Gateway Plaza
Wilmington, DE
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Technical Report 1:
Structural Concepts/Structural Existing Conditions Report

INTRODUCTION

Gateway Plaza is a new, 15-story office under construction in Wilmington, Delaware. It is the first new tower to be constructed in the Central Business District in 15 years. The \$52 million complex is being constructed on the site of the former Delaware Ave. parking lot. Gateway Plaza is returning parking to the site with a 5-story parking garage in its rear, which will provide 600 spaces. Ground was broken in July 2005 and the Plaza's long-awaited arrival is slated for May 2006. The building will feature a public, plaza level which will house a café, U.S. Post Office, and WSFS Bank Branch. Gensler is the design architect on the project. It features a glass curtain wall that will stand out among its EIFS-clad neighbors. The northeast corner of the building is on an angle which mimics the rounded edges of its neighboring DuPont Hotel and Sheraton Hotel. The building will top out at 210'-6" and provides spectacular views of the city. The building offers 387,000 ft^2 of rentable space. The developer and property manager, Buccini/Pollin Group, has already leased 5 of the 14 office floors to its primary tenants, WSFS and Morris, James, Hitchens, & Williams. The remainder of the space is currently for tenant fit-out and is an open floor plan.

The report contains a detailed description of the structural systems: drilled pier foundations, composite steel framing and slabs, and braced and moment frame lateral load resisting elements. A list of codes and standards applicable to the building, and the development of loading conditions are also included. The loading conditions developed will be used to check random member sizes. These random checks will assure that the assumptions made in the report are sound. The attached appendices are intended to supplement the findings of the report through more descriptive diagrams and detailed calculations. Appendix A contains framing plans, B provides detailed lateral load calculations, and Appendix C includes details on the hand calculations and software output of spot-checks.

The goal of this report is to investigate the systems being used in the building and understand their design and development through analysis. An important aim of this report is to become familiar with the development of lateral loading from wind and seismic conditions and how to design elements to resist these loads. Analysis was performed using several methods. Loads were obtained through application of standards in Excel spreadsheets, and members were checked both by hand calculations and through RAM model analysis.

CODES

Gateway Plaza's structural design is based on the 2003 International Building Code. Live and lateral loads due to wind and seismic were calculated using ASCE7-02. Structural standards include:

Structural Steel	AISC "Specifications of Structural Steel Buildings" LRFD-3rd Edition
Reinforced Concrete	ACI 318-"Building Code Requirements for Reinforced Concrete" ACI 315-"Details and Detailing of Concrete Reinforcement" ACI 301-"Specifications for Structural Concrete"
Pre-cast Concrete	ACI 318-"Building Code Requirements for Reinforced Concrete" PCI-MNL 116 & 117-" Manual for Quality Control for plans and production of precast and prestressed concrete products"
Metal Deck	Steel Deck Institute Standards
Foundations	In strict accordance with evaluation performed by Duffield Associates (Project No. 5969.GA Dated March 2005)
Masonry	Building Code Requirements for Masonry Structures ACI 530-99/ASCE5-99/TMS 402-99 Specifications for Masonry Structures ACI 530.1-99/ASCE 6-99/TMS 602-99

The designs contained in this report reflect the standards held in the LRFD-3rd Edition of the "Specifications of Structural Steel Buildings." However, designed members use the ASD-9th Edition of the specification. There will be little difference in the sizing of members because their design is dictating mainly from serviceability criteria, deflection and vibration, rather than strength or stress.

STRUCTURAL SYSTEM

Gateway Plaza has two distinct buildings and two distinct building systems. The office and retail tower is composite steel construction and the parking garage is pre-cast concrete. The two structures are separated using a 2" expansion joint. The structural engineer is responsible for designing the office tower and the pre-cast supplier is responsible for the design of the garage. For this reason, focus will be centered on the office tower design.

Foundations

The foundation of Gateway Plaza uses clusters of auger-cast, drilled piles to support column loads. The piles are 12" in diameter and use high strength concrete to develop 120 tons of bearing capacity. Most of the piles are drilled 70' down to bedrock through sandy-silt and silt, typical of a city located on a river. Grade beams span the pile caps on the entire building's perimeter, and a 5" slab on grade span the grade beams in much of the foundation.

The office tower's steel columns sit on pile caps that are typically 60" thick and vary in shape. The columns from the lateral load resisting system generally sit on clusters of 18 piles where those from the gravity system sit on clusters of 12. The larger foundations under the lateral frames are to resist the overturning moment from wind and seismic loading. The pile clusters in the office tower are on a 30‘x52’ grid on the north side and a 30’x35’ grid on the south side.

The vertical support members in the parking garage sit on pile caps that are 40-50” thick and are generally square. The lateral load resisting system of the garage, pre-cast concrete shearwalls, sits on 7-pile clusters while the cast-in-place concrete columns rest on 4-pile clusters. The clusters in the parking garage are on a 30’x62’ grid.

Framing

Gateway Plaza uses two types of framing systems for its two types of use: composite steel for the office tower and precast/cast-in-place concrete for the parking garage. The structural engineer is responsible for the design of the office tower where the pre-cast contractor is responsible for the design of the precast parking garage.

The composite steel in the office tower uses two grid systems: one orthogonal and one rotated. As aforementioned, the grids are 30’x52’ and 30’x62’. The rotated grid is an adaptation turned 14° clockwise from north, and is used to create the bowed surface on the northeast face. The columns are spliced every other floor or 27’. All framing members on the office floors use wide-flange shapes on A992, Gr. 50 steel where the framing of the penthouse and screen-wall on the roof use HSS tube shapes of A36 steel. All of the columns, in both the lateral and gravity systems, are W14 shapes of various sizes. The girders and beams range in size but are usually W18 or W24 shapes.

The garage is typical construction of cast-in-place concrete columns and pre-cast concrete beams. The pre-cast double tee beams span girders that are pre-cast L-beams. Sizing of these members is left to the pre-cast contractor.

To better visualize the framing systems, please refer to *Appendix A-Framing Plans*.

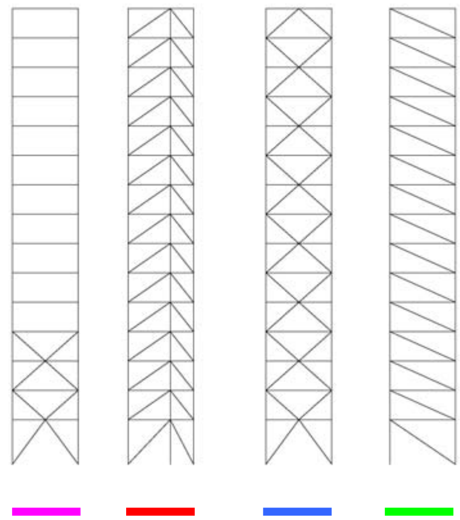
Structural Slabs

There are 6 types of structural slabs used in Gateway Plaza: three slabs on grade and three supported metal deck slabs.

Each type of slab on grade is normal-weight concrete cast over 6” crushed stone and compacted fill. The first type of slab on grade is used in the on a majority of the ground level where there will be retail space and parking. This type is 5” concrete with 6x6-W2.9x2.9 WWF reinforcing. Another type of slab on grade is 6” concrete with 6x6-W2.0x2.0 WWF reinforcing. This S.O.G. can be found in the loading area for the retail occupants. The final type of S.O.G. is 12” concrete reinforced with #8 @ 12” o.c. each way in the top and #6 @ 12” o.c. each way in the bottom. This larger slab is used in the loading dock to be used by the entire building.

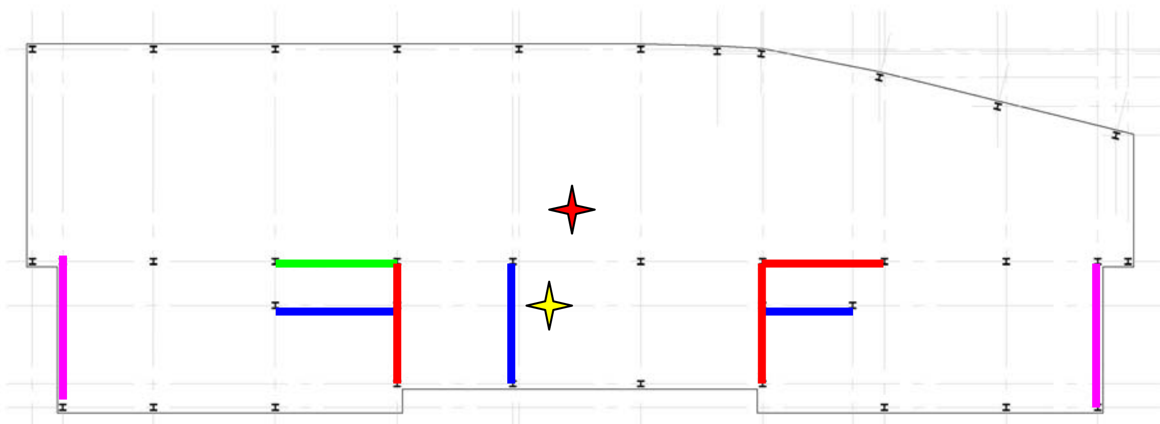
All three types of deck utilize ¾”ϕ shear studs in concrete with a compressive strength of 3000 psi. Two types of supported slabs are 3-1/4” light-weight concrete on 3” Lok-Floor composite deck and use 6x6 W1.4x1.4 WWF reinforcing. The difference between them is the gage of the deck. One type is 20 gage and used in the office area of all the elevated floors. The other is 16 gage which will be shored during construction. The 16 gage deck/slab system will be used in the mechanical areas of each floor. The third type of supported slab in found on the penthouse floor and is 2-1/2” of normal-weight concrete on 1-1/2” Lok-Floor composite deck. It, too, uses 6x6 W1.4xW1.4 WWF reinforcing.

Lateral Load Resisting System



The lateral load resisting system for Gateway Plaza utilizes ordinary moment frames, braced frames, and a type of chevron frame. The system was designed to resist wind loading, which is dominant in Delaware. There are five frames resisting load in the north-south direction, and four in east-west direction. To resist the load in the north-south direction, moment frames are used on the east and west ends of the building where there is curtain wall present. Two chevron frames near the stair-wells and one central cross-braced frame also resist load in the north-south direction. In the east-west direction, a chevron and a cross-braced frame in the two stairwells resist wind loads. The location of these frames does a good job at preventing torsion by keeping the center of rigidity (designated by a yellow star) very close to the center of mass (designated by a red star) of the floor. However, this is only the case for winds in the north-south direction. The structure may be subjected to torsion in the case of winds in the east-west direction because the center of rigidity is further from the center of mass.

The bracing elements are not the traditional, A36, angles but are A992 wide flange shapes. All of the frames are different in some manner, making modeling the stiffness very difficult. Therefore, their behaviors were modeled using RAM Structural System software.

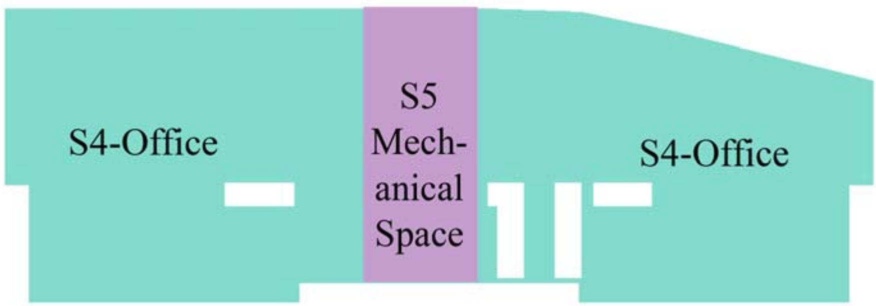


LOADING CONDITIONS

Gravity Loads

Dead and Live Loads

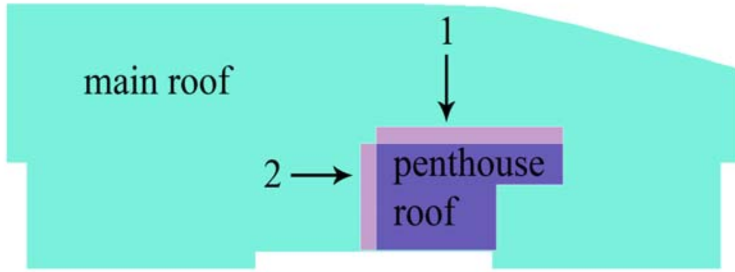
The dead loads of the structure come primarily from the supported slabs and framing. Collateral loads account for sprinklers and MEP. The live loading conditions are those set forth in ASCE7-02. A majority of the office tower is classified as office occupancy which results in a live load of 60 psf, plus an additional 20 psf for partitions. Since the floor plans and corridors are not pre-determined, a live load of 100 psf is used in design. There are portions on each floor considered to be mechanical spaces which houses ventilation equipment and will therefore be designed for a 125 psf live load. This is illustrated in the diagram below.



