GOUVERNEUR HEALTHCARE SERVICES

NEW YORK, NY

TECHNICAL REPORT 3

Scott Rabold

Structural

Consultant: Dr. Ali Memari

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EXECUTIVE SUMMARY

A full lateral analysis was performed for the Gouverneur Healthcare Services Facility. Using a SAP model and an ETABS model, the relative stiffness was determined. As expected, the braced frames throughout the building had a higher relative stiffness than the moment frames throughout the building, and therefore resisted a higher direct shear.

Due to the irregular building plan and irregular layout of the column grids, torsion is a concern for the building. In some cases, the torsional shear was large when compared to the direct shear already distributed to a frame. The column grid for the upper portion of the building is offset from the lower portion. This causes gridlines and frames to not line up, and in some cases, creates skewed moment frames. This can be seen in fig. 4. This irregular pattern and layout of lateral frames creates a lack of symmetry that contributes to the eccentricity between the center of rigidity and the center of mass.

After conducting a drift analysis and spot checks of selected members, it was determined that drift constraints controlled the design of lateral members. Members had significant reserve strength capacity while drift values were determined to be right at, or just exceeding allowable values. Calculated drifts were anticipated to be slightly higher than actual building drifts due to conservative assumptions used in Technical Report 1 when calculating lateral loads. These higher values may account for the fact that the drifts exceeded the allowable values.

INTRODUCTION

The Gouverneur Health Services Modernization Project is an addition to an existing building and a renovation of the 35-year-old healthcare facility. The existing building is a 2-way flat plate floor construction with square and rectangular columns. An existing conditions survey revealed no shear-walls, so it can be assumed that lateral loads are resisting by the continuous frame construction of the flat plate slab. For the purpose of this technical report, and subsequent thesis project, only the addition will be investigated in further detail. Furthermore, portions of the addition that wrap around the existing building and tie into the existing structure will be neglected for this technical report.

The addition that will be the main focus of this thesis project consists of two distinct portions. The first portion is the 5-story ambulatory care facility. This facility is approximately 115'x175' in plan, and sits on the western side of the site, connected to the existing building. The second portion is an expansion to the floor plan to the existing building in floors 6 through 13. It is roughly square, 50'x60' in plan, and extends upwards from the ambulatory center on the western side of the existing building. The portions may be referred to as lower addition and upper addition, or ambulatory addition and tower addition, respectively. See Figures below.

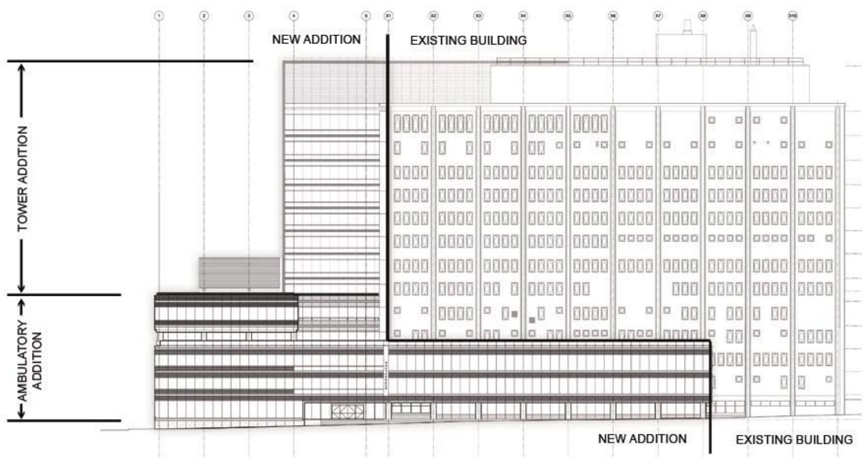

Fig 1. Gouverneur Layout Schematic

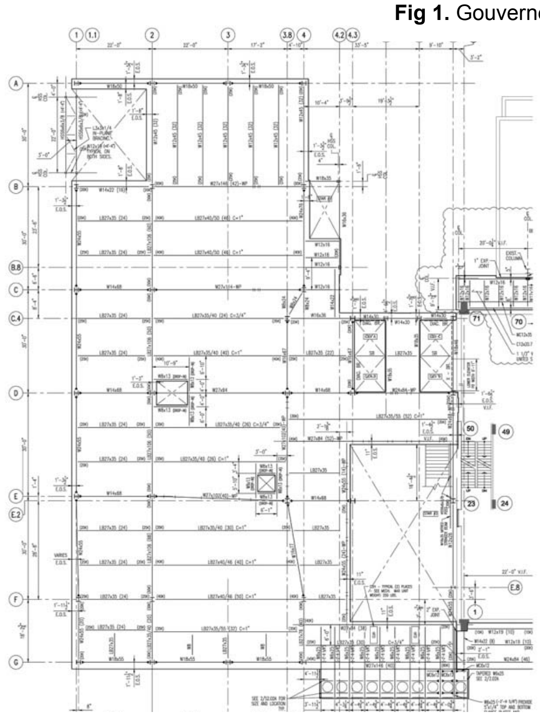

Fig 2. Typical Ambulatory Center Framing Plan

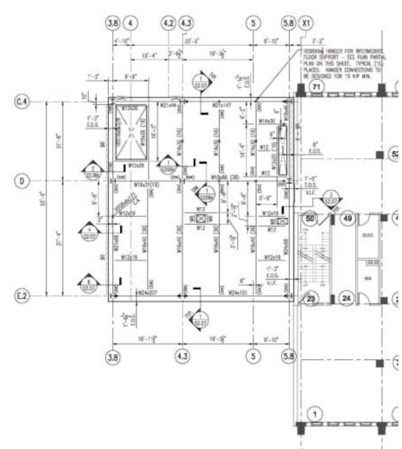

Fig 3. Typical Tower Addition Framing Plan

STRUCTURAL SYSTEM

Foundation

The Gouverneur Healthcare Facility bears on a pile foundation system, with 60-ton capacity, 12" piles. Pile caps vary from 35" to 54" thick with the number of piles ranging from 2 to 16 piles per cap. The footprint for the cellar is smaller than the extents of the overall building so the depths of the pile caps vary. The depths of the caps are either 4'-6" below datum if the columns terminate in the cellar, or 16'-9" above datum if the columns terminate on the first floor.

The piles support grade beams that span between 15' and 40'. Their sizes range from 4'-0" to 8'-3" deep with reinforcing bars from #8 to #12 bars. A structural, one-way slab-on-grade spans between grade beams to make up the cellar floor.

Floor System

The floor system for Gouverneur Healthcare Services is a composite system that utilizes cellular beams for all gravity beams in the ambulatory addition. A 4 ¼" slab rests on a 2" LOK floor composite deck, and is tied to the beam with 5" long, ¾" diameter shear studs. Typical bays are 30'-0" by 44'-0" and almost all beams are nominally 27" deep to accommodate mechanical systems. The tower addition uses traditional W-shapes in a composite floor system. Beams are W16's in areas where clearance for mechanical equipment is not an issue, and W14's where clearance is an issue.

Columns

Almost all columns in the Gouverneur Healthcare Services Building are W14 columns, regardless if it is a part of the lateral system or just a gravity column. Sizes range from W14x43 to W14x257, and are continuous from the foundation to the roof, with only column bearing on a transfer girder on the seventh floor. Columns are spliced on every other floor starting on the third floor. Base plates are typically 22" x 22" with bolts ranging in size from ¾" to 2".

Lateral System

Due to the vast use of glass curtain walls and irregular plan between floors, most of the lateral system in the Gouverneur Healthcare Services Building is moment resisting frames. For the interior moment frames, sizes are either W27's for long span beams or W14's for the shorter spans. Most beams in exterior moment frames are W18's and W24's. In the tower portion of the building, lateral loads are resisted by exterior moment frames in the East-West direction, and braced frames in the North-South direction, both concentric and eccentric. Most braced frames are continuous from the roof to the column termination at the foundation. But at the interface of the upper addition and the lower addition, where one frame is discontinuous, loads transfer into columns in the floor below, and redistribute through the structure.

Wind loads transfer from curtain wall system to floor diaphragm. The floor diaphragm is rigid compared to structure so loads transfer to lateral frames based off of relative stiffness. Loads then transfer to foundations in the form of shear and axial load (tension and compression) in braced frames, and transfer to the foundation through moment frames.

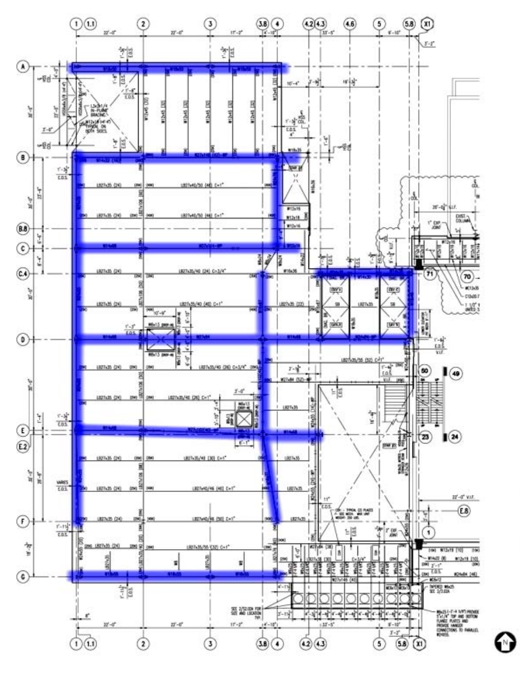

Fig 4. Typical Framing Plan Showing Moment Frames

MATERIALS

Concrete	ASTM	Min Strength
Structural slab-on-grade	-	3000 psi
Pile cap	-	4000 psi
Retaining walls	-	4000 psi
Interior Slabs	-	4000 psi
Reinforcing Steel	A615	60 ksi
Structural Steel		
Structural Tubing	A500	46 ksi
Steel Pipe	A53	35 ksi
Rolled Shapes	A992	50 ksi
Other Rolled Plates	A36	36 ksi
Connection Bolts	A325	90 ksi
Anchor Bolts	A307	45 ksi

APPLICABLE CODES AND DESIGN REQUIREMENTS

Codes and References

The City of New York Building and Administrative Code
New York Electrical Code
All Applicable NFPA Codes
New York State Energy Code
AIA Guidelines for Design and Construction of Hospital and Health Care Facilities

Deflection Criteria

Floor Deflection	L/240 Total and L/360 Live
Lateral Deflection	
Total Drift	3 ½" (due to expansion joint between addition and existing building)
Story Drift	H/400
	$0.10h_{sx}$ (Table 12.21-1 ASCE7-05) for seismic

DESIGN LOADS

Dead Load (psf)	
Floor Load	
3 1/4" LW concrete fill on 3" LOK-Floor	60
Ceiling	2
Floor Finish	2
Mech/Elect	10
Partitions	12
Steel Framing	13
TOTAL	99
	(psf)

Wall assemblies	
1. Metal Panel	25
2. Glass Curtainwall	15
GFRC	40
	(psf)

Dead Load (psf)	
Penthouse Roof	
Steel	8
Deck/Insulation	8
Mechanical	10
Membrane	2
Fire Proofing	2
TOTAL	30
	(psf)

Main Roof	
3 1/4" LW concrete fill on 3" LOK-Floor	60
Ceiling	3
Mech/Elect	14
Roofing/Insulation	9
TOTAL	86
	(psf)

Live Load (psf)		
Live Load	As Designed	As per ASCE7
Dormatory Floors	40	40
Lobby	100	100
Lounge	100	100
Corridor 1st Floor	100	100
Corridor above 1st	80	80
Stairs	100	100
Mechanical Rooms	150	-
Main Roof (Mech)	150	-

Fig 5. Design Load Tables

LOAD CASES

Load Combinations

The load combinations considered in this report are taken from section 2.3 in ASCE7-05. The cases considered are the combinations that may control the design of given members, and account for the loads considered in this tech report.

