided a more accurate solution for these points because much more information was taken into account such as difference in column sizes and rebar, beams and drops, and a more exact floor plan. As you can see this approximation was not entirely far off. Below is a comparison of the CM and CS values for the first floor of the main tower based off the point (0,0) which can be seen in the sketch below and figure 5 of Appendix A.

	ETABS		Hand Calculated	
Coordinate	X	Y	X	Y
CM	98.7'	134.9'	112'	127.8'
CS	101.3'	142.1'	64.1'	175.5'

SHEAR WALL
LATERAL DISTRIBUTION

SIZES (ALL SHEAR WALLS ARE 1' THICK)

1 12'-8"
2 19'-6"
3 12'-8"
4 23'-6"
5 18'-7"
6 20'-8"
7 8'-9"
8 20'-8"
9 26'-2"
10 18'-5"
11 20'-8"



CENTER OF STIFFNES (CS):

$$y = \frac{(20'\text{-}8" + 20'\text{-}8" + 18'\text{-}7" + 23'\text{-}6")\,174.8' + (19'\text{-}6")\,178.6"}{2(20'\text{-}8") + 18'\text{-}7" + 23'\text{-}6" + 19'\text{-}6"} = \frac{18064}{102.9} = 175.5'$$

$$x = \frac{(12'\text{-}8" + 12'\text{-}8")(230.3') + (20'\text{-}8")(11.3') + (18'\text{-}5")(10.2') + (26'\text{-}2")(5.3') + (8'\text{-}9")(-3.4)}{12'\text{-}8" + 12'\text{-}8" + 20'\text{-}8" + 18'\text{-}5" + 26'\text{-}2" + 8'\text{-}9"}$$

$$= \frac{6365}{99.3} = 64.1'$$

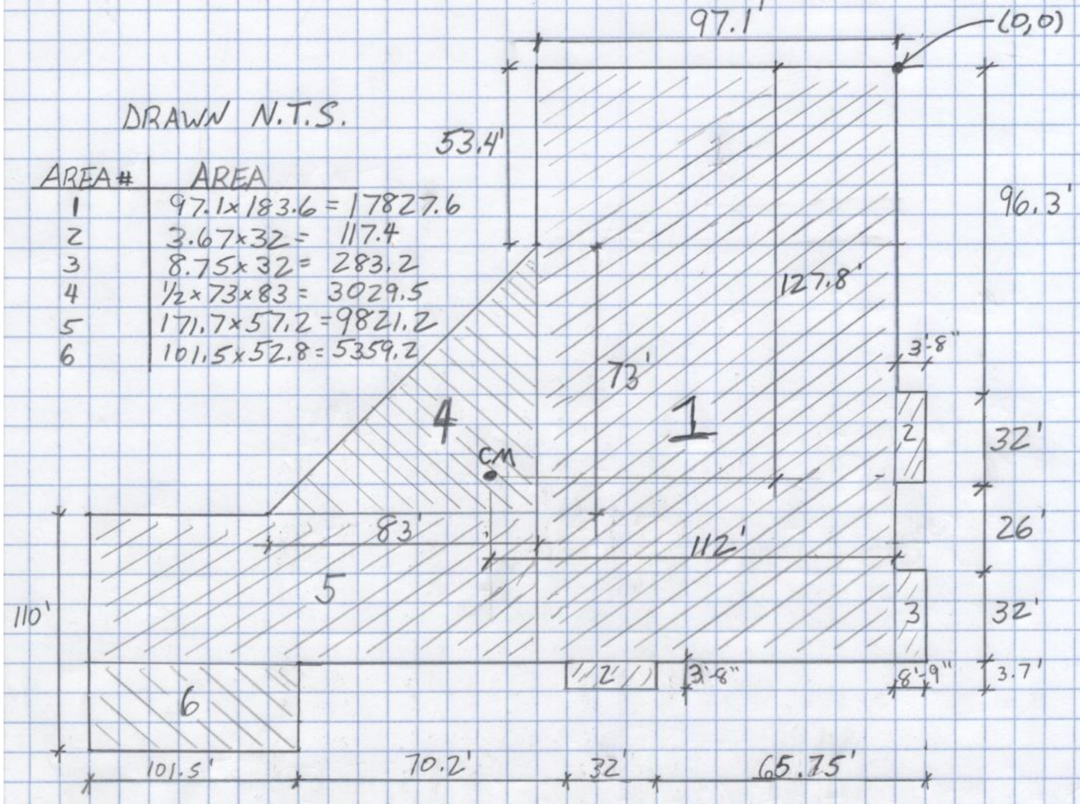
SHEAR WALL LATERAL DISTRIBUTION CONTINUED

ASSUMPTION: COLUMN SPACINGS ARE FAIRLY UNIFORM AND SLAB THICKNESSES ARE THE SAME, THEREFORE TAKE CENTER OF MASS AS THE CENTER OF GEOMETRY.

MUST FIND THIS BECAUSE THE SEISMIC FORCES CONTROL.

DRAWN N.T.S.