The following table summarizes the dead and live loading conditions in each type of occupancy.

LOADING IN POUNDS/SQUARE FOOT	Parking Floors	Office Floors	Mechanical Rooms	Penthouse Floor	Main roof	Penthouse Roof	5" Slab on Grade
Concrete Slab	82						63
Roof & Insulation					5	5	
Steel & Joists		10	10	10	10	10	
Ceiling	5	5	5	5	5	5	
Collateral	5	5	5	5	5	5	
Concrete Tees	50						
Mechanical					10	35	
3-1/4" LW Conc. On Deck		46	46				
2-1/2" NW Conc. On Deck				40			
Total Dead Load	142	66	66	60	35	60	63
Total Live Load	50	100	125	150	60	60	100

Snow Loads



The only place that snow loading can become an issue is on the roof. Drifting can occur around the penthouse. A spreadsheet was developed according to the ASCE 7-02 guidelines set out in Chapter 7. Drift was checked in the blue sections highlighted in the diagram. In section 1 the maximum drift load was found to be 49 psf and in section 2, the load was found to be 63 psf. These loads were not used to check member adequacy in this report, but will in upcoming assignments. For further details on the calculations, please refer to *Appendix B.2–Snow Load Calculations*.

Lateral Loads

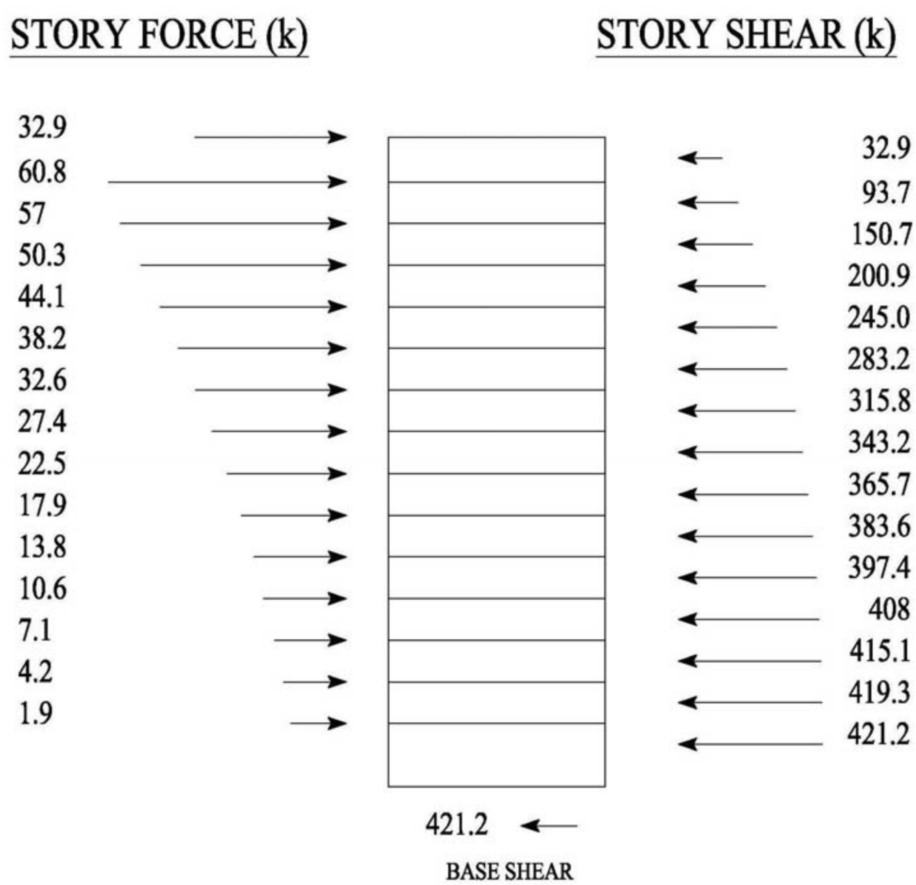
The lateral loads, both wind and seismic, for the building were found using the guidelines set forth in IBC 2003 and ASCE7-02. Seismic Loads were found using the Equivalent Lateral Force Procedure as laid out in Section 9.5.5. Wind Loads on the Main Wind Force Resisting System were found according to the Analytical Procedure, outlined in Section 6.5. A summary of these calculations is provided below. To find the story forces and shears, a tributary area approach was taken. The pressure at each floor level was distributed over an area equal to half the floor height above and below the level. Complete calculations were found through Excel spreadsheets; please refer to *Appendix B-Lateral Load Calculations* for intermediate steps. The accompanying tables are from the calculation spreadsheets and summarize the assumptions made to obtain the loads.

The wind load is distinctly greater in the north-south direction because the building dimension normal to this direction is 270’ which is three times larger than that in the other direction. Though the wind load was calculated in both directions, the pressures and story shears are shown only for the north-south wind direction. In comparison, the wind condition subjects the building to much higher loads than the seismic condition; therefore, the wind condition controls in the design of the lateral resisting system.

Seismic Loading

D	Site Class - Section 1615.1.1
B	Seismic Design Category - Section 1616.3
II	Seismic Use Group – Section 1616.2
.300g	S_S, Spectral Accelerations for Short Periods - Section 1615.1
.075g	S_1, Spectral Accelerations for 1 Second Period - Section 1615.1
1.56	F_a, Site Coefficient - Table 1615.1.2(1)
2.4	F_v, Site Coefficient - Table 1615.1.2(2)
0.468	S_{MS}, Maximum Spectral Accelerations for Short Periods - Section 1615.1.2

0.18	S_{M1}, Maximum Spectral Accelerations for 1 Second Period - Section 1615.1.2
0.312	S_{DS}, Design Spectral Accelerations for Short Periods - Section 1615.1.3
0.12	S_{D1}, Design Spectral Accelerations for 1 Second Period - Section 1615.1.3
0.03	C_T , Building Period Coefficient - Section 1617.4.2.1
0.75	x
210.5 ft	h_n , Building Height - Section 1617.4.2.1
1.66	$T_a = C_T * h_n^{3/4}$ - Approximate Fundamental Period - Section 1617.4.2.1
0.077	$T_O = 0.2 * (S_{D1}/S_{DS})$- Section 1615.1.4
0.385	$T_S = S_{D1}/S_{DS}$ - Section 1615.1.4
0.072	S_a, Spectral Response Acceleration - Section 1615.1.4
1.25	I_e, Seismic Occupancy Importance Factor - Table 1604.5
5	R, Response Modification Factor - Table 1617.6
0.0780	C_S, Seismic Response Coefficient - Section 1617.4.1.1
0.0172	C_S (min) - Section 1617.4.1.1
0.0181	C_S (Max) - Section 1617.4.1.1
0.0181	C_S (Actual) - Section 1617.4.1.1
23,279 k	W, Effective Seismic Weight of Structure - Section 1617.4.1
421.2	$V = C_S * W$ - Seismic Base Shear - Section 1617.4.1
1.579	k, Distribution Exponent - Section 1617.4.3

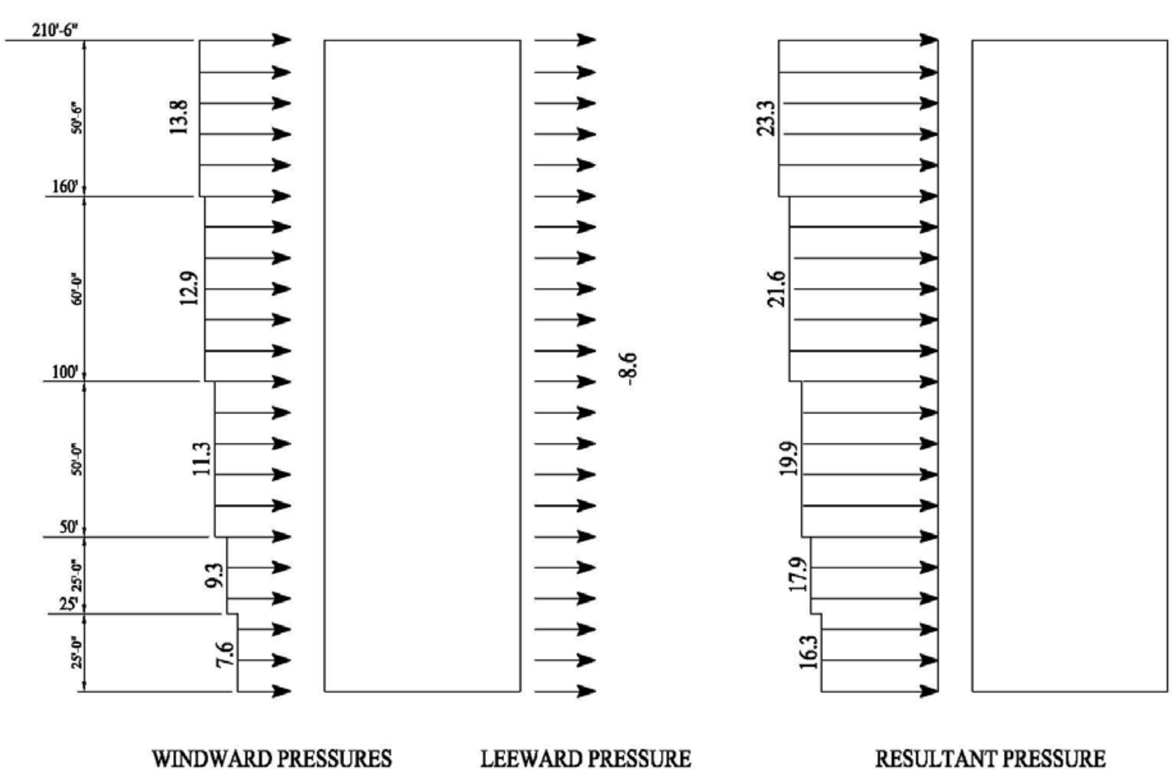


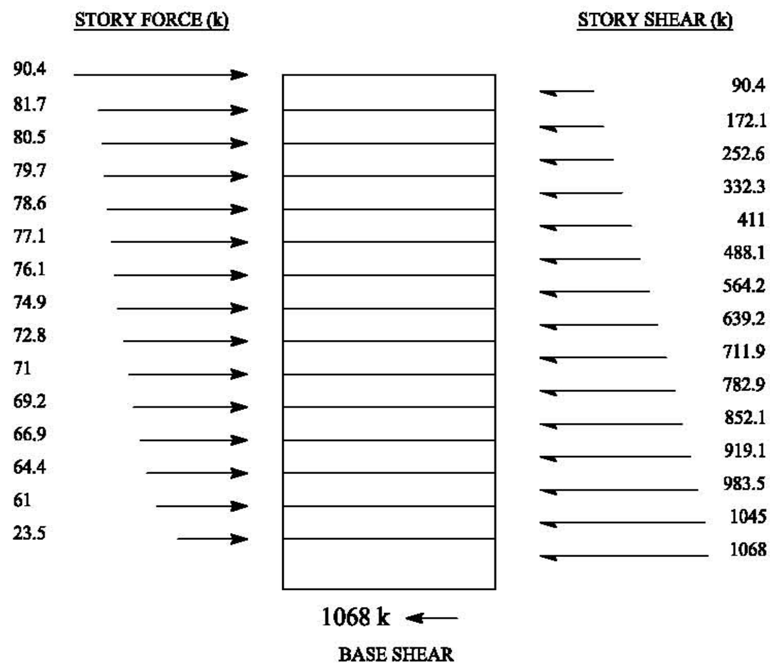
Wind Loading

When finding the wind loads on the building, it is assumed that the footprint of the building a 270'x88' rectangle.