1. $1.4\,D$
2. $1.2\,D + 1.6\,L$
4. $1.2D + 1.6W + L$
5. $1.2D + 1.0E + L$

Wind Cases

ASCE7 provides 4 load cases for wind loading to be used in the analysis of the main wind force resisting system. These cases are described in figure 6-9 in ASCE7-05. For the scope of this technical report, only the Case 1 will be fully investigated. Case 1 is defined as "full design wind pressure acting on the projected area perpendicular to each principle axis of the structure, considered separately along each principle axis."

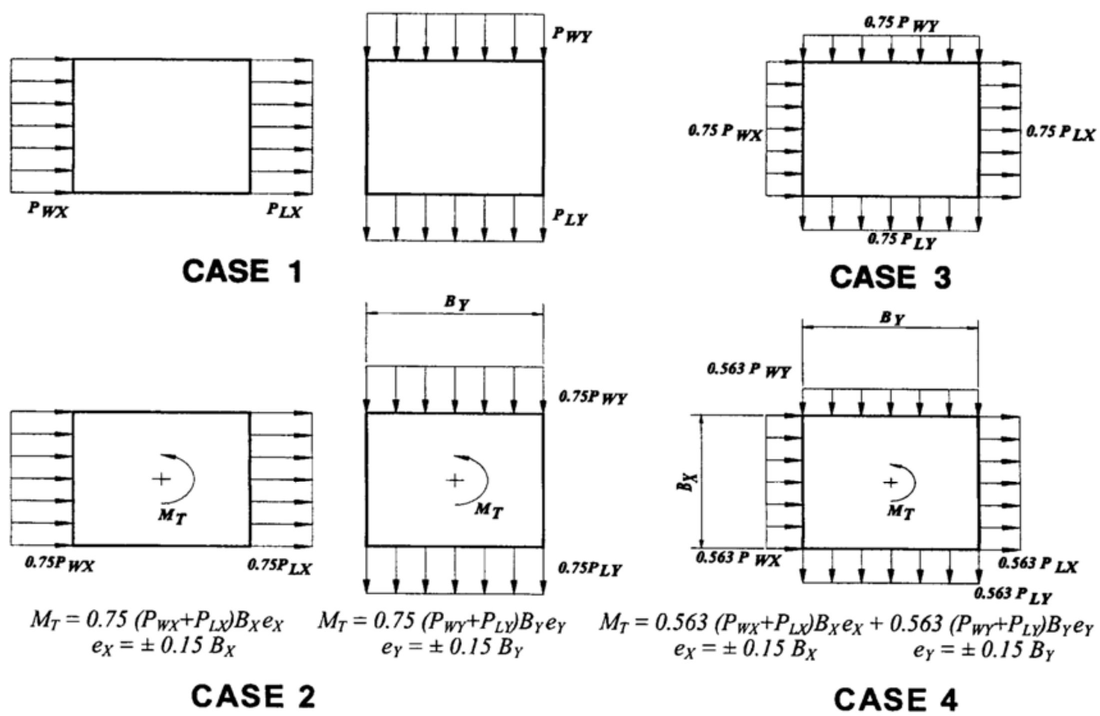

Fig 6. Wind load cases from ASCE7-05 (fig. 6-9)

An ETABS model was developed to analyze the lateral system of the Gouverneur Healthcare Building. An automatic wind load case was created to preliminarily investigate all iterations of the 4 separate wind load cases required by code. Drift values of Case 1 loading were significantly higher than other cases, therefore the decision to fully investigate only Case 1 in further detail was deemed appropriate.

Loads from Technical Report 1 were applied to the building according to Case 1 and investigated.

Seismic Cases

Seismic loads determined in Technical Report 1 were applied at a 5% eccentricity ratio from the center of mass of floors in each direction in order to investigate seismic design.

LATERAL LOAD DISTRIBUTION – RELATIVE STIFFNESS

SAP Modeling

In order to determine the relative stiffness of frames, two models were built using SAP. In each model, every frame in a given direction was modeled in-plane, and constrained to act together. A unit load was applied and the distribution of shear was analyzed to determine the relative stiffness.

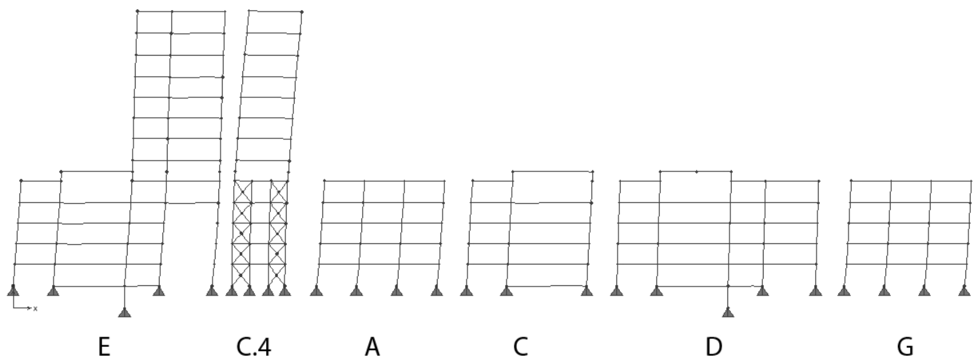

Fig 7. SAP Relative Stiffness Model – East-West Frames

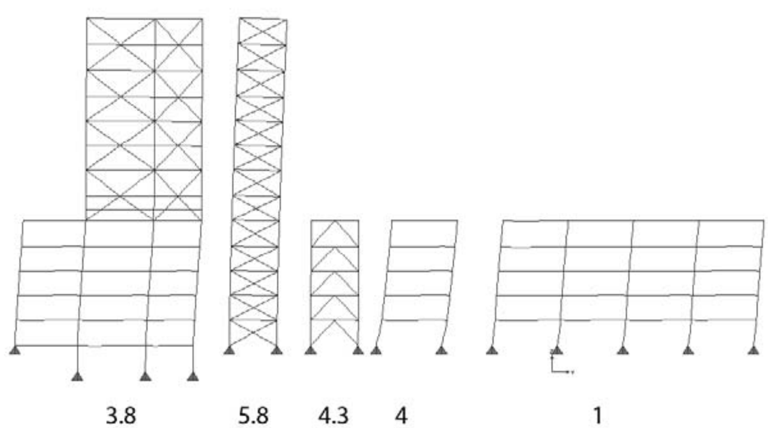

Fig 8. SAP Relative Stiffness Model – North-South Frames

ETABS Modeling

An ETABS model was also utilized to aid in the calculations of multiple portions of this technical report. To be consistent with analysis, the ETABS model was also used to investigate the relative stiffness of frames. Members were modeled and a rigid diaphragm was modeled in place of the floor slab. In order to perform the stiffness analysis, the rotation about the Z-axis was restricted, eliminating torsion effects, and ensuring that forces distributed solely based on relative stiffness. A unit load was then applied to the center of mass of a diaphragm and the shear in individual frames was determined. This provided the distribution of forces, therefore providing the relative stiffness of the frames.

Fig 9. ETABS Model

Relative Stiffness Values

The values obtained using SAP and ETABS were comparable. In order to maintain consistency and ease of use, the values from the ETABS model were used for the extent of this technical report.

Unit Load **100** X-Dir (E-W)

Story	Frame	Shear	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
Roof	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Fig 10. ETABS Model – Stiffness and Torsion Calculations

Story	Frame	Shear	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
Roof	A		0.00	2018.75	760.72	-1258.03	0.00	0.00
	C		0.00	1298.75		-538.03	0.00	0.00
	C4	292.5549	29.26	1200.75	760.72	-440.03	56646.57	0.19
	D		0.00	938.75		-178.03	0.00	0.00
	E	707.4451	70.74	578.75	760.72	181.97	23425.47	-0.19
	G		0.00	0.00		760.72	0.00	0.00
		1000					80072.04	

Fig 11. SAP Model – Stiffness and Torsion Calculations

SHEAR FORCES & TORSION CONSIDERATIONS

Shear Forces

Shear forces are distributed to individual frames by means of relative stiffness. This is the direct shear component of the overall, total shear. Additional shear is distributed to frames due to the effects of torsion. Figure 12 shows the distribution of the story shear for the sixth story, and considers torsion.

Analysis of Torsion

An analysis to determine the impact of torsion was performed for the frames on every floor. Relative stiffness calculations made it possible to obtain the center of rigidity using average of distances to individual frames weighted by the stiffness.

$$d_{CR} = \sum d_i \cdot R_i / \sum R_i$$

d_{CR} – distance to center of rigidity
d_i – distance to individual frame
R_i – relative stiffness of frame

The discrepancy between calculated values and ETABS may be due to the effects of stories below on the center of rigidity of a given floor.