AREA #	AREA
1	97.1×183.6 = 17827.6
2	3.67×32 = 117.4
3	8.75×32 = 283.2
4	½×73×83 = 3029.5
5	171.7×57.2 = 9821.2
6	101.5×52.8 = 5359.2



CENTER OF MASS (CM) =

$$y = \frac{17827.6\left(\frac{183.6}{2}\right) + 117.4(64.15) + 283.2(167.6) + 117.4(185.4) + 9821.2(155) + 5359.2(210) + 3029.5(53.4 + \tfrac{2}{3}\times 73)}{17827.6 + 2(117.4) + 283.2 + 3029.5 + 9821.2 + 5359.2}$$

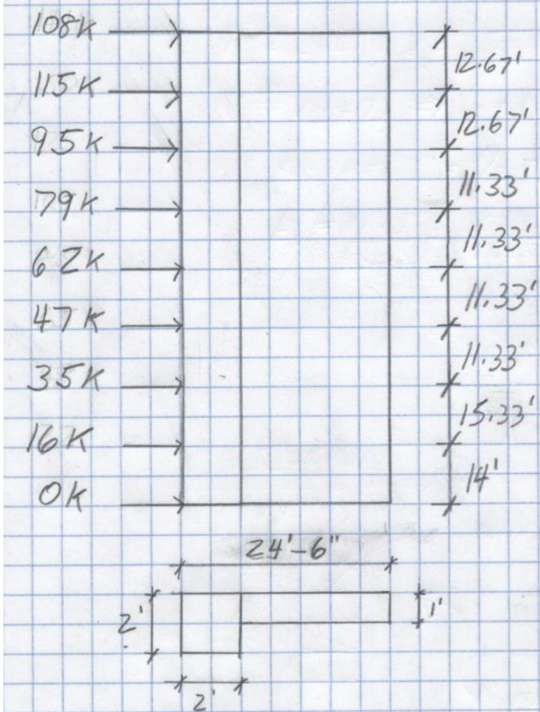
$$= \frac{4670264}{36555.5} = 127.8'$$

$$x = \frac{17827.6(48.6) + 3029.5(124.8) + 9821.2(174.9) + 5359.2(210) + 117.4(73) - 117.4(1.8) - 283.2(4.4)}{36555.5}$$

$$= 4094776/36555.5 = 112'$$

SHEAR WALL CHECK

SHEAR WALL #4



$M_u = 108(100') + 115(87.3') + 95(75') + 79(63') + 62(52') + 47(41') + 35(29.3') + 16(14') = 39342^{'k}$

$V_u = 559^{K}$

$P_u = 1873^{K}$ ← FOUND USING TRIB AREA AND COL. LOAD TAKE DOWN

$C_v = \frac{P_u}{2} + \frac{M_u}{d} = \frac{1873}{2} + \frac{39342}{24.5} = 2542 = P_{UDE}$

BOUNDARY CHECK

$A_g = (1')(22.5) = 22.5\ ft^2$

$I_g = \frac{(1')(22.5)^3}{12} = 949\ ft^4$

$f_c = \frac{P_u}{A_g} + \frac{M_u + \frac{h_w}{2}}{I_g} = \frac{1873}{22.5} + \frac{39342 + \left(\frac{22.5}{2}\right)}{949} = 124.7 k_{sf}$

$= 124.7\ ksf = 0.87\ ksi$

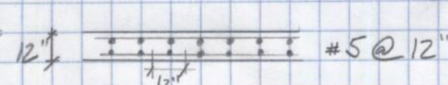
$0.2(f'_c) = 0.2(5\ ksi) = 1$

$f_c = 0.87\ ksi < 1 \therefore$ No BOUNDARY ELEMENT REQUIRED

LONG + TRANSVERSE REINFORCEMENT

$2A_{cv}\sqrt{f'_c} = 2(12 \times 24.5 \times 12)\sqrt{5000}/1000 = 499^K < 559^K \therefore$ NEED TWO CURTAINS

$A_{cv} = (12")(12") = 144\ in^2/ft$



$A_{s(req'd)} = (0.0025)(144) = 0.36\ in^2/ft$

$A_{se} = 2(0.31) = 0.62\ in^2/s$

$\frac{0.36}{12"} = \frac{0.62}{S} \Rightarrow S_{req} = 20.6" > 12" \therefore OK$

SHEAR WALL CHECK CONTINUED

CHECK SHEAR

$V_n = A_{cv}(\alpha_c\sqrt{f'_c} + \rho_t f_y)$

$\frac{h_w}{\ell_w} = \frac{100'}{23.5'} = 4.26 > 2 \therefore \alpha_c = 2.0$

$A_{cv} = (12)(24.5 \times 12) = 3528 \text{ in}^2$

$\rho_t = \frac{2(0.31)}{(12)(12)} = 0.0043$

$V_n = 3528(2\sqrt{5000} + 0.0043(60000))/1000 = 1409^k$

$\phi V_n = 1409(.6) = 845 > V_u = 557^k \therefore OK$

MOMENT FOUND IN TECH. REPORT #1 FOR THIS SHEAR WALL WAS 51984 ft-K ENDED UP BEING OVERCONSERVATIVE FOR DESIGN. THIS IS THE REASON THE WALL FAILED IN TECH #1.