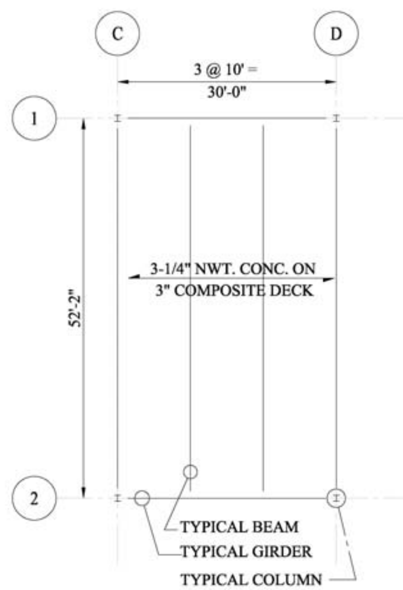
h	**210.50 ft**	*Mean Roof Height of Building*
H	**210.50 ft**	*Total Height of Roof*
Ct	**0.030**	*Fundamental Period Coefficient, ASCE 7-02 Table 9.5.5.3.2*
x	**0.750**	*Fundamental Period Factor, ASCE 7-02 Table 9.5.5.3.2*
Ta	**0.60 Hz**	*Structure is flexible so G will be calculated per ASCE Section 6.5.8.2*
Θ	**0.0 deg**	*Angle of Roof Slope*
V		*Basic Wind Speed, ASCE 7-02 Figure 6-1, IBC 2003 Figure 1609*
I	**1.00**	*Importance Factor for Wind, ASCE 7-02 Table 6-1, IBC 2003 Table 1604.5*
Exposure	**B**	*Exposure Category, ASCE 7-02 Section 6.5.6, IBC 2003 Section 1609.4*
Roof Diaphragm	**Flexible**	*Is roof diaphragm considered rigid or flexible??*
<u>Calculated Information</u>		
Height	HIGH	*"High" for Buildings >60', "Low" for Buildings < 60'*
Cp-w	0.8	*Windward Wall Pressure Coefficient, ASCE 7-02 Figure 6-6*
Cp-S	-0.7	*Side Wall Pressure Coefficient, ASCE 7-02 Figure 6-6*
K_d	0.85	*Wind Directionality Factor, ASCE 7-02 Table 6-4*
G_{cpi}	0.18	*Internal Pressure Coefficients for Enclosed Buildings, ASCE 7-02 Figure 6-5*

DESIGN PRESSURE (psf) FOR WINDS IN THE NORTH-SOUTH DIRECTION





FRAMING ELEMENT SPOT-CHECK



A beam, girder, column, and lateral element on level 8 have been spot-checked using gravity loads for comparison with the actual designed members. The typical bay from which these members were taken is illustrated to the right. These members are in the office areas and will be loaded with a dead load of 66 psf and a live load of 100 psf. A load combination of 1.2DL+1.6LL was used to find the ultimate, factored load in the gravity areas.

In order to aid in the spot-check of framing elements, a RAM Structural System model was constructed. Hand calculations and a RAM design summary can be found in *Appendix C-Spot-Checks*.

Gravity Elements

Beam Spot-Check

The beam shown in the plan above was chosen because of its long span, 52’-2”. It is designed as composite, and resulted in a member size of W24x55 with 54 shear studs when checked by hand. The RAM check yielded a member size of W27x84 with 34 shear studs and a 1” camber. These are similar to the actual design of the member, W24x55 with 68 shear studs. The difference in the number of shear studs could be due to the fact that the actual beam has a 2” camber.

Girder Spot-Check

The girder shown in the plan above is typical of what is found on every office floor. Spacing on one side is 52'-2" and 36' on the other. When checked by hand, a W24x76 [46] was found to be adequate. The RAM model produced a W30x99 [30] member. These are comparable to the actual design, W24x76 [34].

Column Spot-Check

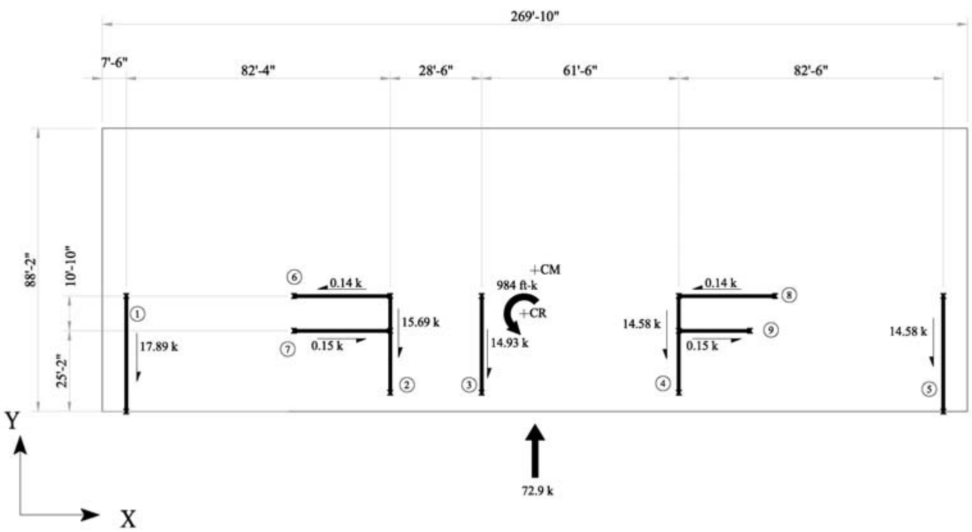
To check the column at C-2 on level 8, live load reductions per ASCE 7 Section 4.8 were utilized. A quick hand check of the loading condition for the column at C-2 yielded W14x159, as did the RAM model. The actual design value is a W14x176. The difference in member sizes can be attributed to the fact that the adjacent columns are W14x176's and the larger size was chosen for consistency. Also, the method used to find the moment on the column is approximate and may yield a higher moment contribution, causing the selection of a larger member.

Lateral Element

Hand Check

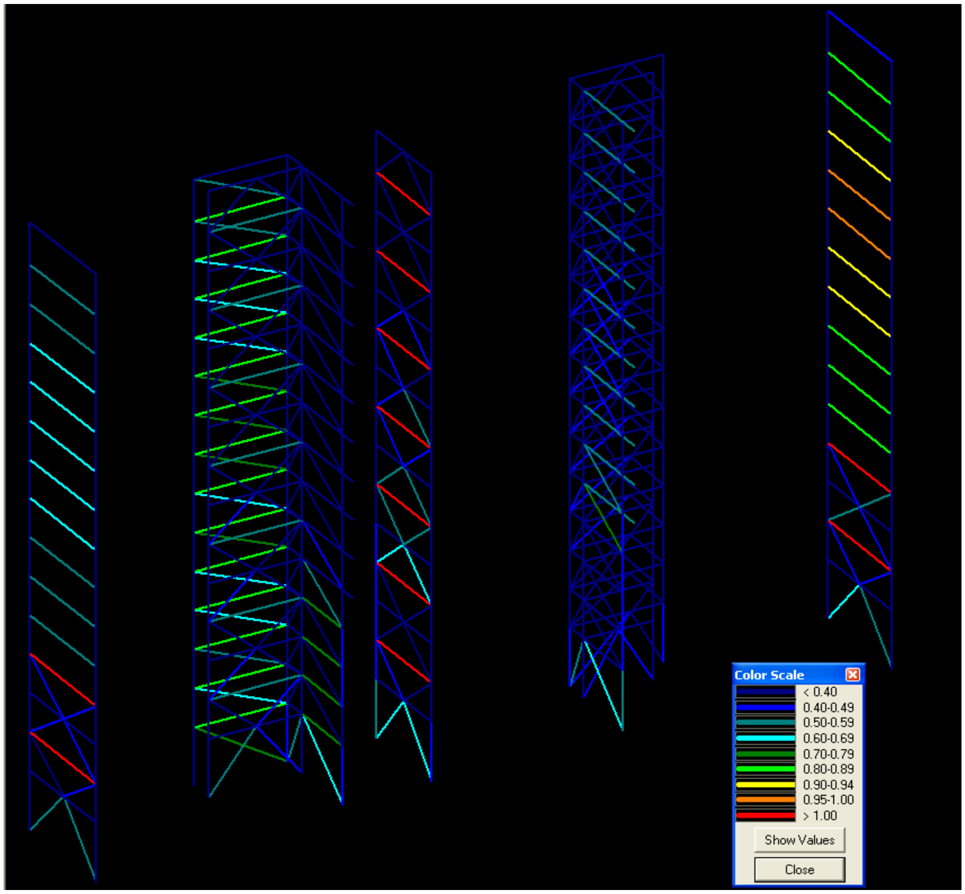
Again, analysis was performed on the 8th floor. For the preliminary spot check of framing elements, a few assumptions had to be made in order to use the simplified, Distribution by Method of Rigidity:

- Lateral distribution by method of rigidity is valid.
- The building is modeled as it was for wind loading, as a 270'x88' rectangle.
- Center of mass is at the center of rectangle.
- All of the lateral frames have equal stiffnesses.
- The story force acts at the center of mass, but the diaphragm rotates about the center of rigidity.



Please refer to *Appendix C.1-Hand Calculations* for details on the method. A summary of the loads on the frames is illustrated in the diagram above.

RAM Check



Since the lateral resisting frames are all different, so are their stiffnesses. In order to assist with the check of lateral resisting elements, a RAM model was built. Instead of re-designing the members according to the acquired loads, as was done in the previous checks, the designed elements were input to the model and checked accordingly. The moment frames were modeled with a fixed fixity in all directions, where the braced frames had pinned fixity in all directions. Load combinations were created according to IBC 2003 and ASCE 7. Using these combinations, RAM subjected the frames to the loads and used the LRFD interaction equation to determine if they would be acceptable.

Above is a diagram showing the code checks of these lateral members. The color coding corresponds to the interaction equation. It is a gradient from blue to red where values are less than 0.4 and greater than 1.0, respectively. Members that are unacceptable are displayed in red.