	CR Coordinate			
	Calculated		ETABS output	
Story	X	Y	X	Y
Roof	814.78	765.35	835.829	813.524
13	803.24	765.35	844.549	825.275
12	820.55	765.35	855.733	841.396
11	791.70	765.35	871.02	863.153
10	820.55	765.35	889.945	890.493
9	791.70	765.35	915.74	924.731
8	826.32	765.35	950.385	969.749
7	791.70	765.35	1001.038	1036.041
6	1013.15	987.02	1059.141	1043.144
5	1013.15	987.02	1067.228	1114.822
4	1013.15	987.02	1074.546	1132.908
3	1013.15	987.02	1080.291	1143.166
2	1013.15	987.02	1080.793	1141.017
1				

Fig12. Center of Rigidity Coordinate Table

This analysis was conducted for every floor, for frames in both directions. Once the coordinates for the center of rigidity was calculated, the impact of torsion was calculated using the following equation:

$$V_i/V_{tot} = (e \cdot d_i \cdot R_i)/J$$

V_i – torsional shear of individual frame

V_{tot} – story shear

e – distance from center of mass to center of rigidity

d_i – distance from frame to center of rigidity

R_i – relative stiffness

J – $\sum R_i \cdot d_i^2$

The effect of torsion on the total shear in a frame was calculated for floors 9 and 6, for wind and seismic loading in both directions. See Appendix for additional tables.

Story 6	Wind E-W	Story Shear	216.4				
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear	V*1.6
A	0.09	18.4	27.4	0.04	8.7	27.1	43.3
C	0.11	23.8	21.5	0.02	3.4	27.2	43.5
C4	0.32	69.2	52.4	0.03	6.8	76.0	121.6
D	0.19	41.1	41.0	0.00	-0.9	40.2	64.3
E	0.19	41.1	37.2	-0.04	-7.7	33.4	53.5
G	0.11	22.7	35.9	-0.05	-10.3	12.5	19.9

Story 6	Wind N-S	Story Shear	186.4				
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear	V*1.6
1	0.04	6.8	5.6	0.10	19.0	25.8	41.3
3.8	0.05	8.5	10.1	0.04	6.5	15.1	24.1
4	0.03	5.2	6.6	0.02	3.2	8.4	13.4
4.3	0.60	111.4	92.1	0.08	15.8	127.3	203.6
5.8	0.29	54.4	63.1	-0.24	-44.6	9.8	15.7

Fig13. Frame Shear Tables (kips)

Torsional Impact

The impact of torsion varies depending on the floor under investigation. Overall, there is a large amount of torsion in the building, as can be seen in the figure above, and can also be seen when inspecting the deflected shape of the structure. In the calculation of torsional sehar, it was assumed that the force applied to a given story was at the center of mass. That is true for the case of seismic loading and in wind loading where the building has a regular footprint, and the center of pressure coincides with the center of mass. This assumption will impact the analysis of the lower floors of the building, where the floorplan is less regular and large floor penetrations exist for the atrium. Most likely, the actual behavior of the building has less torsion effect than determined through hand calculations. Using ETABS, lateral displacements are kept to a reasonable level, but some deal of rotation exists. Therefore, torsion does still exist tp some degree, and an attempt to reduce torsion could be a focus of the proposal for the spring semester.

Overall, the gridlines and frame locations are somewhat irregular. This is partially due to the nonsymmetrical floorplan, but is also considerably affected by the offset of gridlines between the upper portion of the building and lower portion. These two factors created a challenging problem for engineers. With the current solution, torsion is a factor in the design and may possibly be reduced with the implementation of another system or altering of the column grids.

DEFLECTION AND STORY DRIFT

Discussion

Due to the complicated nature of the lateral system for the Gouverneur Healthcare building, an ETABS model was developed to analyze lateral loading, including drift. Initially, it was assumed that Case 1 wind loading would control the drift design of the building. In order to determine the viability of this assumption, ETABS was used to automatically calculate wind loads, and 12 iterations of the wind cases from ASCE7-05 were applied to the building. As anticipated, Case 1, wind in the North-South direction created the largest translation in the North-South direction, and Case 1, wind in the East-West direction created the largest translation in its respective direction.

Values obtained for overall displacement and story drift were then compared to allowable values from ASCE7 and constraints imposed by the construction of the building. For overall building drift, the maximum allowable drift was 3.5" a value more restrictive than H/400. This value was imposed on the design due to the size of the expansion joint between the existing building and the addition that is the focus of this thesis project. The allowable story drift for seismic loading was calculated using Table 12-12.1 from ASCE7.

					Allowable	
Story	Load	UX	UY	RZ	H/400	3.5"
HI ROOF	EQX	1.2516	-0.0004	-0.00019	4.65	3.5
HI ROOF	WINDX	3.389	0.0392	-0.00015	4.65	3.5
HI ROOF	WINDY	-0.0733	1.0629	0.00095	4.65	3.5
HI ROOF	EQY	-0.0359	0.4796	0.00049	4.65	3.5

Fig14. Building Drift Values

	Max Seismic	Max Wind	allowable seismic $0.010h_{sx}$	h/400
drift ratio	0.001175	0.003227		
story drift	0.141	0.38724	0.12	0.36

Fig15. Story Drift Values

As seen in the previous figures, the largest deflection occurs at the roof due to wind X loading, that is, wind loads applied to the East-West direction. This deflection, approximately 3.4" is within the allowable deflection of 3.5". However, obtained values for story drift are slightly higher than allowable. This may be due to conservative assumptions used in Technical Report 1 to determine wind and seismic loads. It can be assumed that a more accurate load analysis would give you lower forces, and deflections that fall within allowable limits.

Because of the large values obtained for overall and story drift, these lateral displacements are believed to have controlled the design of members in the lateral system. In general, it is believed that drift due to Case 1 wind loading controlled the size of the members. This hypothesis can be investigated further through spot checking selected members.

SPOT CHECKS AND OVERTURNING

Spot Check Discussion

Selected columns, beams and braces were analyzed for axial and bending loads. These members were in the frame along grid line 3.8 on stories 12 and 5. Columns under combined axial and bending loads were analyzed according so section H of the specifications section in the Steel Manual. Using the applicable interaction equation (H1-1a), actual forces were compared to allowable. Values obtained were significantly lower than the full capacity of the members, further supporting the hypothesis that drift controlled the design of members.

Similar checks were performed in order to analyze a typical brace member in the frame along grid line 3.8, as well as a beam within the frame. Values obtained were similarly well under capacity, supporting the idea that drift controlled design, not solely strength.

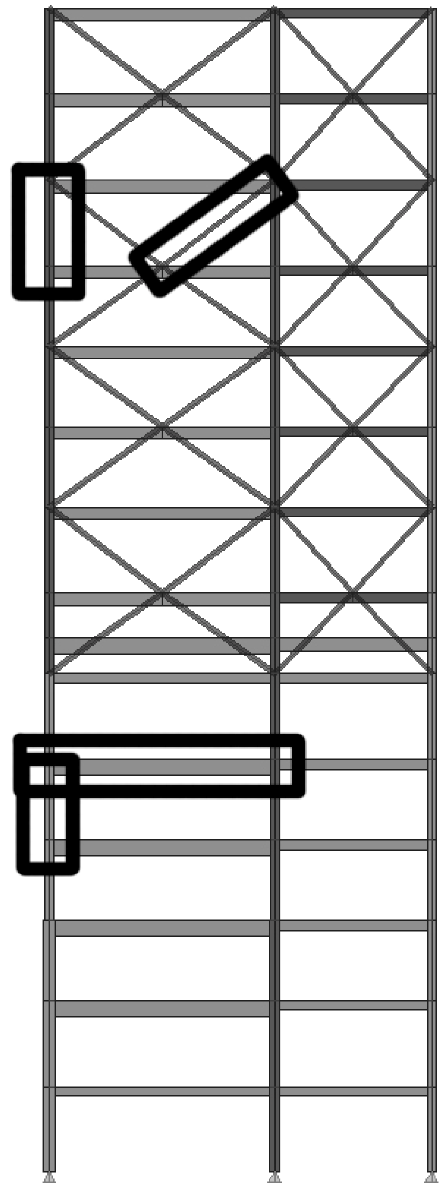

Fig16. Frame Elevation 3.8 - highlighting members selected for spot checking

Overturning Discussion

A preliminary overturning analysis was performed in the Gouverneur Healthcare Facility. The largest overturning moment was obtained from wind load analysis in the East-West direction. This moment also coincided with the shortest dimension of the footprint of the building, ensuring it was the controlling load for overturning.

The moment was then divided by the width of the building to determine the overall, resultant force couple from the moment. The portion of the weight resisting the overturning was determined to be larger than the resultant force couple, and no overturning existing.

This is a simplified analysis of the overturning behavior of the building. In order to perform a more complete analysis, one must analyze individual frames, although the general process would be the same. That is, determining whether the resultant of the moment is resisted by the gravity force of the frame.

It is possible that some frames in the Gouverneur facility experience overturning. However, due to the foundation system used, it is not perceived to be a large problem. The foundation of the building consists of mini-piles, a system that can resist tension, and therefore, resist overturning.

CONCLUSION

A combination of hand calculations and computer modeling was utilized in the lateral analysis of the Gouverneur Healthcare Services Facility. ETABS was used to model the lateral system fully in three dimensions and was used to determine relative stiffness, drifts, and check shear distribution. SAP models were used to confirm the relative stiffness results obtained from ETABS. Values were comparable, with braced frames behaving significantly more stiff than their moment frame counterparts. In some instances, braced frames resisted over 50% more direct shear than the moment frames on the same level.

Within the Gouverneur facility, the column grids and frame layouts are somewhat irregular. This is due to the non-symmetrical floorplan and the offset column grids between the upper and lower portions of the building. This created skewed frames, and frames that used braces on some levels and moment connections on others. The change in stiffness between floors and uneven distribution of stiffness within a floor created an eccentricity between the center of mass and the center of rigidity, making torsion a significant concern for a large part of the building. However, certain analysis assumptions may have increased the effect of torsion. When calculating the torsional shear for wind loading, it was assumed that the force acted at the center of mass. This is only true in a regular building where the center of mass and center of pressure coincide. This assumption to simplify the analysis is not correct and may have increased torsion effects.

A drift analysis was conducted using ETABS. A max building drift of 3.389" was obtained due to wind loading, which is within the allowable limit of H/400. Maximum story drifts of 0.141" and 0.387" were obtained for seismic and wind loading, respectively. These values were slightly higher than the allowable story drifts. This is most likely due to the conservative assumptions used in Technical Report 1, when the lateral loads were calculated. It is expected that a more accurate loading analysis would produce lateral displacements within allowable limits. Since drift numbers were very close to allowable values, it was assumed that drift controlled the design of the sizes of lateral members, not strength.

In order to validate this assumption, spot checks were performed on selected members. Members were loaded to less than 50% capacity using the interaction equation H1-1a from the specifications in the Steel Construction Manual, 13^{th} edition. This check further indicates that drift controlled the design.

A preliminary overturning analysis was also conducted for the entire building. Using critical loads and dimensions, it was determined that the weight of the building was adequate to counteract overturning. It is possible that individual foundations due see tension from the axial loads from individual columns. This would obviously impact the design of the foundation. Since the system utilized in the design is mini-piles, the foundations can resist tension, so this impact would not greatly affect the design.