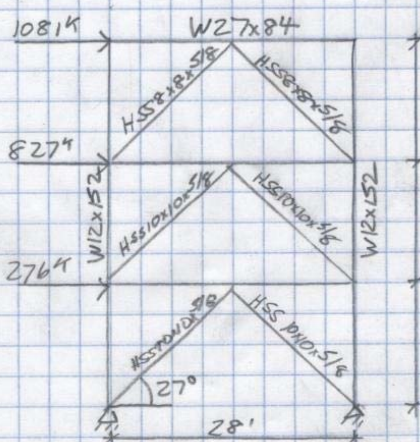
BRACED FRAME CHECK

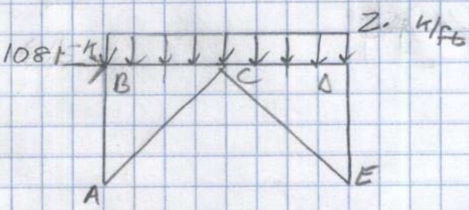
BRACED FRAME #3

TRIB AREA = 1454□
TRIB WIDTH = 51.9'
USE LOAD CASE WHICH INCLUDE SEISMIC

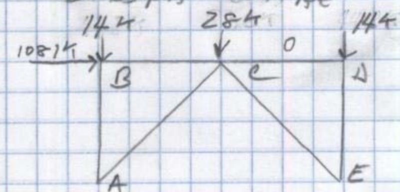
$$1.2D + 1.0E + 1.0L + .2S$$

LOADS
$D = 15\,psf$
$L = 100\,psf$
$S = 21\,psf$
$L_r = 15\,psf$

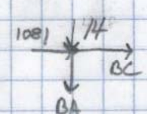




$1.2(15\times51.9+84)+1.0(15\times51.9)+0.2(21\times51.9)$
$= 2031\,plf = (2.1\,k/ft)$

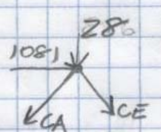


PIN B



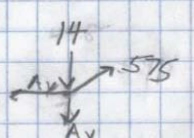
$BC = -1081^k$
$BA = -14^k$

PIN C

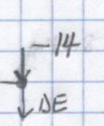


$\uparrow \Sigma F_y = 0 = -CA\sin 27° - CE\sin 27° - 28$
$CA = (-0.454CE - 28)/0.454 = -CE - 61.7^k$
$\rightarrow \Sigma F_x = 0 = 1081 + CE\cos 27° - CA\cos 27°$
$= 1081 + CE\cos 27° + (CE + 61.7)\cos 27°$
$CE = -637^k$
$CA = 575.3$

PIN A

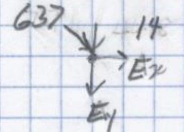


$A_y = (\sin 27°)575 - 14 = 247^k$
$A_x = (\cos 27°)575 = 512^k$



PIN D

$D = -14^k$



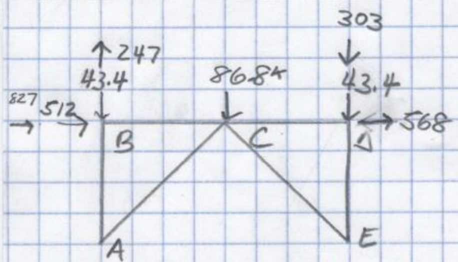
PIN E

$\uparrow \Sigma F_y = 0 = -E_y - 14 - 637\sin 27°$

$E_y = -303^k$

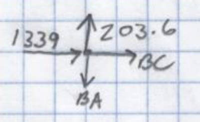
$\xrightarrow{+} \Sigma F_x = E_x + 637\cos 27°$

$E_x = -568^k$



$1.2(15 \times 51.9 + 84) + 1.0(100 \times 51.9) = 6225 = 6.2^k/ft$

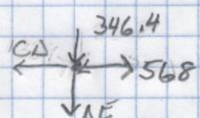
PIN B



$BC = -1339$

$BA = -203$

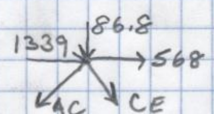
PIN D



$DE = -346.4^k$

$CD = 568^k$

PIN C



$\uparrow \Sigma F_y = 0 = -86.8 - (\sin 27)CE - AC\sin 27°$

$AC = -191.2 - CE$

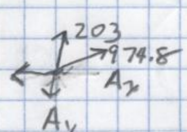
$\xrightarrow{+} \Sigma F_x = 0 = 1339 + 568 + CE\cos 27° - AC\cos 27°$

$1908 + CE\cos 27° + (191.2 + CE)\cos 27°$

$CE = -1166^k$

$AC = 974.8^k$

PIN A



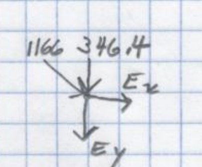
$\uparrow \Sigma F_y = 0 = 203 + 974.8\sin 27° - A_y$