APPENDICES

APPENDIX A: Floor Framing Plans

APPENDIX B: Load Calculations

B.1 Lateral Load Calculations

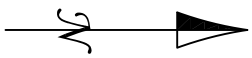
B.2 Snow Load Calculations

APPENDIX C: Spot Checks

C.1 Hand Calculations

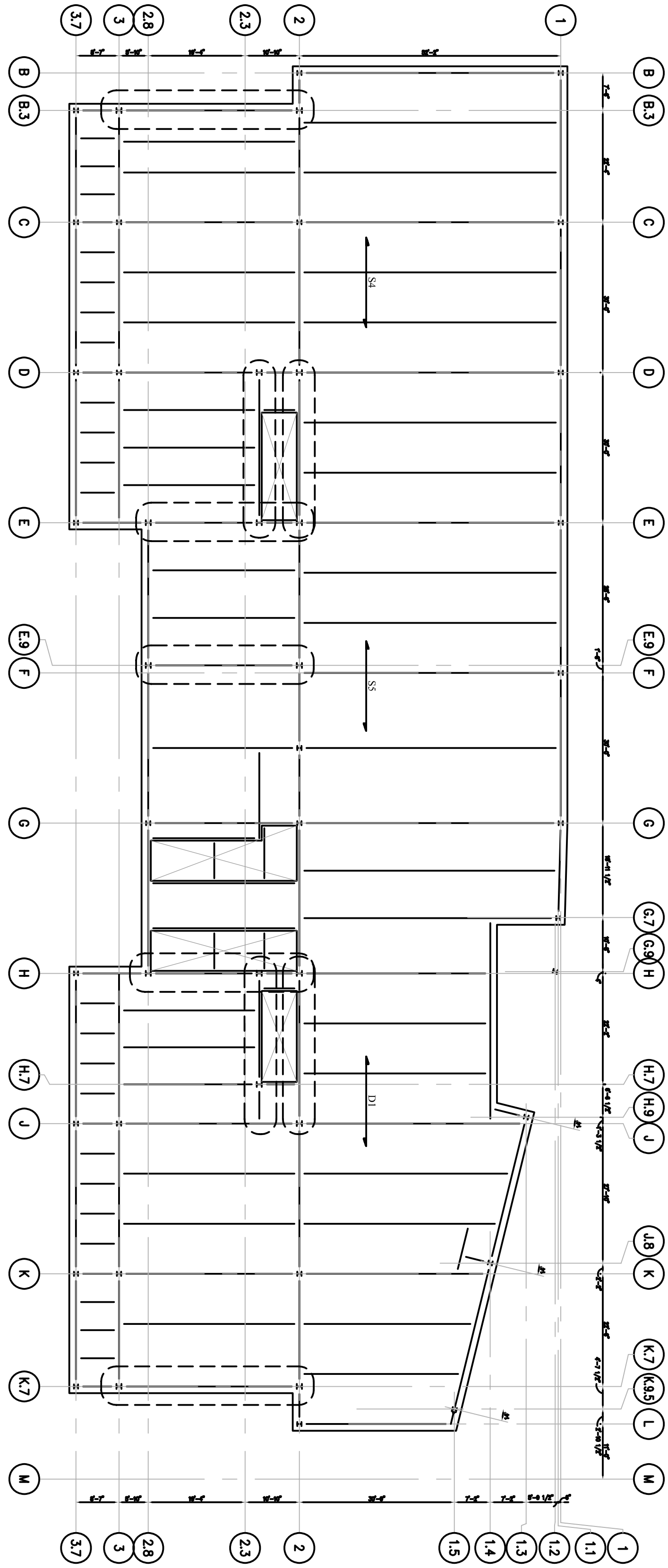
C.2 RAM Output

APPENDIX A: Floor Framing Plans



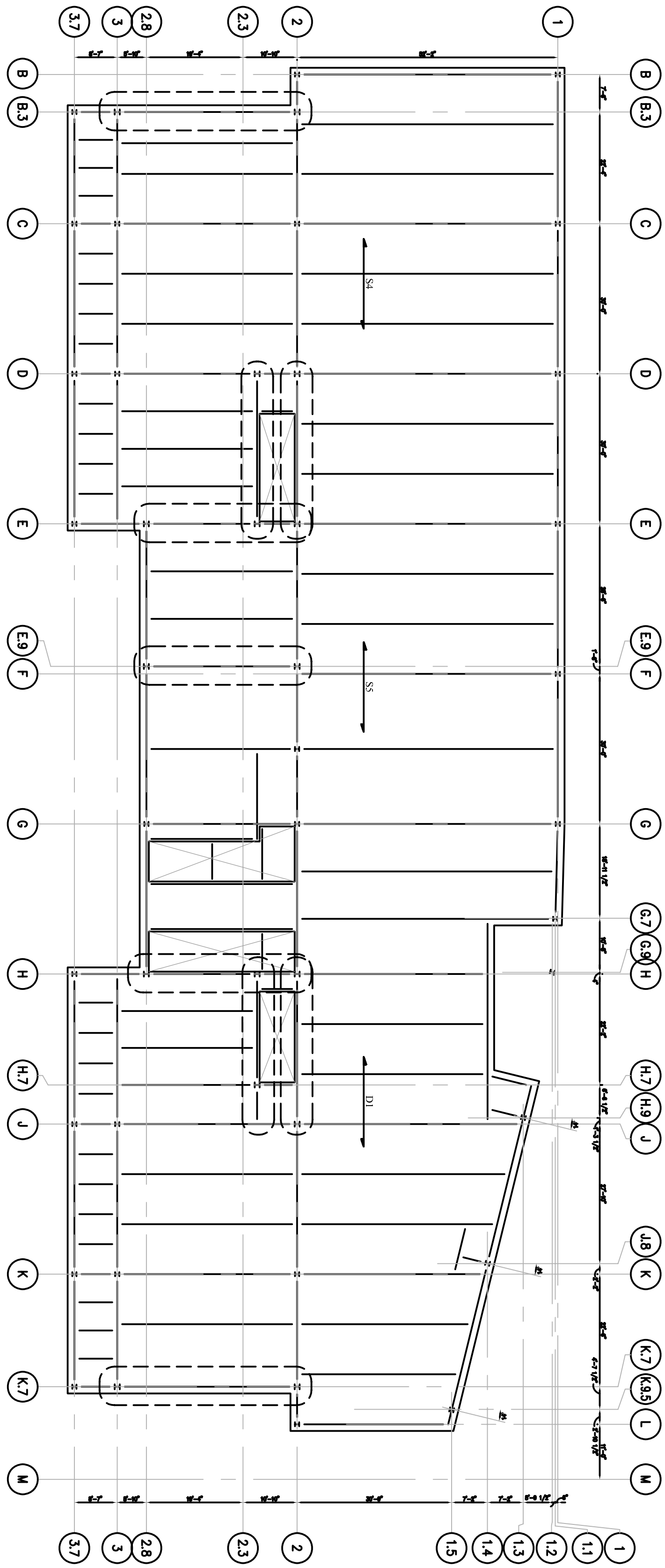
2nd FLOOR FRAMING PLAN

1. DECK OVERHANG IS 16"
2. S4 REFERS TO 3-1/4" NWT. CONC. ON 3" 20 GAGE COMPOSITE LOK-FLOOR DECK, UNSHORED.
3. S5 REFERS TO 3-1/4" NWT. CONC. ON 3" 16 GAGE COMPOSITELOK-FLOOR DECK, SHORED.



GATEWAY PLAZA
500 DELAWARE AVE.
WILMINGTON, DE

2nd FLOOR FRAMING PLAN	
APPENDIX A - FRAMING PLANS	
SCALE: 1/32"=1'-0"	PAGE: 2 OF 8



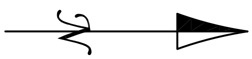
3rd FLOOR FRAMING PLAN

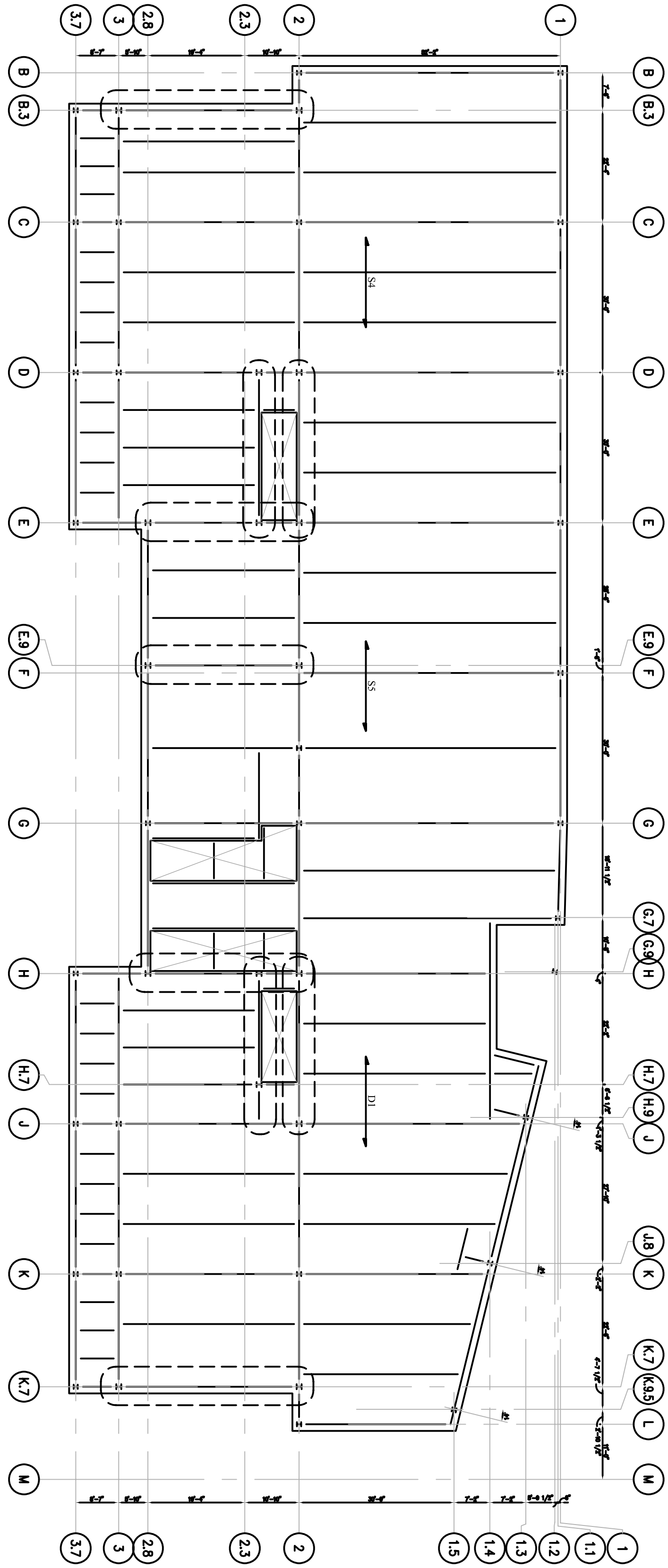
1. DECK OVERHANG IS 16"
2. S4 REFERS TO 3-1/4" NWT. CONC. ON 3" 20 GAGE COMPOSITE LOK-FLOOR DECK, UNSHORED.
3. S5 REFERS TO 3-1/4" NWT. CONC. ON 3" 16 GAGE COMPOSITELOK-FLOOR DECK, SHORED.

GATEWAY PLAZA

500 DELAWARE AVE.
WILMINGTON, DE

3rd FLOOR FRAMING PLAN	
APPENDIX A - FRAMING PLANS	
SCALE: 1/32"=1'-0"	PAGE: 3 OF 8

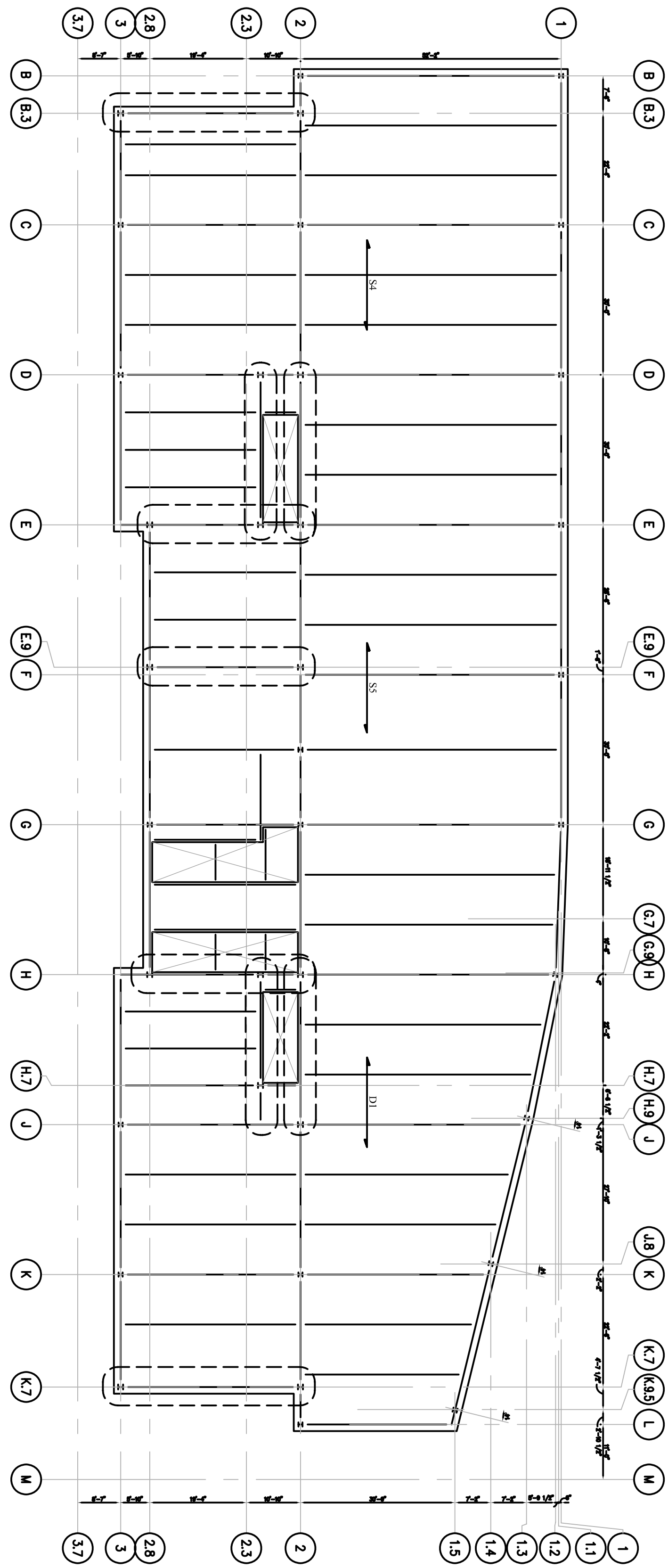




4th FLOOR FRAMING PLAN

1. DECK OVERHANG IS 16"
2. S4 REFERS TO 3-1/4" NWT. CONC. ON 3" 20 GAGE COMPOSITE LOK-FLOOR DECK, UNSHORED.
3. S5 REFERS TO 3-1/4" NWT. CONC. ON 3" 16 GAGE COMPOSITELOK-FLOOR DECK, SHORED.