APPENDIX A LIST OF FIGURES

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Wind E-W

		Height	Kz,Kh	q_z	q_h	$q_zG_fC_p$	$q_hG_fC_p$	$q_h(GC_{pi})$	Windward p_z	Leeward p_h	Total	NYC Code	Total	Overturning
		(ft)							(psf)	(psf)	(psf)	(psf)	(kip)	(ft-k)
Zone 2		***170.00***	1.15	25.97	25.97	22.22	-13.89	4.67	26.89	-9.21	36.11	25.00	31.2	5069
Zone 2		155.00	1.12	25.30	25.97	21.64	-13.89	4.67	26.32	-9.21	35.53	25.00	30.7	4527
Zone 2		140.00	1.09	24.57	25.97	21.02	-13.89	4.67	25.70	-9.21	34.91	25.00	40.2	5227
Zone 2		120.00	1.04	23.51	25.97	20.11	-13.89	4.67	24.79	-9.21	34.00	25.00	39.2	4308
Zone 2		100.00	0.99	22.32	25.97	19.09	-13.89	4.67	23.77	-9.21	32.98	25.00	19.0	1804
Zone 2		90.00	0.96	21.66	25.97	18.53	-13.89	4.67	23.20	-9.21	32.41	25.00	18.7	1587
Zone 2		80.00	0.93	20.94	25.97	17.91	-13.89	4.67	22.59	-9.21	31.80	25.00	18.3	1374
Zone 2		70.00	0.89	20.16	25.97	17.24	-13.89	4.67	21.92	-9.21	31.13	25.00	17.9	1165
Zone 2		60.00	0.85	19.29	25.97	16.50	-13.89	4.67	21.18	-9.21	30.39	25.00	4.3	252
Zone 1	Lower Roof	***57.55***	0.84	19.06	20.16	14.85	-9.82	3.63	18.48	-6.19	24.67	25.00	32.3	1736
Zone 1		50.00	0.81	18.31	20.16	14.27	-9.82	3.63	17.90	-6.19	24.09	25.00	41.7	1878
Zone 1		40.00	0.76	17.18	20.16	13.39	-9.82	3.63	17.01	-6.19	23.20	25.00	40.2	1407
Zone 1		30.00	0.70	15.82	20.16	12.33	-9.82	3.63	15.96	-6.19	22.15	25.00	19.2	528
Zone 1		25.00	0.67	15.02	20.16	11.70	-9.82	3.63	15.33	-6.19	21.52	25.00	18.6	419
Zone 1		20.00	0.62	14.09	20.16	10.98	-9.82	3.63	14.61	-6.19	20.80	25.00	18.0	315
Zone 1		15.00	0.57	12.98	20.16	10.12	-9.82	3.63	13.74	-6.19	19.93	25.00	51.8	388
											Base Shear	0.0	**441.3**	**31983**
												(kip)	(kip)	(ft-k)

	Story	Floor Elev. (ft)	Elev. above datum (ft)	Story Height (ft)	Story Force (kip)	Story Shear (kip)
Zone 2	main roof	155.00	171.01	11.98	24.7	24.7
Zone 2	13	138.28	159.03	11.98	24.2	48.9
Zone 2	12	126.30	147.05	11.98	24.1	73.0
Zone 2	11	114.32	135.07	11.20	22.7	95.7
Zone 2	10	103.13	123.88	11.20	21.8	117.5
Zone 2	9	91.93	112.68	11.20	21.0	138.5
Zone 2	8	80.73	101.48	11.98	21.5	159.9
Zone 2	7	68.75	89.50	11.20	21.0	180.9
Zone 1	6	57.55	78.30	11.98	35.5	216.4
Zone 1	5	45.57	66.32	11.20	48.5	264.9
Zone 1	4	34.38	55.13	11.20	44.8	309.7
Zone 1	3	23.18	43.93	11.20	41.9	351.6
Zone 1	2	11.98	32.73	11.98	40.4	392.0
Zone 1	Ground	0.00	20.75	0.00	20.7	412.7
		Datum	20.75		**412.7**	Total

Wind N-S

		Height	Kz,Kh	q_z	q_h	$q_zG_fC_p$	$q_hG_fC_p$	$q_h(GC_{pi})$	Windward p_z	Leeward p_h	Total	NYC Code	Total	Overturning
		(ft)							(psf)	(psf)	(psf)	(psf)	(kip)	(ft-k)
Zone 2		***170.00***	1.15	25.97	25.97	22.43	-14.02	4.67	27.10	-9.34	36.44	25.00	28.1	4564
Zone 2		155.00	1.12	25.30	25.97	21.84	-14.02	4.67	26.52	-9.34	35.86	25.00	27.6	4076
Zone 2		140.00	1.09	24.57	25.97	21.22	-14.02	4.67	25.89	-9.34	35.23	25.00	36.2	4707
Zone 2		120.00	1.04	23.51	25.97	20.30	-14.02	4.67	24.98	-9.34	34.32	25.00	35.3	3879
Zone 2		100.00	0.99	22.32	25.97	19.27	-14.02	4.67	23.95	-9.34	33.29	25.00	17.1	1625
Zone 2		90.00	0.96	21.66	25.97	18.70	-14.02	4.67	23.38	-9.34	32.72	25.00	16.8	1429
Zone 2		80.00	0.93	20.94	25.97	18.08	-14.02	4.67	22.76	-9.34	32.10	25.00	16.5	1237
Zone 2		70.00	0.89	20.16	20.16	17.40	-10.88	3.63	21.03	-7.25	28.28	25.00	14.5	945
Zone 2		60.00	0.85	19.29	20.16	16.65	-10.88	3.63	20.28	-7.25	27.53	25.00	3.5	204
Zone 1	Lower Roof	***57.55***	0.84	19.06	20.16	15.80	-8.36	3.63	19.43	-4.73	24.16	25.00	20.9	1124
Zone 1		50.00	0.81	18.31	20.16	15.18	-8.36	3.63	18.81	-4.73	23.54	25.00	27.0	1214
Zone 1		40.00	0.76	17.18	20.16	14.24	-8.36	3.63	17.87	-4.73	22.60	25.00	25.9	906
Zone 1		30.00	0.70	15.82	20.16	13.12	-8.36	3.63	16.75	-4.73	21.47	25.00	12.3	338
Zone 1		25.00	0.67	15.02	20.16	12.45	-8.36	3.63	16.08	-4.73	20.81	25.00	11.9	268
Zone 1		20.00	0.62	14.09	20.16	11.68	-8.36	3.63	15.31	-4.73	20.04	25.00	11.5	201
Zone 1		15.00	0.57	12.98	20.16	10.76	-8.36	3.63	14.39	-4.73	19.12	25.00	32.9	246
											Base Shear	0.0	**337.9**	**26963**
												(kip)	(kip)	(ft-k)

	Floor	Floor Elev. (ft)	Elev. above datum (ft)	Story Height (ft)	Story Force (kip)	Story Shear (kip)
Zone 2	main roof	155.00	171.01	11.98	22.2	22.2
Zone 2	13	138.28	159.03	11.98	21.8	44.0
Zone 2	12	126.30	147.05	11.98	21.7	65.7
Zone 2	11	114.32	135.07	11.20	20.5	86.2
Zone 2	10	103.13	123.88	11.20	19.6	105.8
Zone 2	9	91.93	112.68	11.20	18.9	124.7
Zone 2	8	80.73	101.48	11.98	19.3	144.0
Zone 2	7	68.75	89.50	11.20	17.8	161.8
Zone 1	6	57.55	78.30	11.98	24.6	186.4
Zone 1	5	45.57	66.32	11.20	31.4	217.8
Zone 1	4	34.38	55.13	11.20	28.8	246.6
Zone 1	3	23.18	43.93	11.20	26.8	273.4
Zone 1	2	11.98	32.73	11.98	25.7	299.0
Zone 1	Ground	0.00	20.75	0.00	13.1	312.2
		Datum	20.75		**312.2**	Total

General Information

			SOURCE	SECTION/TABLE	PAGE
Occupancy Type		IV	ASCE7-05	Table 1-1 (page 3)	
Occupancy Importance Factor		1.15			
Site Class		B	Seismic Tool		
Seismic Design Category		B	ASCE 7-05	Table 11.6-1	116
Height Above Grade [ft]	h_n	150.00			
Short Period Spectral Response	S_S	0.363	Seismic Tool		
Spectral Response at 1 Second	S_1	0.070	Seismic Tool		
Maximum Short Period Spectral Reponse	S_{MS}	0.363	Seismic Tool		
Maximum Spectral Reponse at 1 Second	S_{M1}	0.070	Seismic Tool		
Design Short Period Spectral Response	S_{DS}	0.242	Seismic Tool		
Design Spectral Response at 1 Second	S_{D1}	0.047	Seismic Tool		
Period Parameter 1	C_t	0.028	ASCE 7-05	Table 12.8-2	129
Period Parameter 2	x	0.8	ASCE 7-05	Table 12.8-2	129
Response Modification Coefficient	R	3.5	ASCE 7-05	Section 12.8.1.1	120 > 129
Approximate Fundamental Period	T_a	1.542	ASCE 7-05	Section 12.8.2.1	129
Fundamental Period	T	1.923	ASCE 7-05	Section 12.8.2	
Long-Period Transition Period	T_L	6.000	ASCE 7-05	see Section 11.4	> 229
Short-Period Transition Period	T_S	0.194			
Seismic Response Coefficient	C_S	0.080	ASCE 7-05	Section 12.8	129
Maximum Required Cs Value	$C_{S,max}$	**0.010**	ASCE 7-05	Section 12.8.1.1	129
Max Cs per ASCE7-12.8.1.1	C_S	0.01			
Effective Weight	**W**	11520.62377			
Base Shear	V	**115.39**	ASCE 7-05	Section 12.8	129
Overturning Moment	M	9737.6			