$A_y = 646^k$

$\xrightarrow{+} \Sigma F_x = 0 = -A_x + (\cos 27°)974.8$

$A_x = 869^k$

PIN E

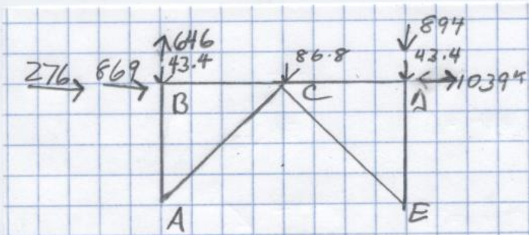


$\uparrow \Sigma F_y = 0 = -346.4 - E_y - 1166\sin 27°$

$E_y = -894^k$

$\xrightarrow{+} \Sigma F_x = 0 = E_x + (\cos 27°)1166$

$E_x = -1039^k$



PIN B

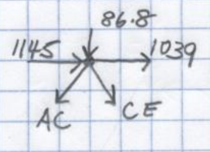
$BA = 602.6^k$

$BC = -1145^k$

PIN D

$DE = -937.4^k$

$CD = 1039^k$



PIN C

$\overset{+}{\uparrow} \Sigma F_y = 0 = -86.8 - CE\sin 27 - AC\sin 27$

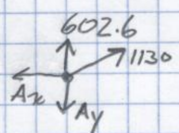
$AC = -191.2 - CE$

$\overset{+}{\rightarrow} \Sigma F_x = 0 = -1145 + 1039 + CE\cos 27^\circ - AC\cos 27^\circ$

$2184 + CE\cos 27^\circ + (191.2 + CE)\cos 27^\circ$

$CE = -1321^k$

$AC = 1130^k$



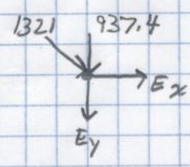
PIN A

$\overset{+}{\uparrow} \Sigma F_y = 0 = 602.6 + 1130\sin 27^\circ - A_y$

$A_y = 1116^k$

$\overset{+}{\rightarrow} \Sigma F_x = 0 = -A_x + (\cos 27^\circ)1130$

$A_x = 1007^k$



PIN E

$\overset{+}{\uparrow} \Sigma F_y = 0 = -937.4 - E_y - 1321\sin 27^\circ$

$E_y = -1537^k$

$\overset{+}{\rightarrow} \Sigma F_x = 0 = E_x + 1321\cos 27^\circ$

$E_x = -1177^k$

CHECK HSS 10x10x5/8

$$A_g = \frac{P_u}{\phi F_y} = \frac{1130}{.9(50)} = 25 \text{ in}^2$$

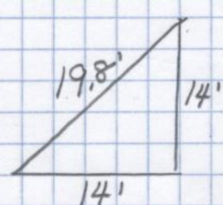
$$A_e = \frac{P_u}{\phi F_u} = \frac{1130}{.75(65)} = 23 \text{ in}^2$$

$$A_g = \frac{23}{.75} = 30 \text{ in}^2$$

NEED AROUND 20 in^2 BUT HSS 10x10x5/8 ONLY HAS AN AREA OF 21 in^2 WHICH DOES NOT SATISFY THIS CRITERIA.

COMPRESSION HSS 10x10x5/8

FORCE = 1321^k



L = 19.8'

AT 19.8' A HSS 10x10x5/8 CAN HOLD ABOUT 636^k WHICH IS MUCH LESS THAN THE CURRENT LOAD. A MORE IN DEPTH ANALYSIS IN THE FUTURE WILL LOOK AT THESE LOADS AND FIND WHERE THE PROBLEM LIES.

Conclusion

This paper has been designed to take a deeper look into the lateral resisting system of the Christiana Hospital. It was observed, with the use of hand calculations along with the help of ETABS, that the shear walls have be properly designed. Further analysis regarding the braced frames is a must. In the calculations above it seemed that they may have been undersized. While this is most likely not the case further review will follow. In conclusion I feel this analysis has shown that the lateral system of the Christiana hospital has been adequately designed and constructed.