GATEWAY PLAZA 500 DELAWARE AVE. WILMINGTON, DE	4th FLOOR FRAMING PLAN APPENDIX A - FRAMING PLANS SCALE: 1/32"=1'-0" PAGE: 4 OF 8



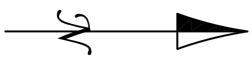
5th FLOOR FRAMING PLAN

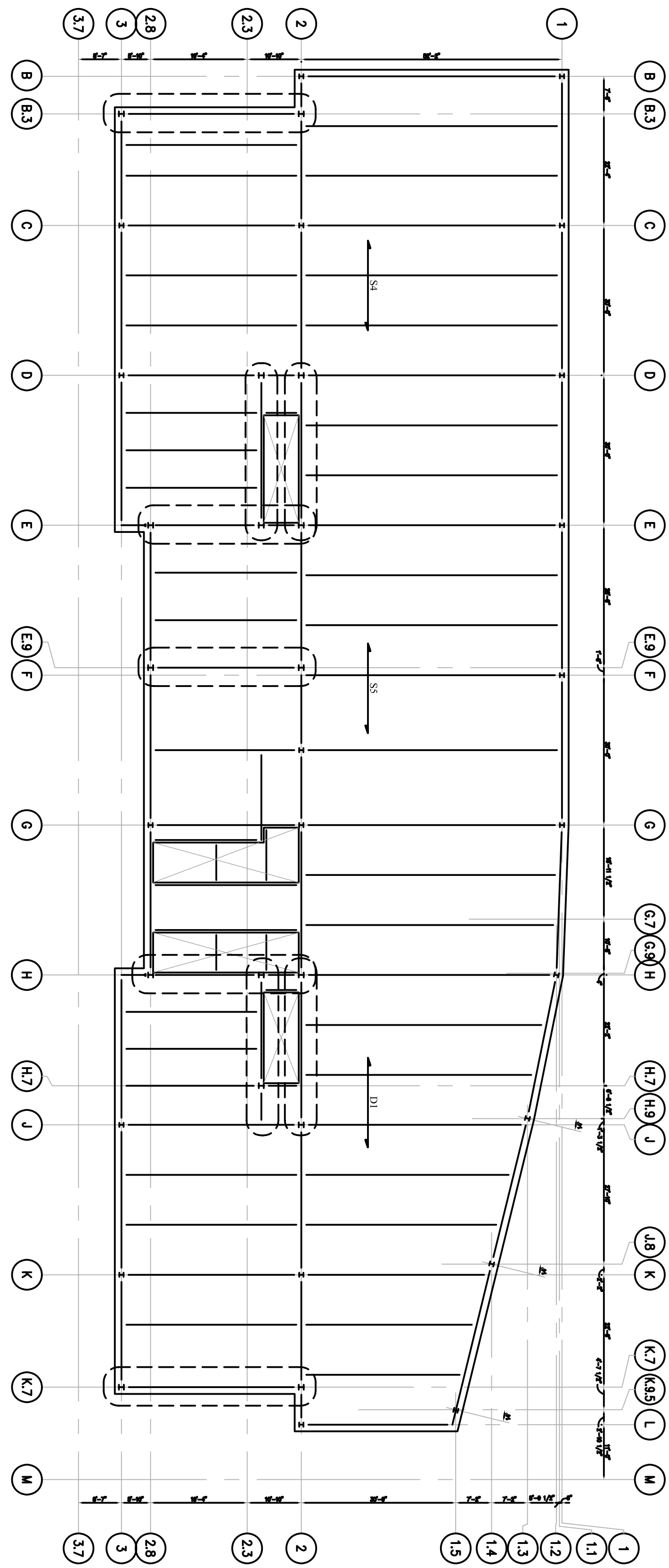
1. DECK OVERHANG IS 16"
2. S4 REFERS TO 3-1/4" NWT. CONC. ON 3" 20 GAGE COMPOSITE LOK-FLOOR DECK, UNSHORED.
3. S5 REFERS TO 3-1/4" NWT. CONC. ON 3" 16 GAGE COMPOSITELOK-FLOOR DECK, SHORED.
4. D1 REFERS TO 2-1/2" ROOF DECK.

GATEWAY PLAZA

500 DELAWARE AVE.
WILMINGTON, DE

5th FLOOR FRAMING PLAN	
APPENDIX A - FRAMING PLANS	
SCALE: 1/32"=1'-0"	PAGE: 5 OF 8





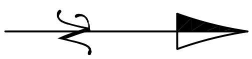
TYPICAL FLOOR FRAMING PLAN

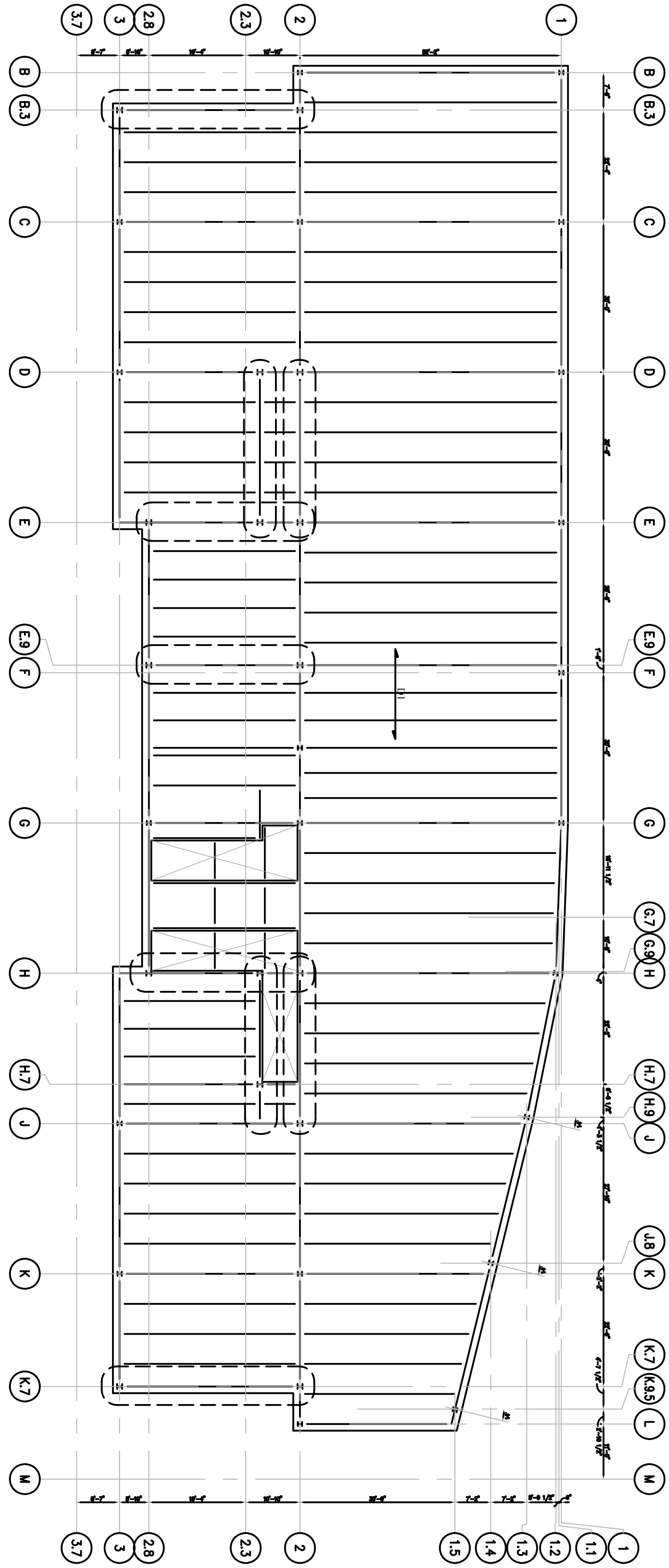
1. DECK OVERHANG IS 16"
2. S4 REFERS TO 3-1/4" NWT. CONC. ON 3" 20 GAGE COMPOSITE LOK-FLOOR DECK, UNSHORED.
3. S5 REFERS TO 3-1/4" NWT. CONC. ON 3" 16 GAGE COMPOSITELOK-FLOOR DECK, SHORED.

GATEWAY PLAZA

500 DELAWARE AVE.
WILMINGTON, DE

TYPICAL FLOOR FRAMING PLAN (5-15)	
APPENDIX A - FRAMING PLANS	
SCALE: 1/32"=1'-0"	PAGE: 6 OF 8





ROOF/PENTHOUSE FRAMING PLAN

1. D1 REFERS TO 2-1/2" ROOF DECK.

GATEWAY PLAZA

500 DELAWARE AVE.
WILMINGTON, DE

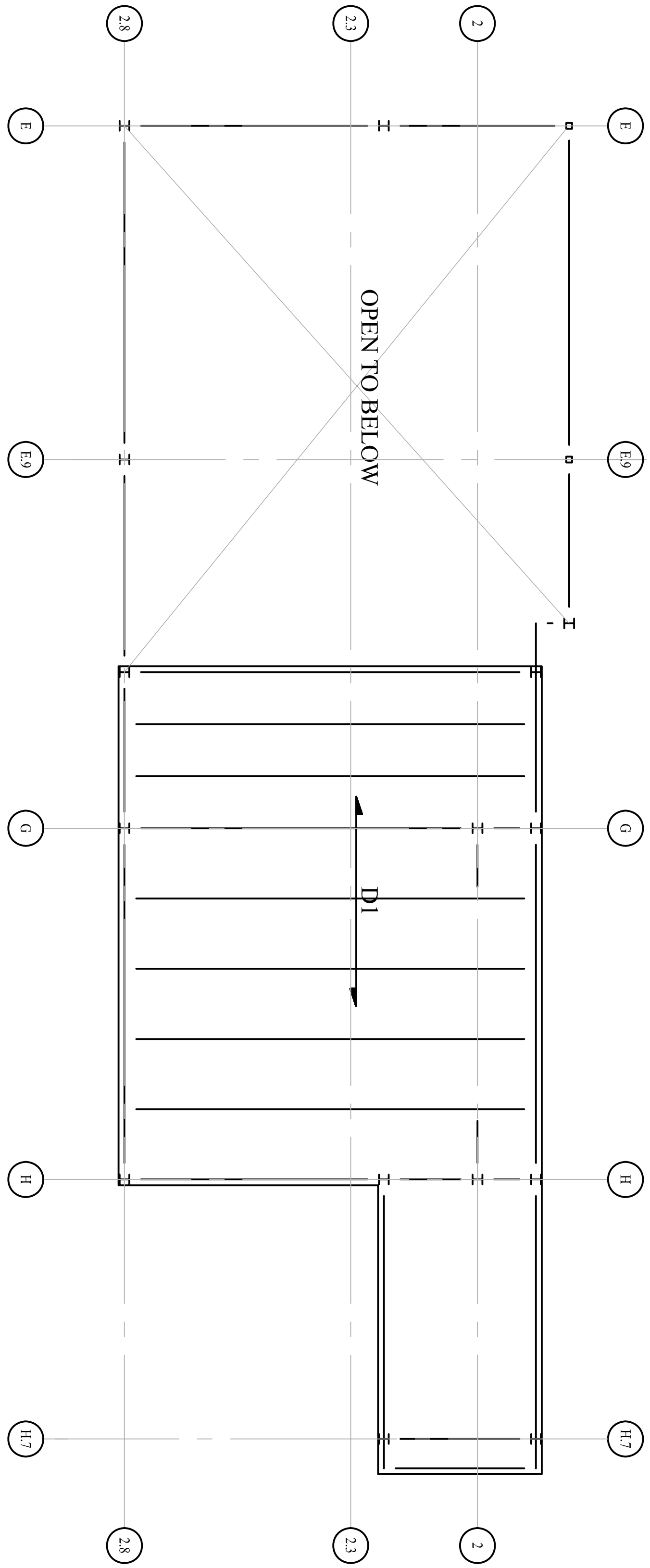
ROOF FRAMING PLAN

APPENDIX A - FRAMING PLANS

SCALE: 1/32"=1'-0"

PENTHOUSE ROOF FRAMING PLAN

1. D1 REFERS TO 2-1/2" ROOF DECK.



GATEWAY PLAZA 500 DELAWARE AVE. WILMINGTON, DE	PENTHOSUE ROOF FRAMING PLAN APPENDIX A - FRAMING PLANS SCALE: 1/32"=1'-0" — PAGE: 8 OF 8