Story	Floor Height	Floor Weight	$w_i h_i^k$	C_{vx}	Story Force	Story Shear	Moment Contribution
Main Roof	157.00	367.8	57752	0.100	11.589	11.589	1819.464
13	140.3	343.4	48178	0.084	9.668	21.257	1356.208
12	128.3	343.4	44064	0.077	8.842	30.099	1134.474
11	116.3	343.4	39950	0.069	8.017	38.116	932.519
10	105.1	343.4	36104	0.063	7.245	45.360	761.621
9	93.9	343.4	32258	0.056	6.473	51.834	608.007
8	82.7	343.4	28413	0.049	5.701	57.535	471.677
7	70.8	343.4	24299	0.042	4.876	62.411	344.969
6	59.6	1438.5	85664	0.149	17.190	79.601	1023.687
5	47.6	1450.3	68994	0.120	13.845	93.445	658.631
4	36.4	1447.4	52649	0.092	10.565	104.010	384.299
3	25.2	1447.4	36441	0.063	7.313	111.323	184.109
2	14.0	1450.3	20274	0.035	4.068	115.391	56.870
Ground	2.0	1380.5	2761	0.005	0.554	115.945	1.108
	(ft)	(kip)			115.95		9737.6
					Base Shear		**Overturning**

APPENDIX C ETABS MODEL STIFFNESS CALCULATIONS

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	CR Coordinate				CM Coordinate		Distance from CM to CR	
	Calculated		ETABS output					
Story	X	Y	X	Y	X	Y	X	Y
Roof	814.78	765.35	835.829	813.524	1020.65	878.547	-205.87	-113.20
13	803.24	765.35	844.549	825.275	1020.756	879.128	-217.52	-113.78
12	820.55	765.35	855.733	841.396	1020.745	879.341	-200.20	-113.99
11	791.70	765.35	871.02	863.153	1020.711	879.473	-229.01	-114.12
10	820.55	765.35	889.945	890.493	1020.627	879.654	-200.08	-114.30
9	791.70	765.35	915.74	924.731	1020.505	879.874	-228.81	-114.52
8	826.32	765.35	950.385	969.749	1020.328	879.886	-194.01	-114.54
7	791.70	765.35	1001.038	1036.041	1020.195	879.748	-228.50	-114.40
6	1013.15	987.02	1059.141	1043.144	820.608	912.579	192.54	74.44
5	1013.15	987.02	1067.228	1114.822	746.684	923.082	266.46	63.94
4	1013.15	987.02	1074.546	1132.908	709.949	919.957	303.20	67.06
3	1013.15	987.02	1080.291	1143.166	680.246	924.744	332.90	62.28
2	1013.15	987.02	1080.793	1141.017	658.176	928.535	354.97	58.49
1					666.789	915.491		

Unit Load **100** X-Dir (E-W)

Story	Frame	Shear	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
Roof	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
13	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
12	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
11	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
10	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
9	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
8	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
7	A		0.00	2018.75	765.35	-1253.40	0.00	0.00
	C		0.00	1298.75		-533.40	0.00	0.00
	C4	30	30.00	1200.75	765.35	-435.40	56871.95	0.18
	D		0.00	938.75		-173.40	0.00	0.00
	E	70	70.00	578.75	765.35	186.60	24373.69	-0.18
	G		0.00	0.00		765.35	0.00	0.00
		100					81245.64	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
6	A	8.5	8.50	2018.75	987.02	-1031.73	90479.46	0.04
	C	11	11.00	1298.75		-311.73	10689.23	0.02
	C4	32	32.00	1200.75	987.02	-213.73	14617.59	0.03
	D	19	19.00	938.75		48.27	442.72	0.00
	E	19	19.00	578.75	987.02	408.27	31670.23	-0.04
	G	10.5	10.50	0.00		987.02	102292.15	-0.05
		100					250191.38	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
5	A	8.5	8.50	2018.75	987.02	-1031.73	90479.46	-0.02
	C	11	11.00	1298.75		-311.73	10689.23	-0.01
	C4	32	32.00	1200.75	987.02	-213.73	14617.59	-0.02
	D	19	19.00	938.75		48.27	442.72	0.00
	E	19	19.00	578.75	987.02	408.27	31670.23	0.02
	G	10.5	10.50	0.00		987.02	102292.15	0.03
		100					250191.38	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
4	A	8.5	8.50	2018.75	987.02	-1031.73	90479.46	-0.02
	C	11	11.00	1298.75		-311.73	10689.23	-0.01
	C4	32	32.00	1200.75	987.02	-213.73	14617.59	-0.02
	D	19	19.00	938.75		48.27	442.72	0.00
	E	19	19.00	578.75	987.02	408.27	31670.23	0.02
	G	10.5	10.50	0.00		987.02	102292.15	0.03
		100					250191.38	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
3	A	8.5	8.50	2018.75	987.02	-1031.73	90479.46	-0.02
	C	11	11.00	1298.75		-311.73	10689.23	-0.01
	C4	32	32.00	1200.75	987.02	-213.73	14617.59	-0.02
	D	19	19.00	938.75		48.27	442.72	0.00
	E	19	19.00	578.75	987.02	408.27	31670.23	0.02
	G	10.5	10.50	0.00		987.02	102292.15	0.03
		100					250191.38	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
2	A	8.5	8.50	2018.75	987.02	-1031.73	90479.46	-0.02
	C	11	11.00	1298.75		-311.73	10689.23	-0.01
	C4	32	32.00	1200.75	987.02	-213.73	14617.59	-0.02
	D	19	19.00	938.75		48.27	442.72	0.00
	E	19	19.00	578.75	987.02	408.27	31670.23	0.02
	G	10.5	10.50	0.00		987.02	102292.15	0.02
		100					250191.38	

Unit Load **100** Y-Dir (N-S)

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
roof	1		0.00	0.00	814.78	814.78	0.00	0.00
	3.8	86	86.00	734.00		80.78	5611.85	-0.36
	4		0.00	792.00	814.78	22.78	0.00	0.00
	4.3		0.00	961.50		-146.72	0.00	0.00
	5.8	14	14.00	1311.00		-496.22	34472.80	0.36
		100					40084.65	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
13	1		0.00	0.00	803.24	803.24	0.00	0.00
	3.8	88	88.00	734.00		69.24	4218.88	-0.38
	4		0.00	792.00	803.24	11.24	0.00	0.00
	4.3		0.00	961.50		-158.26	0.00	0.00
	5.8	12	12.00	1311.00		-507.76	30938.43	0.38
		100					35157.30	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
12	1		0.00	0.00	820.55	820.55	0.00	0.00
	3.8	85	85.00	734.00		86.55	6367.27	-0.35
	4		0.00	792.00	820.55	28.55	0.00	0.00
	4.3		0.00	961.50		-140.95	0.00	0.00
	5.8	15	15.00	1311.00		-490.45	36081.18	0.35
		100					42448.45	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
11	1		0.00	0.00	791.70	791.70	0.00	0.00
	3.8	90	90.00	734.00		57.70	2996.36	-0.40
	4		0.00	792.00	791.70	-0.30	0.00	0.00
	4.3		0.00	961.50		-169.80	0.00	0.00
	5.8	10	10.00	1311.00		-519.30	26967.25	0.40
		100					29963.61	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
10	1		0.00	0.00	820.55	820.55	0.00	0.00
	3.8	85	85.00	734.00		86.55	6367.27	-0.35
	4		0.00	792.00	820.55	28.55	0.00	0.00
	4.3		0.00	961.50		-140.95	0.00	0.00
	5.8	15	15.00	1311.00		-490.45	36081.18	0.35
		100					42448.45	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
9	1		0.00	0.00	791.70	791.70	0.00	0.00
	3.8	90	90.00	734.00		57.70	2996.36	-0.40
	4		0.00	792.00	791.70	-0.30	0.00	0.00
	4.3		0.00	961.50		-169.80	0.00	0.00
	5.8	10	10.00	1311.00		-519.30	26967.25	0.40
		100					29963.61	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
8	1		0.00	0.00	826.32	826.32	0.00	0.00
	3.8	84	84.00	734.00		92.32	7159.31	-0.34
	4		0.00	792.00	826.32	34.32	0.00	0.00
	4.3		0.00	961.50		-135.18	0.00	0.00
	5.8	16	16.00	1311.00		-484.68	37586.35	0.34
		100					44745.66	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
7	1		0.00	0.00	791.70	791.70	0.00	0.00
	3.8	90	90.00	734.00		57.70	2996.36	-0.40
	4		0.00	792.00	791.70	-0.30	0.00	0.00
	4.3		0.00	961.50		-169.80	0.00	0.00
	5.8	10	10.00	1311.00		-519.30	26967.25	0.40
		100					29963.61	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
6	1	3.6	3.66	0.00	1013.15	1013.15	37572.68	0.10
	3.8	4.5	4.58	734.00		279.15	3565.34	0.04
	4	2.75	2.80	792.00	1013.15	221.15	1367.46	0.02
	4.3	58.8	59.79	961.50		51.65	1594.68	0.08
	5.8	28.7	29.18	1311.00		-297.85	25888.96	-0.24
		98.35					69989.13	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
5	1	3.6	3.66	0.00	1013.15	1013.15	37572.68	0.14
	3.8	4.5	4.58	734.00		279.15	3565.34	0.05
	4	2.75	2.80	792.00	1013.15	221.15	1367.46	0.02
	4.3	58.8	59.79	961.50		51.65	1594.68	0.12
	5.8	28.7	29.18	1311.00		-297.85	25888.96	-0.33
		98.35					69989.13	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
4	1	3.6	3.66	0.00	1013.15	1013.15	37572.68	0.16
	3.8	4.5	4.58	734.00		279.15	3565.34	0.06
	4	2.75	2.80	792.00	1013.15	221.15	1367.46	0.03
	4.3	58.8	59.79	961.50		51.65	1594.68	0.13
	5.8	28.7	29.18	1311.00		-297.85	25888.96	-0.38
		98.35					69989.13	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
3	1	3.6	3.66	0.00	1013.15	1013.15	37572.68	0.18
	3.8	4.5	4.58	734.00		279.15	3565.34	0.06
	4	2.75	2.80	792.00	1013.15	221.15	1367.46	0.03
	4.3	58.8	59.79	961.50		51.65	1594.68	0.15
	5.8	28.7	29.18	1311.00		-297.85	25888.96	-0.41
		98.35					69989.13	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
2	1	3.6	3.66	0.00	1013.15	1013.15	37572.68	0.19
	3.8	4.5	4.58	734.00		279.15	3565.34	0.06
	4	2.75	2.80	792.00	1013.15	221.15	1367.46	0.03
	4.3	58.8	59.79	961.50		51.65	1594.68	0.16
	5.8	28.7	29.18	1311.00		-297.85	25888.96	-0.44
		98.35					69989.13	