Appendix A

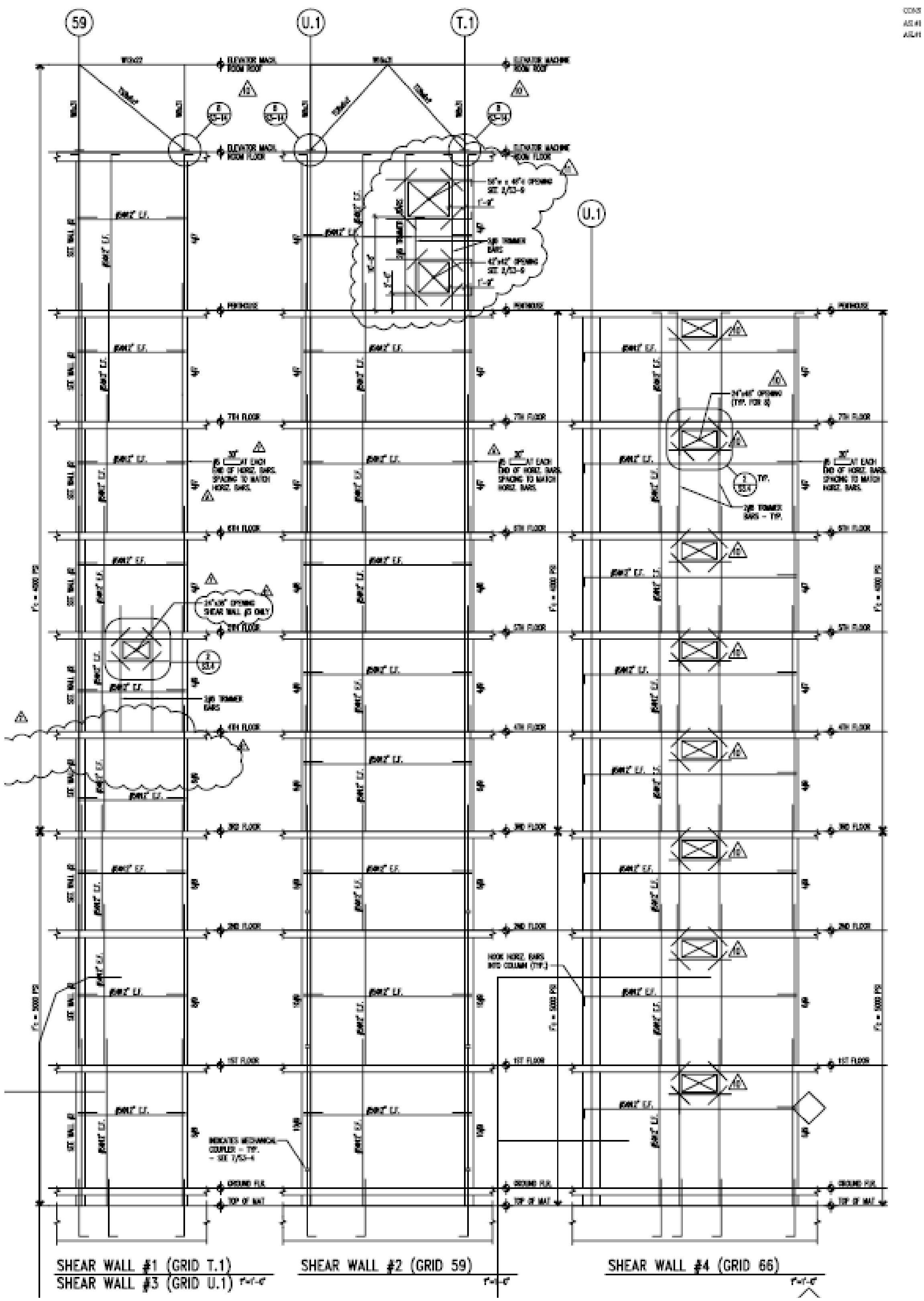


Figure 1

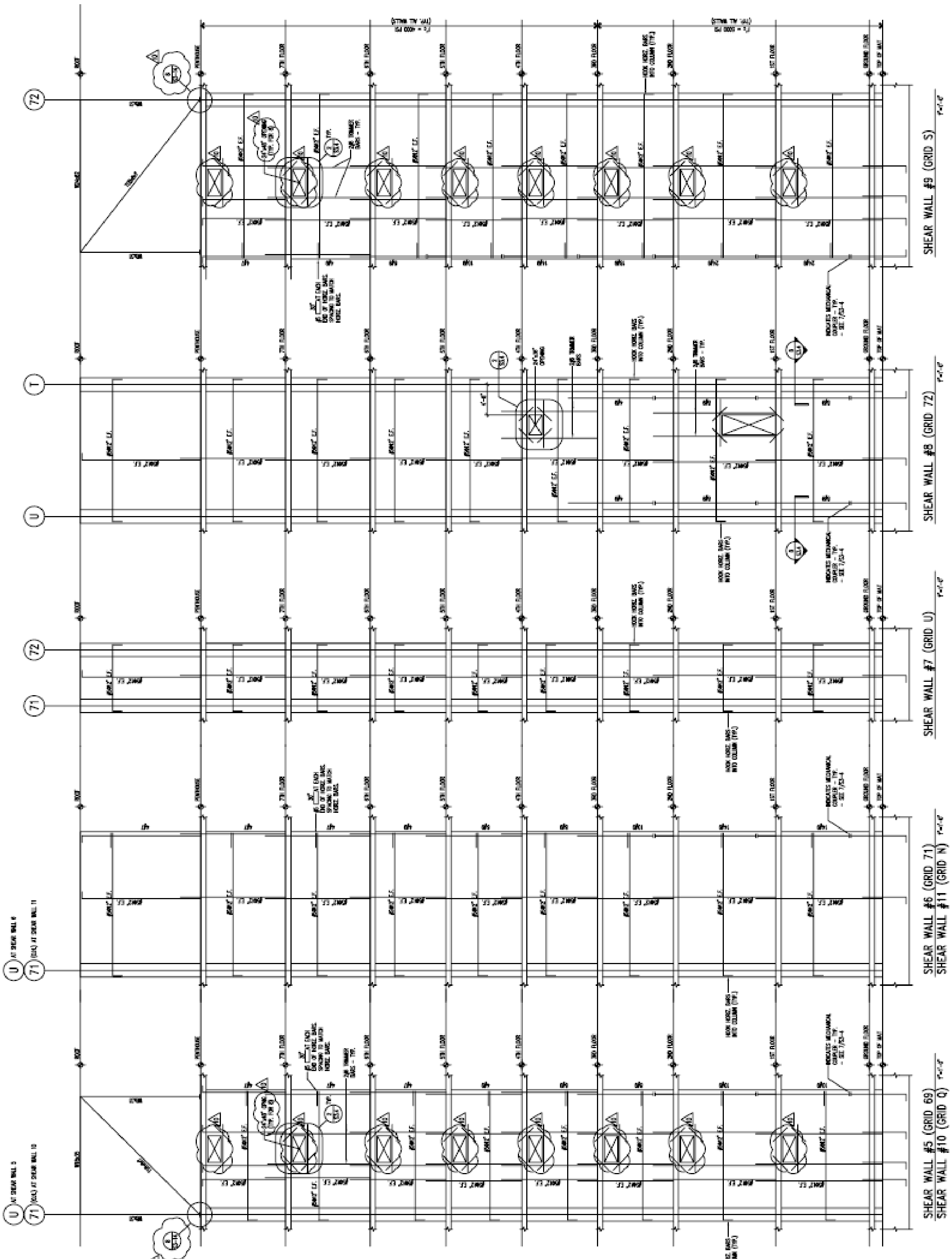

SHEAR WALL #9 (GRID S)
SHEAR WALL #8 (GRID 72)
SHEAR WALL #7 (GRID U)
SHEAR WALL #6 (GRID 71)
SHEAR WALL #11 (GRID N)
SHEAR WALL #5 (GRID 69)
SHEAR WALL #10 (GRID Q)