Appendix B: Load Calculations

B.1.1 Wind Load Calculations

Design Wind Pressures
Title

Gateway Plaza, Wilmington, DE
Project Name

Per IBC 2003 and ASCE 7-02
Reference

Input Information

	L: Length of Building in X- Direction	B: Length of Building in Y - Direction	L/B	B/L	Story Heights (ft)	Building Story Height (ft)
						210.50 ft
R	270.00 ft	88.00 ft	3.07	0.33	14.50 ft	210.50 ft
15	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	196.00 ft
14	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	182.50 ft
13	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	169.00 ft
12	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	155.50 ft
11	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	142.00 ft
10	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	128.50 ft
9	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	115.00 ft
8	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	101.50 ft
7	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	88.00 ft
6	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	74.50 ft
5	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	61.00 ft
4	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	47.50 ft
3	270.00 ft	88.00 ft	3.07	0.33	13.50 ft	34.00 ft
2	270.00 ft	88.00 ft	3.07	0.33	10.25 ft	20.50 ft
Int.	270.00 ft	88.00 ft	3.07	0.33	10.25 ft	10.25 ft
					210.50 ft	

h	210.50 ft	*Mean Roof Height of Building*
H	210.50 ft	*Total Height of Roof*
Ct	0.030	*Fundamental Period Coefficient, ASCE 7-02 Table 9.5.5.3.2*
x	0.750	*Fundamental Period Factor, ASCE 7-02 Table 9.5.5.3.2*
Ta	0.60 Hz	*Structure is flexible so G will be calculated per ASCE Section 6.5.8.2*
Θ	0.0 deg	*Angle of Roof Slope*
V	90 mph	*Basic Wind Speed, ASCE 7-02 Figure 6-1, IBC 2003 Figure 1609*
I	1.00	*Importance Factor for Wind, ASCE 7-02 Table 6-1, IBC 2003 Table 1604.5*
Exposure	B	*Exposure Category, ASCE 7-02 Section 6.5.6, IBC 2003 Section 1609.4*
Roof Diapragm	2	*Is roof diaphragm considered rigid or flexible??*

Calculated Information

Height	HIGH	*"High" for Buildings >60', "Low" for Buildings < 60'*
Cp-w	0.8	*Windward Wall Pressure Coefficient, ASCE 7-02 Figure 6-6*
Cp-S	-0.7	*Side Wall Pressure Coefficient, ASCE 7-02 Figure 6-6*
Kd	0.85	*Wind Directionality Factor, ASCE 7-02 Table 6-4*
Gcpi	0.18	*Internal Pressure Coefficients for Enclosed Buildings, ASCE 7-02 Figure 6-5*

Gust Effect Calculations
Title

Gateway Plaza, Wilmington, DE
Project Name

Per IBC 2003 and ASCE 7-02
Reference

Criteria			Reference/Description
h	210.5		height of building
zmin	30		RIGID: From Table 6-2 of ASCE 7-02
zbar	126.3		RIGID: 0.6*h > zmin: ASCE 7-02 Section 6.5.8
c	0.3		RIGID: From Table 6-2 of ASCE
g_q	3.4		per section 6.5.8.1 and 6.5.8.2 of ASCE 7-02
g_v	3.4		per section 6.5.8.1 and 6.5.8.2 of ASCE 7-02
l	320		RIGID: Table 6-2 of ASCE 7-02
e	0.33		RIGID: Table 6-2 of ASCE 7-02
n_1, Y-dir	0.561		Natural Period
n_1, X-dir	0.81		Natural Period
β	0.05		Damping Factor
V	90		Basic Wind Speed
βbar	0.45		FLEXIBLE: Table 6-2 ASCE 7-02
αbar	0.25		FLEXIBLE: Table 6-2 ASCE 7-02
I_z	0.239868		Equation 6-5 ASCE 7-02
L_z	500.5264		Equation 6-7 ASCE 7-02
	Y - Direction	X - Direction	
g_r	4.049343	4.138937	FLEXIBLE: Equation 6-9
V_z	75.52941	75.52941	FLEXIBLE: Equation 6-14
h_h	10.38434	10.38434	FLEXIBLE: Section 6.5.8.2
R_h	0.091662	0.091662	FLEXIBLE: Section 6.5.8.2
N_1	5.367795	5.367795	FLEXIBLE: Equation 6-12
R_n	0.048501	0.048501	FLEXIBLE: Equation 6-11

Gust Effect Calculations
Title

Gateway Plaza, Wilmington, DE
Project Name

Per IBC 2003 and ASCE 7-02
Reference

Stiff Building Calculations / Flexible Building Calculations

Level	Height	B	L	Q	G stiff X-dir	nl	nb	Rl	Rb	R	G flex X-dir
Int.	10.25	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
3	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
4	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
5	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
6	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
7	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
8	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
9	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
10	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
11	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
12	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
13	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
14	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
15	13.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
R	14.5	88	270	0.829	0.833	44.592	4.341	0.0222	0.204	0.099	0.838
0	0	0	0	0.856	0.848	0.000	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Stiff Building Calculations / Flexible Building Calculations

Level	Height	B	L		G stiff Y-dir	nl	nb	Rl	Rb	R	G flex Y-dir
Int.	10.25	270	88	0.787	0.811	10.066	9.225	0.0944	0.103	0.072	0.813
3	13.5	270	88	0.787	0.811	10.066	9.225	0.0944	0.103	0.072	0.813
4	13.5	270	88	0.787	0.811	10.066	9.225	0.0944	0.103	0.072	0.813
5	13.5	270	88	0.787	0.811	10.066	9.225	0.0944	0.103	0.072	0.813
6	13.5	270	88	0.787	0.811	10.066	9.225	0.0944	0.103	0.072	0.813
7	13.5	270	88	0.787	0.811	10.066	9.225	0.0944	0.103	0.072	0.813
8	13.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
9	13.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
10	13.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
11	13.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
12	13.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
13	13.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
14	13.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
15	13.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
R	14.5	270	88	0.787	0.811	14.534	13.320	0.0664	0.072	0.060	0.812
0	0	0	0	0.856	0.848	0.000	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Summary

h			G flex Y-dir	G flex X-dir		height	par to short	par to long
10	0	1	0.813	0.838	1	0	0.813	0.838
24	20	3	0.813	0.838	2	15	0.813	0.838
37.3	30	5	0.813	0.838	3	20	0.813	0.838
50.8	50	7	0.813	0.838	4	25	0.813	0.838
64	60	8	0.813	0.838	5	30	0.813	0.838
78	70	9	0.813	0.838	6	40	0.813	0.838
91	90	11	0.812	0.838	7	50	0.813	0.838
105	100	12	0.812	0.838	8	60	0.813	0.838
118	110	13	0.812	0.838	9	70	0.813	0.838
132	130	15	0.812	0.838	10	80	0.813	0.838
145	140	16	0.812	0.838	11	90	0.812	0.838
159	150	17	0.812	0.838	12	100	0.812	0.838
172	170	19	0.812	0.838	13	110	0.812	0.838
172	170	19	#DIV/0!	#DIV/0!	14	120	0.812	0.838
					15	130	0.812	0.838

Design Wind Pressures

Title

Gateway Plaza, Wilmington, DE

Project Name

Per IBC 2003 and ASCE 7-02

Reference

Design Wind Pressures on Main-Wind-Force-Resisting-Systems

ASCE Section 6.5

Height above ground level, z	Kz	G X-Dir	G Y-Dir	L/B	B/L	Cp Leeward X-Dir	Cp Leeward Y-Dir	Velocity Pressure, qz	Velocity Pressure, qh	Design Windward Wall Pressure in X- Dir	Design Windward Wall Pressure in Y-Dir	Design Leeward Wall Pressure in X-Dir	Design Leeward Wall Pressure in Y-Dir	Total Pressure for MWFRS in X Dir	Total Pressure for MWFRS in Y Dir	Building Floor Elevation
0 ft	0.575	0.8378	0.8131	3.07	0.33	-0.248	-0.500	10.1 psf	21.2 psf	6.8 psf	6.6 psf	-4.4 psf	-8.6 psf	**11.2 psf**	**15.2 psf**	10.25 ft
15 ft	0.575	0.8378	0.8131	3.07	0.33	-0.248	-0.500	10.1 psf	21.2 psf	6.8 psf	6.6 psf	-4.4 psf	-8.6 psf	**11.2 psf**	**15.2 psf**	20.50 ft
20 ft	0.624	0.8378	0.8131	3.07	0.33	-0.248	-0.500	11.0 psf	21.2 psf	7.4 psf	7.2 psf	-4.4 psf	-8.6 psf	**11.8 psf**	**15.8 psf**	34.00 ft
25 ft	0.665	0.8378	0.8131	3.07	0.33	-0.248	-0.500	11.7 psf	21.2 psf	7.9 psf	7.6 psf	-4.4 psf	-8.6 psf	**12.3 psf**	**16.3 psf**	47.50 ft
30 ft	0.701	0.8378	0.8131	3.07	0.33	-0.248	-0.500	12.3 psf	21.2 psf	8.3 psf	8.0 psf	-4.4 psf	-8.6 psf	**12.7 psf**	**16.7 psf**	61.00 ft
40 ft	0.761	0.8378	0.8131	3.07	0.33	-0.248	-0.500	13.4 psf	21.2 psf	9.0 psf	8.7 psf	-4.4 psf	-8.6 psf	**13.4 psf**	**17.4 psf**	74.50 ft
50 ft	0.811	0.8378	0.8131	3.07	0.33	-0.248	-0.500	14.3 psf	21.2 psf	9.6 psf	9.3 psf	-4.4 psf	-8.6 psf	**14.0 psf**	**17.9 psf**	88.00 ft
60 ft	0.854	0.8378	0.8131	3.07	0.33	-0.248	-0.500	15.1 psf	21.2 psf	10.1 psf	9.8 psf	-4.4 psf	-8.6 psf	**14.5 psf**	**18.4 psf**	101.50 ft
70 ft	0.892	0.8378	0.8131	3.07	0.33	-0.248	-0.500	15.7 psf	21.2 psf	10.5 psf	10.2 psf	-4.4 psf	-8.6 psf	**14.9 psf**	**18.9 psf**	115.00 ft
80 ft	0.927	0.8378	0.8131	3.07	0.33	-0.248	-0.500	16.3 psf	21.2 psf	11.0 psf	10.6 psf	-4.4 psf	-8.6 psf	**15.4 psf**	**19.3 psf**	128.50 ft
90 ft	0.959	0.8378	0.8124	3.07	0.33	-0.248	-0.500	16.9 psf	21.2 psf	11.3 psf	11.0 psf	-4.4 psf	-8.6 psf	**15.7 psf**	**19.6 psf**	142.00 ft
100 ft	0.988	0.8378	0.8124	3.07	0.33	-0.248	-0.500	17.4 psf	21.2 psf	11.7 psf	11.3 psf	-4.4 psf	-8.6 psf	**16.1 psf**	**19.9 psf**	155.50 ft
120 ft	1.041	0.8378	0.8124	3.07	0.33	-0.248	-0.500	18.3 psf	21.2 psf	12.3 psf	11.9 psf	-4.4 psf	-8.6 psf	**16.7 psf**	**20.6 psf**	169.00 ft
140 ft	1.088	0.8378	0.8124	3.07	0.33	-0.248	-0.500	19.2 psf	21.2 psf	12.9 psf	12.5 psf	-4.4 psf	-8.6 psf	**17.3 psf**	**21.1 psf**	182.50 ft
160 ft	1.130	0.8378	0.8124	3.07	0.33	-0.248	-0.500	19.9 psf	21.2 psf	13.4 psf	12.9 psf	-4.4 psf	-8.6 psf	**17.8 psf**	**21.6 psf**	196.00 ft
180 ft	1.169	0.8378	0.8124	3.07	0.33	-0.248	-0.500	20.6 psf	21.2 psf	13.8 psf	13.4 psf	-4.4 psf	-8.6 psf	**18.2 psf**	**22.0 psf**	210.50 ft
200 ft	1.205	0.8378	0.8124	3.07	0.33	-0.248	-0.500	21.2 psf	21.2 psf	14.2 psf	13.8 psf	-4.4 psf	-8.6 psf	**18.6 psf**	**22.4 psf**	210.50 ft
250 ft	1.284	0.8378	0.8124	3.07	0.33	-0.248	-0.500	22.6 psf	21.2 psf	15.2 psf	14.7 psf	-4.4 psf	-8.6 psf	**19.6 psf**	**23.3 psf**	
300 ft	1.353	0.8378	0.8124													
350 ft	1.414	0.8378	0.8124													
400 ft	1.469	0.8378	0.8124													
450 ft	1.519	0.8378	0.8124													
500 ft	1.565	0.8378	0.8124													