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Unit Load **1000** X-Dir

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
Roof	A		0.00	2018.75	810.85	-1207.90	0.00	0.00
	C		0.00	1298.75		-487.90	0.00	0.00
	C4	9.921028612	37.32	1200.75	810.85	-389.90	56727.06	0.11
	D		0.00	938.75		-127.90	0.00	0.00
	E	16.66583337	62.68	578.75	810.85	232.10	33769.14	-0.11
	G		0.00	0.00		810.85	0.00	0.00
		26.58686199					90496.20	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
13	A		0.00	2018.75	810.85	-1207.90	0.00	0.00
	C		0.00	1298.75		-487.90	0.00	0.00
	C4	9.921028612	37.32	1200.75	810.85	-389.90	56727.06	0.11
	D		0.00	938.75		-127.90	0.00	0.00
	E	16.66583337	62.68	578.75	810.85	232.10	33769.14	-0.11
	G		0.00	0.00		810.85	0.00	0.00
		26.58686199					90496.20	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
12	A		0.00	2018.75	810.85	-1207.90	0.00	0.00
	C		0.00	1298.75		-487.90	0.00	0.00
	C4	9.921028612	37.32	1200.75	810.85	-389.90	56727.06	0.11
	D		0.00	938.75		-127.90	0.00	0.00
	E	16.66583337	62.68	578.75	810.85	232.10	33769.14	-0.11
	G		0.00	0.00		810.85	0.00	0.00
		26.58686199					90496.20	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
11	A		0.00	2018.75	810.85	-1207.90	0.00	0.00
	C		0.00	1298.75		-487.90	0.00	0.00
	C4	9.921028612	37.32	1200.75	810.85	-389.90	56727.06	0.11
	D		0.00	938.75		-127.90	0.00	0.00
	E	16.66583337	62.68	578.75	810.85	232.10	33769.14	-0.11
	G		0.00	0.00		810.85	0.00	0.00
		26.58686199					90496.20	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
10	A		0.00	2018.75	810.85	-1207.90	0.00	0.00
	C		0.00	1298.75		-487.90	0.00	0.00
	C4	9.921029	37.32	1200.75	810.85	-389.90	56727.06	0.11
	D		0.00	938.75		-127.90	0.00	0.00
	E	16.66583	62.68	578.75	810.85	232.10	33769.14	-0.11
	G		0.00	0.00		810.85	0.00	0.00
		26.58686					90496.20	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
9	A		0.00	2018.75	810.85	-1207.90	0.00	0.00
	C		0.00	1298.75		-487.90	0.00	0.00
	C4	9.921029	37.32	1200.75	810.85	-389.90	56727.06	0.11
	D		0.00	938.75		-127.90	0.00	0.00
	E	16.66583	62.68	578.75	810.85	232.10	33769.14	-0.11
	G		0.00	0.00		810.85	0.00	0.00
		26.58686					90496.20	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
8	A		0.00	2018.75	810.85	-1207.90	0.00	0.00
	C		0.00	1298.75		-487.90	0.00	0.00
	C4	9.921029	37.32	1200.75	810.85	-389.90	56727.06	0.11
	D		0.00	938.75		-127.90	0.00	0.00
	E	16.66583	62.68	578.75	810.85	232.10	33769.14	-0.11
	G		0.00	0.00		810.85	0.00	0.00
		26.58686					90496.20	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
7	A		0.00	2018.75	810.85	-1207.90	0.00	0.00
	C		0.00	1298.75		-487.90	0.00	0.00
	C4	9.921029	37.32	1200.75	810.85	-389.90	56727.06	0.11
	D		0.00	938.75		-127.90	0.00	0.00
	E	16.66583	62.68	578.75	810.85	232.10	33769.14	-0.11
	G		0.00	0.00		810.85	0.00	0.00
		26.58686					90496.20	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
6	A	19.02327	6.10	2018.75	1048.45	-970.30	57455.62	0.02
	C	25.31972	8.12	1298.75		-250.30	5088.87	0.01
	C4	153.9433	49.38	1200.75	1048.45	-152.30	11455.27	0.03
	D	49.41615	15.85	938.75		109.70	1907.66	-0.01
	E	41.98629	13.47	578.75	1048.45	469.70	29715.19	-0.02
	G	22.0326	7.07	0.00		1048.45	77694.99	-0.03
		311.7213					183317.59	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
5	A	19.02327	6.10	2018.75	1048.45	-970.30	57455.62	-0.03
	C	25.31972	8.12	1298.75		-250.30	5088.87	-0.01
	C4	153.9433	49.38	1200.75	1048.45	-152.30	11455.27	-0.04
	D	49.41615	15.85	938.75		109.70	1907.66	0.01
	E	41.98629	13.47	578.75	1048.45	469.70	29715.19	0.03
	G	22.0326	7.07	0.00		1048.45	77694.99	0.04
		311.7213					183317.59	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
4	A	19.02327	6.10	2018.75	1048.45	-970.30	57455.62	-0.04
	C	25.31972	8.12	1298.75		-250.30	5088.87	-0.02
	C4	153.9433	49.38	1200.75	1048.45	-152.30	11455.27	-0.06
	D	49.41615	15.85	938.75		109.70	1907.66	0.01
	E	41.98629	13.47	578.75	1048.45	469.70	29715.19	0.05
	G	22.0326	7.07	0.00		1048.45	77694.99	0.06
		311.7213					183317.59	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
3	A	19.02327	6.10	2018.75	1048.45	-970.30	57455.62	-0.03
	C	25.31972	8.12	1298.75		-250.30	5088.87	-0.01
	C4	153.9433	49.38	1200.75	1048.45	-152.30	11455.27	-0.04
	D	49.41615	15.85	938.75		109.70	1907.66	0.01
	E	41.98629	13.47	578.75	1048.45	469.70	29715.19	0.04
	G	22.0326	7.07	0.00		1048.45	77694.99	0.04
		311.7213					183317.59	

Story	Frame	Stiffness	% Total	Y Ordinate	CR Y Ordinate	D_i	J	V_i/V_{tot}
2	A	19.02327	6.10	2018.75	1048.45	-970.30	57455.62	-0.03
	C	25.31972	8.12	1298.75		-250.30	5088.87	-0.01
	C4	153.9433	49.38	1200.75	1048.45	-152.30	11455.27	-0.04
	D	49.41615	15.85	938.75		109.70	1907.66	0.01
	E	41.98629	13.47	578.75	1048.45	469.70	29715.19	0.03
	G	22.0326	7.07	0.00		1048.45	77694.99	0.04
		311.7213					183317.59	

Unit Load **1000** Y-Dir CR X ordinate

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
roof	1		0.00	0.00	959.45	959.45	0.00	0.00
	3.8	33.89370933	60.93	734.00		225.45	30967.54	-0.11
	4		0.00	792.00	959.45	167.45	0.00	0.00
	4.3		0.00	961.50		-2.05	0.00	0.00
	5.8	21.73582281	39.07	1311.00		-351.55	48289.16	0.11
		55.62953214					79256.70	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
13	1		0.00	0.00	959.45	959.45	0.00	0.00
	3.8	33.89370933	60.93	734.00		225.45	30967.54	-0.11
	4		0.00	792.00	959.45	167.45	0.00	0.00
	4.3		0.00	961.50		-2.05	0.00	0.00
	5.8	21.73582281	39.07	1311.00		-351.55	48289.16	0.11
		55.62953214					79256.70	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
12	1		0.00	0.00	959.45	959.45	0.00	0.00
	3.8	33.89370933	60.93	734.00		225.45	30967.54	-0.11
	4		0.00	792.00	959.45	167.45	0.00	0.00
	4.3		0.00	961.50		-2.05	0.00	0.00
	5.8	21.73582281	39.07	1311.00		-351.55	48289.16	0.11
		55.62953214					79256.70	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
11	1		0.00	0.00	959.45	959.45	0.00	0.00
	3.8	33.89370933	60.93	734.00		225.45	30967.54	-0.11
	4		0.00	792.00	959.45	167.45	0.00	0.00
	4.3		0.00	961.50		-2.05	0.00	0.00
	5.8	21.73582281	39.07	1311.00		-351.55	48289.16	0.11
		55.62953214					79256.70	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
10	1		0.00	0.00	959.45	959.45	0.00	0.00
	3.8	33.89371	60.93	734.00		225.45	30967.54	-0.11
	4		0.00	792.00	959.45	167.45	0.00	0.00
	4.3		0.00	961.50		-2.05	0.00	0.00
	5.8	21.73582	39.07	1311.00		-351.55	48289.16	0.11
		55.62953					79256.70	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
9	1		0.00	0.00	959.45	959.45	0.00	0.00
	3.8	33.89371	60.93	734.00		225.45	30967.54	-0.10
	4		0.00	792.00	959.45	167.45	0.00	0.00
	4.3		0.00	961.50		-2.05	0.00	0.00
	5.8	21.73582	39.07	1311.00		-351.55	48289.16	0.10
		55.62953					79256.70	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
8	1		0.00	0.00	959.45	959.45	0.00	0.00
	3.8	33.89371	60.93	734.00		225.45	30967.54	-0.10
	4		0.00	792.00	959.45	167.45	0.00	0.00
	4.3		0.00	961.50		-2.05	0.00	0.00
	5.8	21.73582	39.07	1311.00		-351.55	48289.16	0.10
		55.62953					79256.70	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
7	1		0.00	0.00	959.45	959.45	0.00	0.00
	3.8	33.89371	60.93	734.00		225.45	30967.54	-0.10
	4		0.00	792.00	959.45	167.45	0.00	0.00
	4.3		0.00	961.50		-2.05	0.00	0.00
	5.8	21.73582	39.07	1311.00		-351.55	48289.16	0.10
		55.62953					79256.70	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
6	1	16.72101	2.84	0.00	1059.52	1059.52	31927.67	0.21
	3.8	44.18718	7.52	734.00		325.52	7964.14	0.17
	4	11.35847	1.93	792.00	1059.52	267.52	1382.67	0.04
	4.3	270.4896	46.01	961.50		98.02	4420.49	0.32
	5.8	245.1581	41.70	1311.00		-251.48	26371.65	-0.73
		587.9144					72066.62	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
5	1	16.72101	2.84	0.00	1059.52	1059.52	31927.67	0.21
	3.8	44.18718	7.52	734.00		325.52	7964.14	0.17
	4	11.35847	1.93	792.00	1059.52	267.52	1382.67	0.04
	4.3	270.4896	46.01	961.50		98.02	4420.49	0.31
	5.8	245.1581	41.70	1311.00		-251.48	26371.65	-0.71
		587.9144					72066.62	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
4	1	16.72101	2.84	0.00	1059.52	1059.52	31927.67	0.20
	3.8	44.18718	7.52	734.00		325.52	7964.14	0.16
	4	11.35847	1.93	792.00	1059.52	267.52	1382.67	0.03
	4.3	270.4896	46.01	961.50		98.02	4420.49	0.29
	5.8	245.1581	41.70	1311.00		-251.48	26371.65	-0.68
		587.9144					72066.62	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
3	1	16.72101	2.84	0.00	1059.52	1059.52	31927.67	0.22
	3.8	44.18718	7.52	734.00		325.52	7964.14	0.18
	4	11.35847	1.93	792.00	1059.52	267.52	1382.67	0.04
	4.3	270.4896	46.01	961.50		98.02	4420.49	0.32
	5.8	245.1581	41.70	1311.00		-251.48	26371.65	-0.75
		587.9144					72066.62	