Figure 2

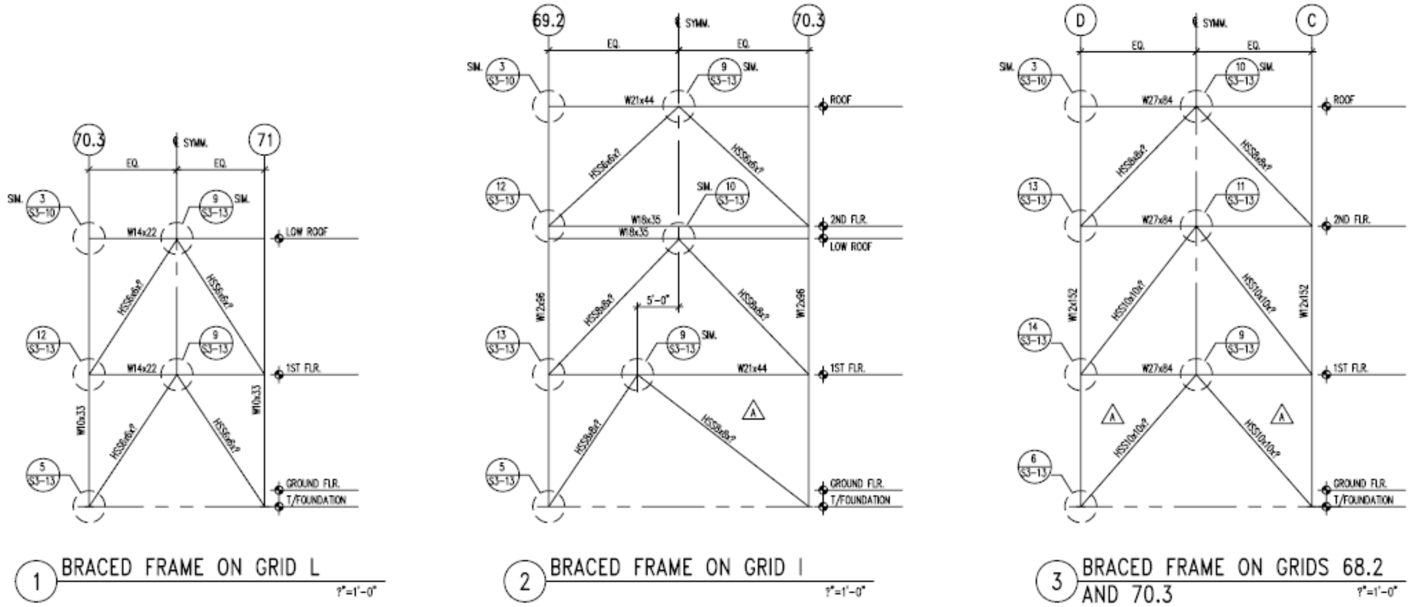


Figure 3

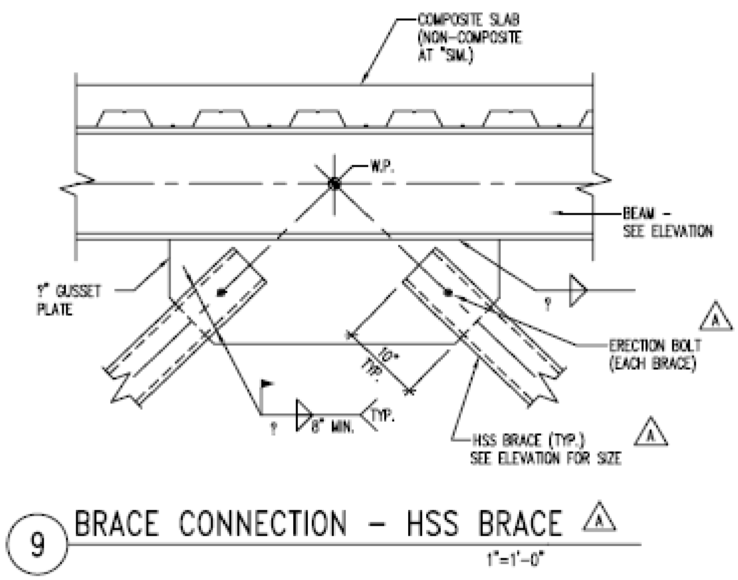
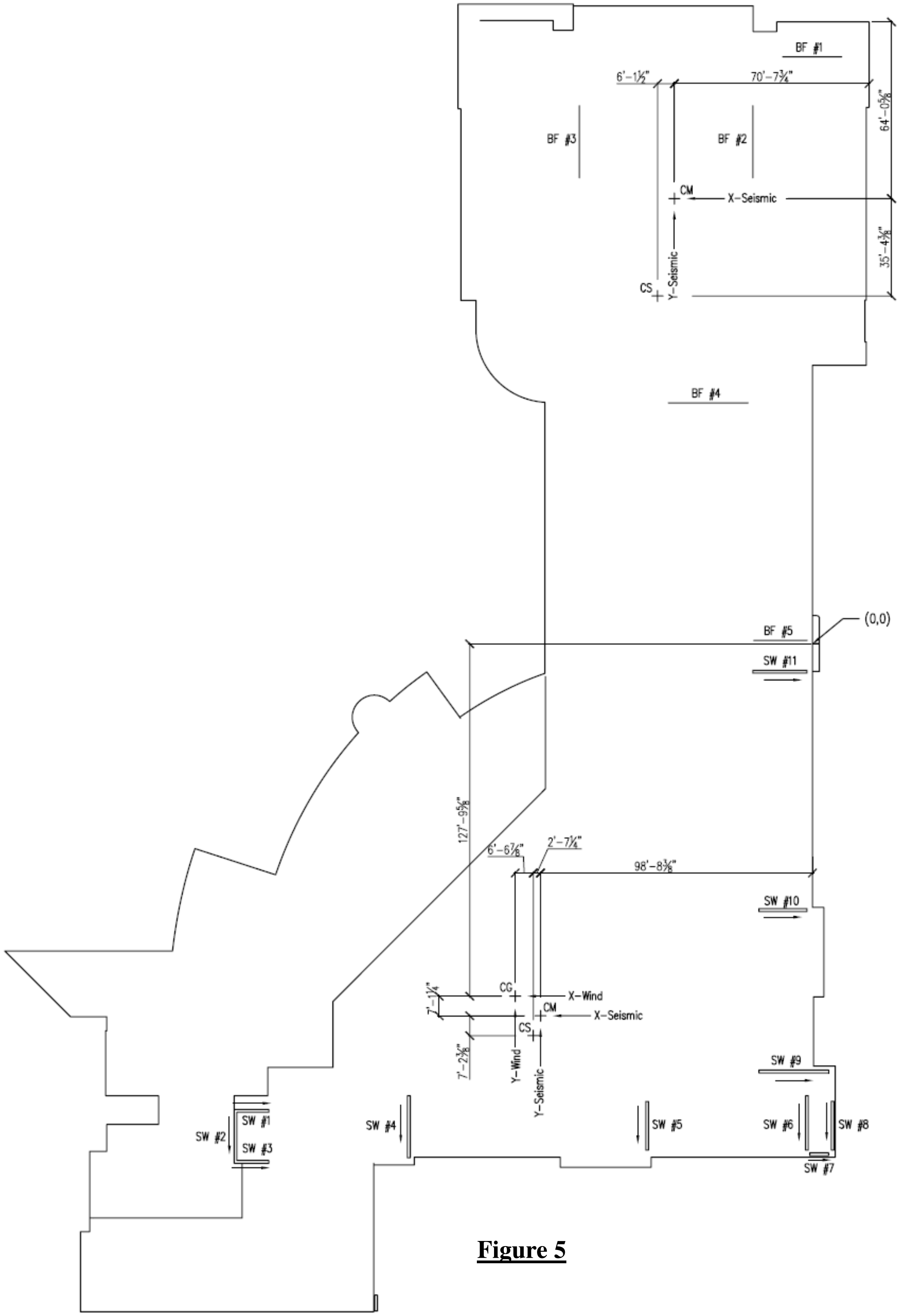


Figure 4



BF #1
6'-1½"
70'-7¾"
64'-0⅝"
BF #3
BF #2
CM
X-Seismic
35'-4⅜"
CS
Y-Seismic
BF #4
(0,0)
BF #5
SW #11
127'-9⅝"
6'-6⅞"
2'-7¼"
98'-8⅜"
SW #10
CG
X-Wind
7'-1¼"
CM
X-Seismic
CS
7'-2⅞"
Y-Wind
Y-Seismic
SW #9
SW #1
SW #2
SW #3
SW #4
SW #5
SW #6
SW #8
SW #7