Design Wind Pressures
Title

Gateway Plaza, Wilmington, DE
Project Name

Per IBC 2003 and ASCE 7-02
Reference

Total Pressure for Frames Resisting Wind Forces Parellel to Y Direction

Total, Windward, Leeward? Total

Height above ground level, z	Total Design Pressure	0.5	2	3	4	5	6	7	8	9	10	11	12	13	14	15	R
Floor To Floor Heights		**10.25 ft**	**10.25 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**14.50 ft**
Story Elevations		10.25 ft	20.50 ft	34.00 ft	47.50 ft	61.00 ft	74.50 ft	88.00 ft	101.50 ft	115.00 ft	128.50 ft	142.00 ft	155.50 ft	169.00 ft	182.50 ft	196.00 ft	210.50 ft
Mid - Story Elevations		15.38 ft	27.25 ft	40.75 ft	54.25 ft	67.75 ft	81.25 ft	94.75 ft	108.25 ft	121.75 ft	135.25 ft	148.75 ft	162.25 ft	175.75 ft	189.25 ft	203.25 ft	210.50 ft
0 ft	15.2 psf																
20 ft	15.8 psf		78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf	78.9 plf
25 ft	16.3 psf		8.1 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf	81.3 plf
30 ft	16.7 psf			83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf	83.3 plf
40 ft	17.4 psf			69.4 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf	173.5 plf
50 ft	17.9 psf				134.5 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf	179.3 plf
60 ft	18.4 psf					184.2 plf	184.2 plf	184.2 plf	184.2 plf	184.2 plf	184.2 plf	184.2 plf	184.2 plf	184.2 plf	184.2 plf	184.2 plf	184.2 plf
70 ft	18.9 psf					18.9 plf	188.7 plf	188.7 plf	188.7 plf	188.7 plf	188.7 plf	188.7 plf	188.7 plf	188.7 plf	188.7 plf	188.7 plf	188.7 plf
80 ft	19.3 psf						86.7 plf	192.6 plf	192.6 plf	192.6 plf	192.6 plf	192.6 plf	192.6 plf	192.6 plf	192.6 plf	192.6 plf	192.6 plf
90 ft	19.6 psf							156.9 plf	196.1 plf	196.1 plf	196.1 plf	196.1 plf	196.1 plf	196.1 plf	196.1 plf	196.1 plf	196.1 plf
100 ft	19.9 psf								199.5 plf	199.5 plf	199.5 plf	199.5 plf	199.5 plf	199.5 plf	199.5 plf	199.5 plf	199.5 plf
120 ft	20.6 psf								30.8 plf	308.3 plf	411.0 plf	411.0 plf	411.0 plf	411.0 plf	411.0 plf	411.0 plf	411.0 plf
140 ft	21.1 psf										179.3 plf	421.8 plf	421.8 plf	421.8 plf	421.8 plf	421.8 plf	421.8 plf
160 ft	21.6 psf											43.1 plf	334.4 plf	431.5 plf	431.5 plf	431.5 plf	431.5 plf
180 ft	22.0 psf													198.1 plf	440.3 plf	440.3 plf	440.3 plf
200 ft	22.4 psf														56.1 plf	358.8 plf	448.5 plf
250 ft	23.3 psf																245.0 plf
300 ft																	
350 ft																	
400 ft																	
450 ft																	
500 ft																	
Total Story Shear @ Floor		0 plf	87 plf	313 plf	552 plf	799 plf	1056 plf	1319 plf	1588 plf	1866 plf	2148 plf	2433 plf	2725 plf	3020 plf	3318 plf	3621 plf	3956 plf
Story Force per Floor		**0.000 klf**	**0.087 klf**	**0.226 klf**	**0.239 klf**	**0.248 klf**	**0.256 klf**	**0.263 klf**	**0.270 klf**	**0.277 klf**	**0.282 klf**	**0.286 klf**	**0.291 klf**	**0.295 klf**	**0.298 klf**	**0.303 klf**	**0.335 klf**

Total Wind Force on MWFRS in Y Direction

Floor Level	0.5	2	3	4	5	6	7	8	9	10	11	12	13	14	15	R
Length of Building	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**	**270.0 ft**
Frame Story Force per Floor	0.0 k	23.5 k	61.0 k	64.4 k	66.9 k	69.2 k	71.0 k	72.8 k	74.9 k	76.1 k	77.1 k	78.6 k	79.7 k	80.5 k	81.7 k	90.4 k
Frame Story Shear per Floor	1068.0 k	1068.0 k	1044.5 k	983.5 k	919.1 k	852.1 k	782.9 k	711.9 k	639.2 k	564.2 k	488.1 k	411.0 k	332.3 k	252.6 k	172.1 k	90.4 k

Design Wind Pressures
Title

Gateway Plaza, Wilmington, DE
Project Name

Per IBC 2003 and ASCE 7-02
Reference

Total Pressure for Frames Resisting Wind Forces Parellel to X Direction

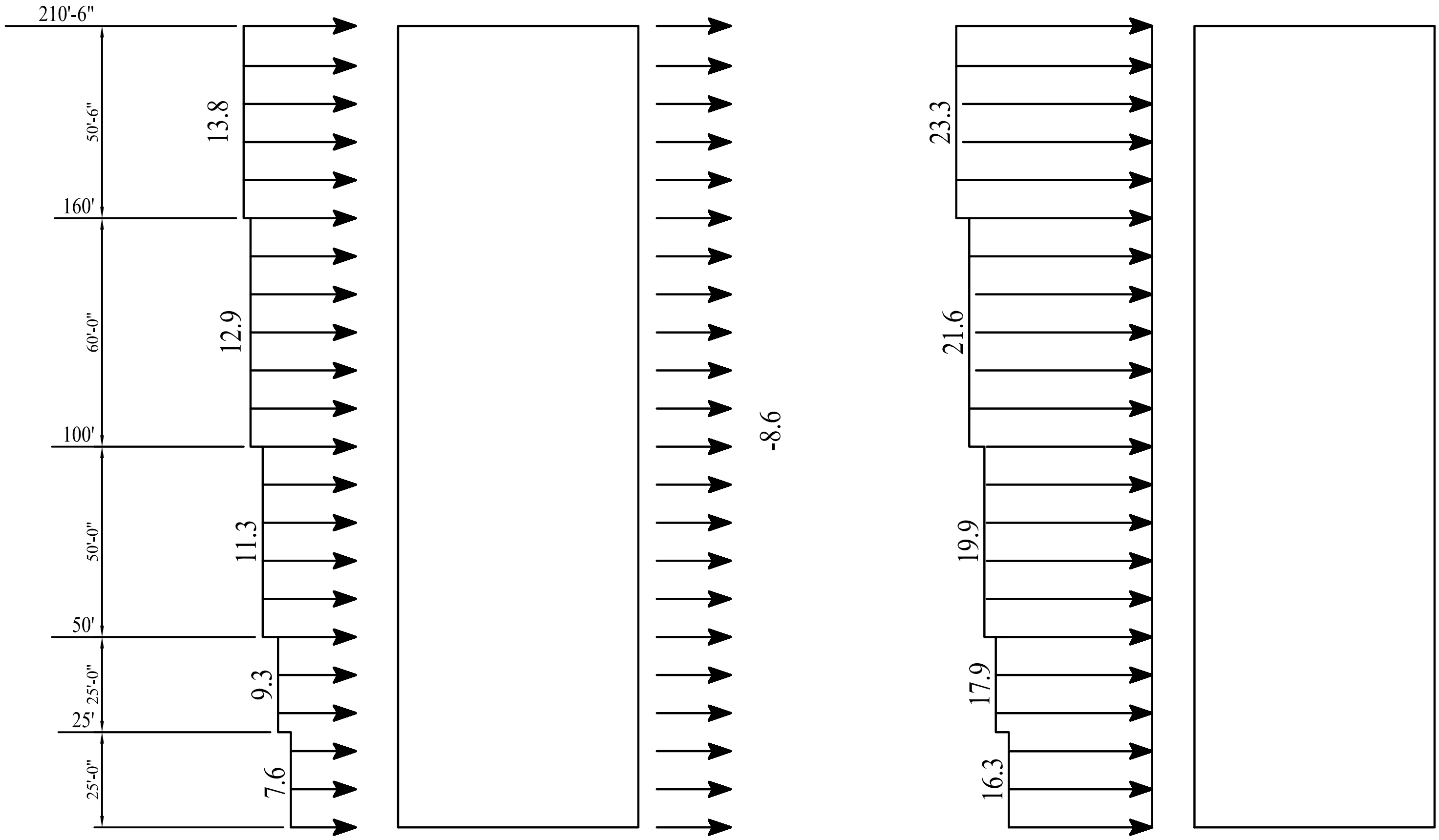
Total, Windward, Leeward? Total

Height above ground level, z	Total Design Pressure	Int.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	R
Floor To Floor Heights		**10.25 ft**	**10.25 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**13.50 ft**	**14.50 ft**
Story Elevations		10.25 ft	20.50 ft	34.00 ft	47.50 ft	61.00 ft	74.50 ft	88.00 ft	101.50 ft	115.00 ft	128.50 ft	142.00 ft	155.50 ft	169.00 ft	182.50 ft	196.00 ft	210.50 ft
Mid - Story Elevations		15.38 ft	27.25 ft	40.75 ft	54.25 ft	67.75 ft	81.25 ft	94.75 ft	108.25 ft	121.75 ft	135.25 ft	148.75 ft	162.25 ft	175.75 ft	189.25 ft	203.25 ft	210.50 ft
0 ft	11.2 psf																
20 ft	11.8 psf		58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf	58.9 plf
25 ft	12.3 psf		6.1 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf	61.3 plf
30 ft	12.7 psf			63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf	63.4 plf
40 ft	13.4 psf			53.6 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf	133.9 plf
50 ft	14.0 psf				104.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf	139.8 plf
60 ft	14.5 psf					144.9 plf	144.9 plf	144.9 plf	144.9 plf	144.9 plf	144.9 plf	144.9 plf	144.9 plf	144.9 plf	144.9 plf	144.9 plf	144.9 plf
70 ft	14.9 psf					14.9 plf	149.5 plf	149.5 plf	149.5 plf	149.5 plf	149.5 plf	149.5 plf	149.5 plf	149.5 plf	149.5 plf	149.5 plf	149.5 plf
80 ft	15.4 psf						69.1 plf	153.6 plf	153.6 plf	153.6 plf	153.6 plf	153.6 plf	153.6 plf	153.6 plf	153.6 plf	153.6 plf	153.6 plf
90 ft	15.7 psf							125.8 plf	157.3 plf	157.3 plf	157.3 plf	157.3 plf	157.3 plf	157.3 plf	157.3 plf	157.3 plf	157.3 plf
100 ft	16.1 psf								160.8 plf	160.8 plf	160.8 plf	160.8 plf	160.8 plf	160.8 plf	160.8 plf	160.8 plf	160.8 plf
120 ft	16.7 psf								25.1 plf	250.5 plf	334.0 plf	334.0 plf	334.0 plf	334.0 plf	334.0 plf	334.0 plf	334.0 plf
140 ft	17.3 psf										146.7 plf	345.1 plf	345.1 plf	345.1 plf	345.1 plf	345.1 plf	345.1 plf
160 ft	17.8 psf											35.5 plf	275.2 plf	355.1 plf	355.1 plf	355.1 plf	355.1 plf
180 ft	18.2 psf													163.9 plf	364.2 plf	364.2 plf	364.2 plf
200 ft	18.6 psf														46.6 plf	298.1 plf	372.7 plf
250 ft	19.6 psf																205.5 plf
300 ft																	
350 ft																	
400 ft																	
450 ft																	
500 ft																	
Total Story Shear @ Floor		0.0 plf	65.0 plf	237.1 plf	422.3 plf	617.1 plf	820.7 plf	1031.0 plf	1248.3 plf	1473.8 plf	1704.0 plf	1937.9 plf	2177.6 plf	2421.4 plf	2668.4 plf	2919.9 plf	3200.0 plf
Story Force per Floor		**0.000 klf**	**0.065 klf**	**0.172 klf**	**0.185 klf**	**0.195 klf**	**0.204 klf**	**0.210 klf**	**0.217 klf**	**0.225 klf**	**0.230 klf**	**0.234 klf**	**0.240 klf**	**0.244 klf**	**0.247 klf**	**0.252 klf**	**0.280 klf**