Story	Frame	Stiffness	% Total	X Ordinate	CR X ordinate	D_i	J	V_i/V_{tot}
2	1	16.72101	2.84	0.00	1059.52	1059.52	31927.67	0.22
	3.8	44.18718	7.52	734.00		325.52	7964.14	0.18
	4	11.35847	1.93	792.00	1059.52	267.52	1382.67	0.04
	4.3	270.4896	46.01	961.50		98.02	4420.49	0.33
	5.8	245.1581	41.70	1311.00		-251.48	26371.65	-0.77
		587.9144					72066.62	

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Story 9	Wind E-W	Story Shear	138.5				
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear	V*1.6
A	0.00	0.0		0.00	0.0	0.0	0.0
C	0.00	0.0		0.00	0.0	0.0	0.0
C4	0.30	41.5	39.4	0.18	25.5	67.0	107.2
D	0.00	0.0		0.00	0.0	0.0	0.0
E	0.70	96.9	94.6	-0.18	-25.5	71.4	114.3
G	0.00	0.0		0.00	0.0	0.0	0.0

Story 9	Wind N-S	Story Shear	124.7				
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear	V*1.6
1	0.00	0.0		0.00	0.0	0.0	0.0
3.8	0.86	107.2	112.9	-0.36	-44.5	62.7	100.4
4	0.00	0.0		0.00	0.0	0.0	0.0
4.3	0.00	0.0		0.00	0.0	0.0	0.0
5.8	0.14	17.5	7.3	0.36	44.5	61.9	99.1

Story 6	Wind E-W	Story Shear	216.4				
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear	V*1.6
A	0.09	18.4	27.4	0.04	8.7	27.1	43.3
C	0.11	23.8	21.5	0.02	3.4	27.2	43.5
C4	0.32	69.2	52.4	0.03	6.8	76.0	121.6
D	0.19	41.1	41.0	0.00	-0.9	40.2	64.3
E	0.19	41.1	37.2	-0.04	-7.7	33.4	53.5
G	0.11	22.7	35.9	-0.05	-10.3	12.5	19.9

Story 6	Wind N-S	Story Shear	186.4				
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear	V*1.6
1	0.04	6.8	5.6	0.10	19.0	25.8	41.3
3.8	0.05	8.5	10.1	0.04	6.5	15.1	24.1
4	0.03	5.2	6.6	0.02	3.2	8.4	13.4
4.3	0.60	111.4	92.1	0.08	15.8	127.3	203.6
5.8	0.29	54.4	63.1	-0.24	-44.6	9.8	15.7

Story 9	Seismic E-W	Story Shear	51.8			
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear
A	0.00	0.0		0.00	0.0	0.0
C	0.00	0.0		0.00	0.0	0.0
C4	0.30	15.6	14.8	0.18	9.5	25.1
D	0.00	0.0		0.00	0.0	0.0
E	0.70	36.3	35.3	-0.18	-9.5	26.7
G	0.00	0.0		0.00	0.0	0.0

Story 9	Seismic N-S	Story Shear	51.8			
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear
1	0.00	0.0		0.00	0.0	0.0
3.8	0.86	44.6	49.0	-0.36	-18.5	26.1
4	0.00	0.0		0.00	0.0	0.0
4.3	0.00	0.0		0.00	0.0	0.0
5.8	0.14	7.3	3.0	0.36	18.5	25.8

Story 6	Seismic E-W	Story Shear	79.6			
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear
A	0.09	6.8	9.7	0.04	3.2	10.0
C	0.11	8.8	7.6	0.02	1.2	10.0
C4	0.32	25.5	21.4	0.03	2.5	28.0
D	0.19	15.1	14.5	0.00	-0.3	14.8
E	0.19	15.1	13.2	-0.04	-2.8	12.3
G	0.11	8.4	12.7	-0.05	-3.8	4.6

Story 6	Seismic N-S	Story Shear	79.6			
Frame	Relative Stiffness	Direct Shear	ETABS V_{dir}	V_i/V_{tot}	Torsional Shear	Total Shear
1	0.04	2.9	2.4	0.10	8.1	11.0
3.8	0.05	3.6	4.5	0.04	2.8	6.4
4	0.03	2.2	2.9	0.02	1.4	3.6
4.3	0.60	47.6	40.3	0.08	6.8	54.4
5.8	0.29	23.2	27.6	-0.24	-19.0	4.2

APPENDIX F DRIFT TABLES

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Story	Load	UX	UY	RZ	Allowable H/400	3.5"
HI ROOF	EQX	1.2516	-0.0004	-0.00019	4.65	3.5
HI ROOF	WINDX	3.389	0.0392	-0.00015	4.65	3.5
HI ROOF	WINDY	-0.0733	1.0629	0.00095	4.65	3.5
HI ROOF	EQY	-0.0359	0.4796	0.00049	4.65	3.5
LO ROOF	EQX	0.318	-0.0667	0.00011	2.16	3.5
LO ROOF	WINDX	0.9641	-0.2457	0.00043	2.16	3.5
LO ROOF	WINDY	-0.0365	0.5403	-0.00028	2.16	3.5
LO ROOF	EQY	-0.0147	0.2309	-0.00012	2.16	3.5

	Max Seismic	Max Wind	allowable seismic $0.010h_{sx}$	h/400
drift ratio	0.001175	0.003227		
story drift	0.141	0.38724	0.12	0.36

Story	Item	Load	DriftX	DriftY
HI ROOF	Max Drift X	EQX	0.000551	
HI ROOF	Max Drift Y	EQX		0.000095
HI ROOF	Max Drift X	EQY	0.000175	
HI ROOF	Max Drift Y	EQY		0.000426
13	Max Drift X	EQX	0.000755	
13	Max Drift Y	EQX		0.000097
13	Max Drift X	EQY	0.000184	
13	Max Drift Y	EQY		0.000441
12	Max Drift X	EQX	0.000884	
12	Max Drift Y	EQX		0.0001
12	Max Drift X	EQY	0.000186	
12	Max Drift Y	EQY		0.000448
11	Max Drift X	EQX	0.000989	
11	Max Drift Y	EQX		0.000097
11	Max Drift X	EQY	0.000192	
11	Max Drift Y	EQY		0.000451
10	Max Drift X	EQX	0.001084	
10	Max Drift Y	EQX		0.000098
10	Max Drift X	EQY	0.000187	
10	Max Drift Y	EQY		0.000448
9	Max Drift X	EQX	0.001152	
9	Max Drift Y	EQX		0.000086
9	Max Drift X	EQY	0.000191	
9	Max Drift Y	EQY		0.000436
8	Max Drift X	EQX	0.00108	
8	Max Drift Y	EQX		0.000094
8	Max Drift X	EQY	0.000192	
8	Max Drift Y	EQY		0.000414
7	Max Drift X	EQX	0.001175	
7	Max Drift Y	EQX		0.000087
7	Max Drift X	EQY	0.000265	
7	Max Drift Y	EQY		0.000394
LO ROOF	Max Drift X	EQX	0.000616	
LO ROOF	Max Drift Y	EQX		0.000107
LO ROOF	Max Drift X	EQY	0.000032	
LO ROOF	Max Drift Y	EQY		0.000304
5	Max Drift X	EQX	0.000622	
5	Max Drift Y	EQX		0.000131
5	Max Drift X	EQY	0.000102	
5	Max Drift Y	EQY		0.000388
4	Max Drift X	EQX	0.00063	
4	Max Drift Y	EQX		0.000171
4	Max Drift X	EQY	0.000185	
4	Max Drift Y	EQY		0.000439
3	Max Drift X	EQX	0.000584	
3	Max Drift Y	EQX		0.000203
3	Max Drift X	EQY	0.000245	
3	Max Drift Y	EQY		0.000453
2	Max Drift X	EQX	0.000592	
2	Max Drift Y	EQX		0.000297
2	Max Drift X	EQY	0.000392	
2	Max Drift Y	EQY		0.000553

Story	Item	Load	DriftX	DriftY
HI ROOF	Max Drift X	WINDX	0.001247	
HI ROOF	Max Drift Y	WINDX		0.000233
HI ROOF	Max Drift X	WINDY	0.00036	
HI ROOF	Max Drift Y	WINDY		0.000873
13	Max Drift X	WINDX	0.001754	
13	Max Drift Y	WINDX		0.000237
13	Max Drift X	WINDY	0.000366	
13	Max Drift Y	WINDY		0.000906
12	Max Drift X	WINDX	0.002119	
12	Max Drift Y	WINDX		0.000245
12	Max Drift X	WINDY	0.000367	
12	Max Drift Y	WINDY		0.000928
11	Max Drift X	WINDX	0.002438	
11	Max Drift Y	WINDX		0.000238
11	Max Drift X	WINDY	0.000377	
11	Max Drift Y	WINDY		0.000943
10	Max Drift X	WINDX	0.002747	
10	Max Drift Y	WINDX		0.00024
10	Max Drift X	WINDY	0.000369	
10	Max Drift Y	WINDY		0.000945
9	Max Drift X	WINDX	0.003002	
9	Max Drift Y	WINDX		0.000211
9	Max Drift X	WINDY	0.000382	
9	Max Drift Y	WINDY		0.000931
8	Max Drift X	WINDX	0.002895	
8	Max Drift Y	WINDX		0.000234
8	Max Drift X	WINDY	0.00039	
8	Max Drift Y	WINDY		0.000899
7	Max Drift X	WINDX	0.003227	
7	Max Drift Y	WINDX		0.000218
7	Max Drift X	WINDY	0.000549	
7	Max Drift Y	WINDY		0.000869
LO ROOF	Max Drift X	WINDX	0.001883	
LO ROOF	Max Drift Y	WINDX		0.000412
LO ROOF	Max Drift X	WINDY	0.000057	
LO ROOF	Max Drift Y	WINDY		0.000666
5	Max Drift X	WINDX	0.00195	
5	Max Drift Y	WINDX		0.000508
5	Max Drift X	WINDY	0.000213	
5	Max Drift Y	WINDY		0.000855
4	Max Drift X	WINDX	0.002041	
4	Max Drift Y	WINDX		0.000653
4	Max Drift X	WINDY	0.000419	
4	Max Drift Y	WINDY		0.001001
3	Max Drift X	WINDX	0.001978	
3	Max Drift Y	WINDX		0.000779
3	Max Drift X	WINDY	0.000599	
3	Max Drift Y	WINDY		0.001093
2	Max Drift X	WINDX	0.002123	
2	Max Drift Y	WINDX		0.001145
2	Max Drift X	WINDY	0.001004	
2	Max Drift Y	WINDY		0.001408