Figure 5

Appendix B

Concrete Tower

Story	Load	Loc	VX (kips)	VY (kips)	T	MX (ft-kips)	MY (ft-kips)
FIRST FLOOR	1.2D + 1.6W + 0.5L + 0.5L_R	Top	-954.96	-1461.9	-9357121	72496427.13	-152965236.6
FIRST FLOOR	1.2D + 1.6W + 0.5L + 0.5L_R	Bottom	-954.96	-1461.9	-9357121	87717824.33	-187895696.9
FIRST FLOOR	1.2D + 1.6W + 1.0L + 0.5L_R	Top	-954.96	-1461.9	-9357121	65384981.42	-140024551.9
FIRST FLOOR	1.2D + 1.6W + 1.0L + 0.5L_R	Bottom	-954.96	-1461.9	-9357121	80606378.62	-174955012.2
FIRST FLOOR	1.2D + 1.6W + 0.5L + 0.5S	Top	-954.96	-1461.9	-9357121	72945935.73	-153931427.7
FIRST FLOOR	1.2D + 1.6W + 0.5L + 0.5S	Bottom	-954.96	-1461.9	-9357121	88167332.93	-188861887.9
FIRST FLOOR	1.2D + 1.6W + 1.0L + 0.5S	Top	-954.96	-1461.9	-9357121	65834490.02	-140990743
FIRST FLOOR	1.2D + 1.6W + 1.0L + 0.5S	Bottom	-954.96	-1461.9	-9357121	81055887.22	-175921203.3
FIRST FLOOR	0.9D + 1.6W	Top	-954.96	-1461.9	-9357121	48678530.73	-103972792
FIRST FLOOR	0.9D + 1.6W	Bottom	-954.96	-1461.9	-9357121	60155978.44	-130210745.7

Story	Item	Load	Point	X	Y	Z	DriftX (in)	DriftY (in)
ROOF	Max Drift Y	1.2D + 1.6W + 0.5L + 0.5S	73	11157.036	3652.9	1416		0.000543
ROOF	Max Drift X	0.9D + 1.6W	83	8706.02	3612.9	1416	0.000597	
EIGHTH STORY	Max Drift X	0.9D + 1.6W	180	10349.036	3598.9	1200	0.000541	
EIGHTH STORY	Max Drift Y	12D16W05L05S	184	11163.036	4012.9	1200		0.000521
SEVENTH STORY	Max Drift X	1.2D + 1.6W + 1.0L + 0.5L_R	180	10349.036	3598.9	1048	0.000516	
SEVENTH STORY	Max Drift Y	1.2D + 1.6W + 0.5L + 0.5S	184	11163.036	4012.9	1048		0.00051
SEVENTH STORY	Max Drift X	0.9D + 1.6W	180	10349.036	3598.9	1048	0.000522	
SEVENTH STORY	Max Drift Y	0.9D + 1.6W	184	11163.036	4012.9	1048		0.000482
SIXTH STORY	Max Drift Y	1.2D + 1.6W + 0.5L + 0.5S	184	11163.036	4012.9	896		0.000492
SIXTH STORY	Max Drift X	0.9D + 1.6W	180	10349.036	3598.9	896	0.000497	
FIFTH STORY	Max Drift Y	1.2D + 1.6W + 0.5L + 0.5S	184	11163.036	4012.9	760		0.000466
FIFTH STORY	Max Drift X	0.9D + 1.0E	180	10349.036	3598.9	760	0.000462	
FOURTH STORY	Max Drift Y	1.2D + 1.6W + 0.5L + 0.5S	184	11163.036	4012.9	624		0.000423
FOURTH STORY	Max Drift X	1.2D + 1.0E + 0.5L + 0.2S	303	8250.036	2947.116	624	0.000473	
FOURTH STORY	Max Drift X	1.2D + 1.0E + 1L + 0.2S	303	8250.036	2947.116	624	0.000473	
THIRD STORY	Max Drift Y	1.2D + 1.6W + 0.5L + 0.5S	184	11163.036	4012.9	488		0.000388
THIRD STORY	Max Drift X	1.2D + 1.0E + 1L + 0.2S	1036	9158.031	2947.116	488	0.000394	
SECOND STORY	Max Drift X	0.9D + 1.6W	54	10697.036	5848.9	352	0.000254	
SECOND STORY	Max Drift Y	0.9D + 1.6W	967	7895.427	2947.116	352		0.000328
FIRST FLOOR	Max Drift X	0.9D + 1.6W	651	9904.994	5851.144	168	0.000023	
FIRST FLOOR	Max Drift Y	0.9D + 1.6W	163	7895.427	3025.116	168		0.000038

Steel Conference Wing

Story	Load Case	Loc	VX (kips)	VY (kips)	T	MX (ft-kips)	MY (ft-kips)
FIRST FLOOR	1.2D + 1.0E + 1.0L + 0.2S	Bottom	-597.62	0	4550153	83356682	-115515072
FIRST FLOOR	0.9D + 1.0E	Bottom	-597.62	0	4550157	38605960	-53444153.9

Story	Item	Load	Point	X	Y	Z	DriftX (in)
THIRD STORY	Max Drift X	0.9D + 1.0E	1628	10802.035	8628.918	488	0.000574
SECOND STORY	Max Drift X	1.2D + 1.0E 1.0L + 0.2S	1628	10802.035	8628.918	352	0.000969
SECOND STORY	Max Drift X	0.9D + 1.0E	1628	10802.035	8628.918	352	0.000969
FIRST FLOOR	Max Drift X	1.2D + 1.0E 1.0L + 0.2S	1662	11057.036	5876.9	168	0.000108