APPENDIX G ETABS FRAME OUTPUT

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Story	Column	Shape	Load	Loc	P	V2	V3	T	M2	M3
12	C17	W14x132	EQX	0	8.33	5.6	0.01	-0.039	0.0775	31.89708
12	C17		EQX	118.05	8.33	5.6	0.01	-0.039	-0.029	-23.1812
12	C17		EQY	0	10.4	0.72	0.01	0.078	0.066667	4.314583
12	C17		EQY	118.05	10.4	0.72	0.01	0.078	-0.06333	-2.74633
12	C17		16WINDX	0	29.04	22.2	0.04	-0.12	0.2805	125.624
12	C17		16WINDX	118.05	29.04	22.2	0.04	-0.12	-0.10592	-92.8045
12	C17		16WINDY	0	33.59	2.04	0.04	0.25	0.139417	12.25683
12	C17		16WINDY	118.05	33.59	2.04	0.04	0.25	-0.24925	-7.79342
12	C17		10WINDX	0	18.15	13.88	0.02	-0.075	0.175333	78.515
12	C17		10WINDX	118.05	18.15	13.88	0.02	-0.075	-0.06617	-58.0028
12	C17		10WINDY	0	21	1.27	0.02	0.157	0.087083	7.6605
12	C17		10WINDY	118.05	21	1.27	0.02	0.157	-0.15575	-4.87083
5	C17	W14x257	EQX	0	70.77	-1.06	-5.52	0.086	-30.2145	-6.30417
5	C17		EQX	107.275	70.77	-1.06	-5.52	0.086	19.14892	3.1595
5	C17		EQY	0	46.82	3.64	0.59	-0.087	2.79775	21.58992
5	C17		EQY	107.275	46.82	3.64	0.59	-0.087	-2.51533	-10.9844
5	C17		16WINDX	0	294.05	-5.45	-26.57	0.599	-144.49	-31.5086
5	C17		16WINDX	107.275	294.05	-5.45	-26.57	0.599	93.0695	17.22633
5	C17		16WINDY	0	172.76	12.91	1.96	-0.29	8.9795	75.74267
5	C17		16WINDY	107.275	172.76	12.91	1.96	-0.29	-8.51833	-39.6633
5	C17		10WINDX	0	183.78	-3.41	-16.61	0.375	-90.3064	-19.6928
5	C17		10WINDX	107.275	183.78	-3.41	-16.61	0.375	58.16842	10.7665
5	C17		10WINDY	0	107.98	8.07	1.22	-0.182	5.61225	47.33917
5	C17		10WINDY	107.275	107.98	8.07	1.22	-0.182	-5.324	-24.7896

Story	Brace	Shape	Load	Loc	P	V2	V3	T	M2	M3
12	D3	HSS8x8x0.625	EQX	0	2.78	0	0	0	0	0
12	D3		EQX	236.66	2.78	0	0	0	0	0
12	D3		EQY	0	7.58	0	0	0	0	0
12	D3		EQY	236.66	7.58	0	0	0	0	0
12	D3		16WINDX	0	9.15	0	0	0	0	0
12	D3		16WINDX	236.66	9.15	0	0	0	0	0
12	D3		16WINDY	0	26.25	0	0	0	0	0
12	D3		16WINDY	236.66	26.25	0	0	0	0	0
12	D3		10WINDX	0	5.72	0	0	0	0	0
12	D3		10WINDX	236.66	5.72	0	0	0	0	0
12	D3		10WINDY	0	16.4	0	0	0	0	0
12	D3		10WINDY	236.66	16.4	0	0	0	0	0

Story	Beam	Shape	Load	Loc	P	V2	V3	T	M2	M3
5	B7	W27x102	EQX	8.2	0	-0.5	0	0.006	0	-102.834
5	B7		EQX	368.2	0	-0.5	0	0.006	0	78.219
5	B7		EQY	8.2	0	1.31	0	0.001	0	266.974
5	B7		EQY	368.2	0	1.31	0	0.001	0	-204.111
5	B7		16WINDX	8.2	0	-2.35	0	0.021	0	-479.096
5	B7		16WINDX	368.2	0	-2.35	0	0.021	0	366.353
5	B7		16WINDY	8.2	0	4.62	0	0.001	0	942.797
5	B7		16WINDY	368.2	0	4.62	0	0.001	0	-721.873
5	B7		10WINDX	8.2	0	-1.47	0	0.013	0	-299.435
5	B7		10WINDX	368.2	0	-1.47	0	0.013	0	228.971
5	B7		10WINDY	8.2	0	2.89	0	0.001	0	589.248
5	B7		10WINDY	368.2	0	2.89	0	0.001	0	-451.171

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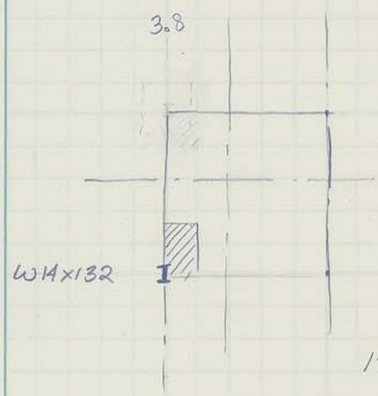
SPOT CHECKS   frame along col. line 3.8

STORY 12



$T_{A_{flr}} = \frac{1}{2}(19) \times \frac{1}{2}(31.33)$

$= 149\ ft^2$

W14x132
$\phi P_n = 1590\ K$ $K_L = 11'$
$\phi M_{ny} = 424$
$\phi M_{nx} = 878$

12th Floor

149 ft² roof load

149x2 = 298 ft² floor load

$P_D = (149 \times 86) + (298 \times 99) = 42.3\ K$ ←

$P_L = (149 \times 150) + (298 \times 100) = 52.1\ K$ ←

→ $1.2D + 1.6L = 1.2(42.3) + 1.6(52.1) = 84.6K = P_u$

TABLE 4-1 $\phi P_n = 1590\ K > P_u = 84.6\ K$ ∴ OK

$1.2D + 1.6W + L$ WIND X

Lateral $P_w = 29\ K$ 1.6 taken into account in ETABS

$P_u = 1.2(42.3) + (29) + 52.1 = 149\ K$ $\frac{P_u}{P_c} = \frac{149}{1590} = 0.9 > 0.2$ ∴ H1-1a

$M_{ux} = 125.6$ $M_{uy} = 0.281$

$$\frac{149}{1590} + \frac{8}{9}\left(\frac{125.6}{878} + \frac{0.281}{424}\right) = 0.22 < 1.0 \quad \therefore OK$$

By inspection – 1.2D+1.6W+L Wind Y DNC } from load output

1.2D+1.0E+L   DNC

Column Story 5

WA × 257

$T_{A\,upper} = 149$

$\phi P_n = 3160$

$T_{A\,Lower} = 149 \times 4 = 596\ ft^2$

$\phi M_x = 1830$

$\phi M_y = 923$

$P_D = 149(86) + 149 \times 7(99) + 596 \times 2(99) = 234\ K$

$P_L = 149(150) + 149 \times 7(100) + 596 \times 2(100) = 246\ K$

$1.2D + 1.6L = 1.2(234) + 1.6(246) = 671 < 3160$ ∴ ok

$1.2D + 1.6W + 1.0L$ wind x

$P_u = 1.2(234) + 294 + 246 = 821$ $\qquad \frac{821}{3160} > .2$ ∴ H1-1a

$$\frac{821}{3160} + \frac{8}{9}\left(\frac{31.5}{1830} + \frac{144}{923}\right) = 0.41 < 1.0 \quad \therefore \text{ OK}$$

BY inspection wind y DNC, seismic DNC } see ETABS output

BRACE

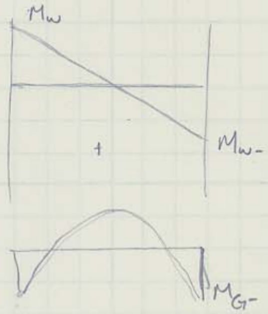
Max load $1.6W \Rightarrow P_u = 26.25$

HSS8×8×5/8

$KL = 19.7$

$\phi P_n = 439\,k > P_u = 26.25\,k$ ∴ OK ✓

Beam Story 5 W27x102 $\phi M_p =$



$1.2D + 1.6W + 1.0L$

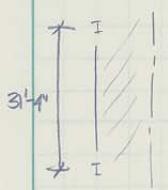
$M_{w-} \Rightarrow$ from $1.6W_y$

$M_u = 942.8$ k-in $= 78.6$ ft-k

$\frac{wl^2}{12}$

$w_D = \frac{19}{2} \times 99 = 940$ plf

$W_L = \frac{19}{2} \times 100 = 950$ plf



$TW = \frac{19}{2}$

$w_u = 1.2D + 1.0L = 1.2(940) + (950) = 2.08$ klf

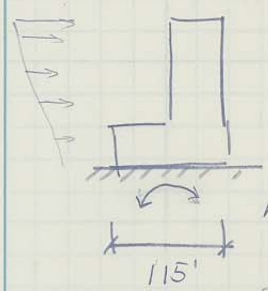
$M_u = \frac{wl^2}{12} = \frac{(2.08)(31.33)^2}{12} = 170$ ft-k

$M_{u\,total} = 78.6 + 170 = 250$ ft-k

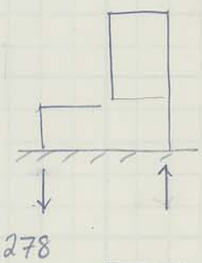
$\phi M_n = 600$ ft-k unbraced > 250 $\therefore$ ok

controlling case by inspection

Overturning

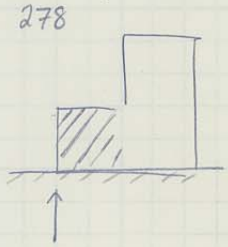


$M_{over} = 31980$ ft-k



Overturning axial forces

$$P_a = \frac{M}{arm} = \frac{31980}{115} = 278 \text{ k}$$



Resisting due to weight

$$(5 \times 1400)/2 = 3500 \text{ k} > 278 \text{ k} \therefore \text{ok}$$

no Building overturning