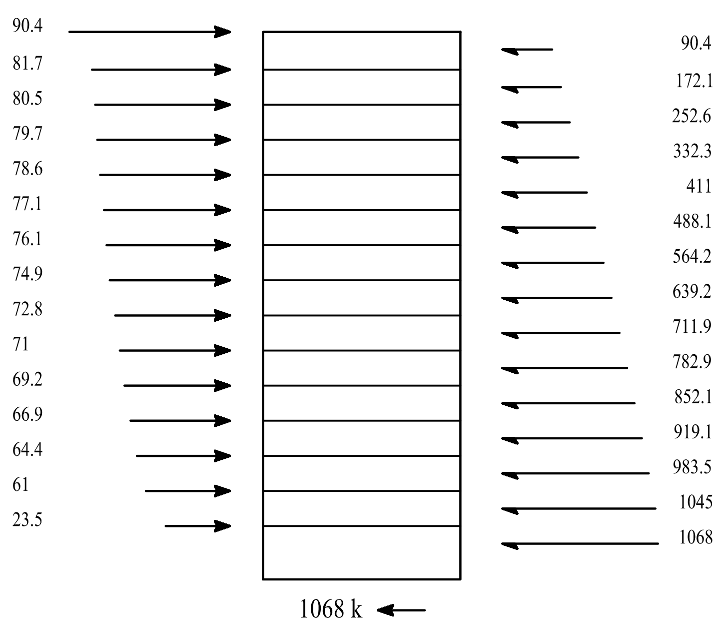
Total Wind Force on MWFRS in X Direction

Floor Level	Int.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	R
Length of Building	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**	**88.0 ft**
Frame Story Force per Floor	0.0 k	5.7 k	15.1 k	16.3 k	17.1 k	17.9 k	18.5 k	19.1 k	19.8 k	20.3 k	20.6 k	21.1 k	21.5 k	21.7 k	22.1 k	24.6 k
Frame Story Shear per Floor	281.6 k	281.6 k	275.9 k	260.7 k	244.4 k	227.3 k	209.4 k	190.9 k	171.7 k	151.9 k	131.6 k	111.1 k	90.0 k	68.5 k	46.8 k	24.6 k

DESIGN PRESSURE (psf) FOR WINDS IN THE NORTH-SOUTH DIRECTION



WINDWARD PRESSURES   LEEWARD PRESSURE   RESULTANT PRESSURE



BASE SHEAR

GATEWAY PLAZA 500 DELAWARE AVE. WILMINGTON, DE	WIND LOADING DIAGRAM APPENDIX B-CALCULATIONS SCALE: NTS PAGE: -

Equivalent Lateral Force Procedure

Design Seismic Forces
Title

Per IBC 2003 and ASCE 7-02
Reference

Gateway Plaza
Project Name

Input Information

D	Site Class - Section 1615.1.1
II	Seismic Use Group - Section 1616.2
B	Seismic Design Category - Section 1616.3
.300g	S_S, Spectral Accelerations for Short Periods - Section 1615.1
.075g	S_1, Spectral Accelerations for 1 Second Period - Section 1615.1
1.56	F_a, Site Coefficient - Table 1615.1.2(1)
2.4	F_v, Site Coefficient - Table 1615.1.2(2)
0.468	S_{MS}, Maximum Spectral Accelerations for Short Periods - Section 1615.1.2
0.18	S_{M1}, Maximum Spectral Accelerations for 1 Second Period - Section 1615.1.2
0.312	S_{DS}, Design Spectral Accelerations for Short Periods - Section 1615.1.3
0.12	S_{D1}, Design Spectral Accelerations for 1 Second Period - Section 1615.1.3
0.03	C_T , Building Period Coefficient - Section 1617.4.2.1
0.75	x
210.5 ft	h_n , Building Height - Section 1617.4.2.1
1.66	$T_a = C_T{*}h_n^{3/4}$ - Approximate Fundamental Period - Section 1617.4.2.1
0.077	$T_O = 0.2 * (S_{D1}/S_{DS})$- Section 1615.1.4
0.385	$T_S = S_{D1}/S_{DS}$ - Section 1615.1.4
0.072	S_a, Spectral Response Acceleration - Section 1615.1.4
1.25	I_e, Seismic Occupancy Importance Factor - Table 1604.5
5	R, Response Modification Factor - Table 1617.6
0.0780	C_S, Seismic Response Coefficient - Section 1617.4.1.1
0.0172	C_S (min) - Section 1617.4.1.1
0.0181	C_S (Max) - Section 1617.4.1.1
0.0181	C_S (Actual) - Section 1617.4.1.1
23,279 k	W, Effective Seismic Weight of Structure - Section 1617.4.1
421.2	$V = C_S{*}W$ - Seismic Base Shear - Section 1617.4.1
1.579	k, Distribution Exponent - Section 1617.4.3

Equivalent Lateral Force Procedure

Design Seismic Forces
Title

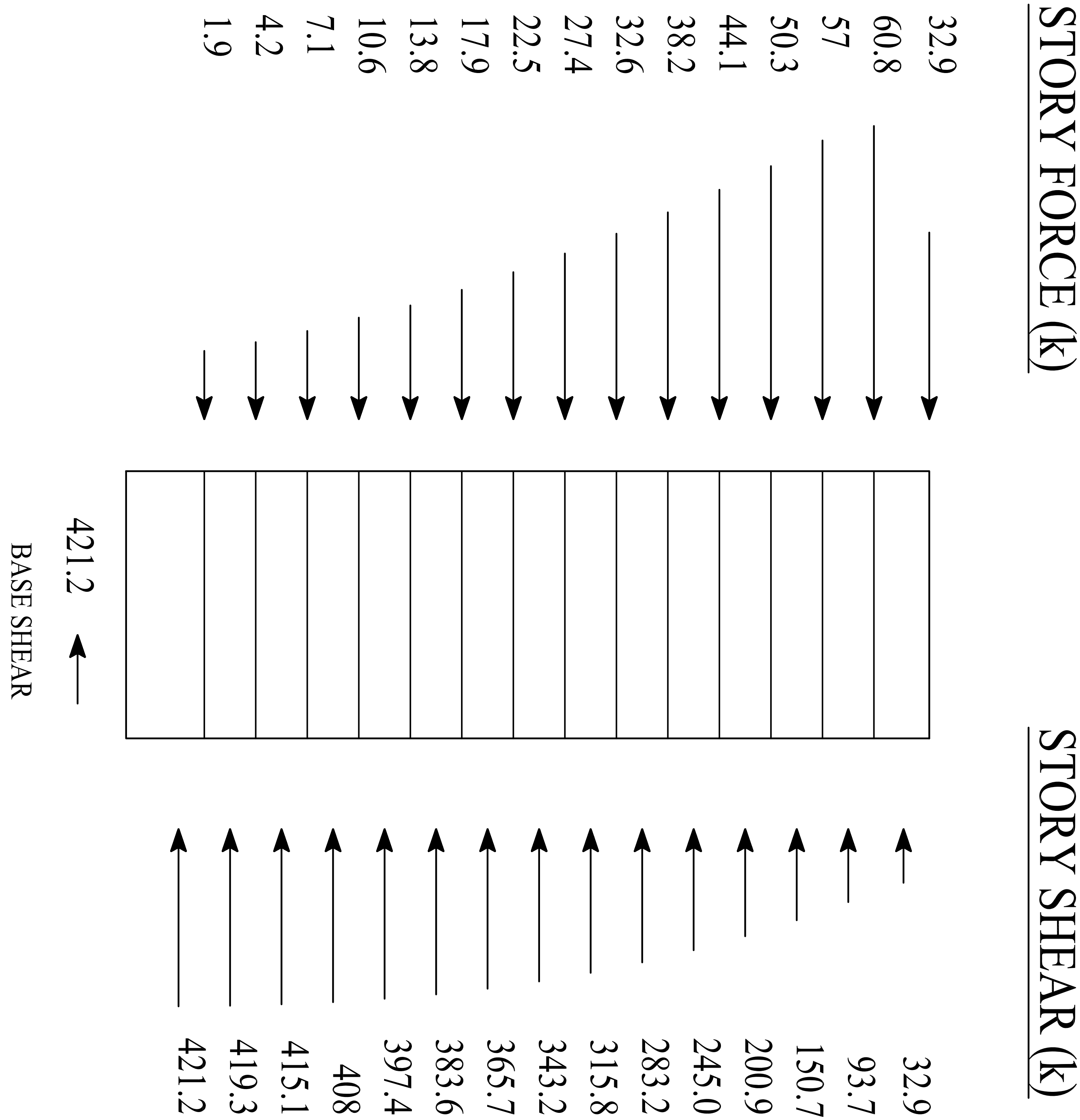
Per IBC 2003 and ASCE 7-02
Reference

0
Project Name

	Mass Calculations						Force Calculations				
Floor	**Floor-Floor Height (ft)**	**Area (ft^2)**	**Floor Load (psf)**	**Perimeter**	**Wall Loading (psf)**	**Weight**	**Height from Ground**	**$w_x h_x^k$**	**Cvx, (Eq. 9.5.4-2)**	**Story Force (k)**	**Story Shear (k)**
						0 k	210.5 ft	0	0	0.0 k	0.0 k
R		21,000	35.0 psf	718 ft	15.0 psf	735 k	210.5 ft	3424484	0.0780	32.9 k	32.9 k
15	14.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1523 k	196 ft	6,341,674	0.144	60.8 k	93.7 k
14	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1596 k	182.5 ft	5,936,241	0.135	57.0 k	150.7 k
13	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1591 k	169 ft	5,240,159	0.119	50.3 k	200.9 k
12	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1591 k	155.5 ft	4,594,680	0.105	44.1 k	245.0 k
11	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1591 k	142 ft	3,980,871	0.091	38.2 k	283.2 k
10	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1591 k	128.5 ft	3,399,968	0.077	32.6 k	315.8 k
9	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1591 k	115 ft	2,853,389	0.065	27.4 k	343.2 k
8	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1591 k	101.5 ft	2,342,780	0.053	22.5 k	365.7 k
7	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1591 k	88 ft	1,870,090	0.043	17.9 k	383.6 k
6	13.5 ft	21,900	66.0 psf	718 ft	15.0 psf	1591 k	74.5 ft	1,437,681	0.033	13.8 k	397.4 k
5	13.5 ft	23,000	66.0 psf	773 ft	15.0 psf	1675 k	61 ft	1,103,690	0.025	10.6 k	408.0 k
4	13.5 ft	23,000	66.0 psf	773 ft	15.0 psf	1675 k	47.5 ft	743,559	0.017	7.1 k	415.1 k
3	13.5 ft	23,000	66.0 psf	773 ft	15.0 psf	1675 k	34 ft	438,559	0.010	4.2 k	419.3 k
2	13.5 ft	23,000	66.0 psf	773 ft	15.0 psf	1675 k	20.5 ft	197,284	0.004	1.9 k	421.2 k
Gnd	20.5 ft	21,000					**TOTAL**	**43,905,108**	**1.000**	**421.24**	
TOTAL	**210.5 ft**	**353,000**				**23,279 k**					

2-5 Floor Plan
Area = 23,011 ft²
Perimeter = 773'

Typical Floor Plan
Area = 21,900 ft²
Perimeter = 718'



GATEWAY PLAZA 500 DELAWARE AVE. WILMINGTON, DE	SEISMIC LOADING DIAGRAM	
	APPENDIX B-CALCULATIONS	
	SCALE: NTS	PAGE: -

Snow Drift Load Calculation

Title

Gateway Plaza

Project Name

Per IBC 2003 and ASCE 7-02

Reference

Drift Location: **Location 1 on diagram**

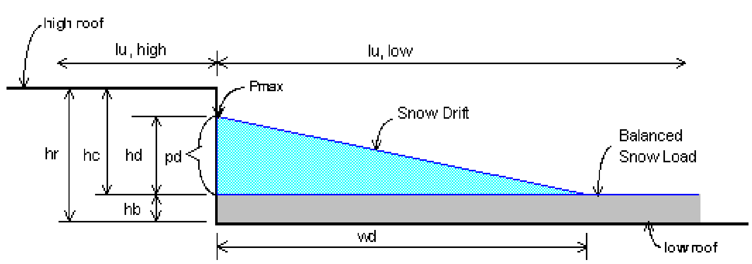
Design Parameters

Pg =	25	psf	Ground Snow Load - Figure 1608.2
	Above Tree Line		Terrain Category - Section 1609.4
	Fully Exposed		Roof Exposure - Table 1608.3.1b
Ce =	0.7		Exposure Factor - Table 1608.3.1
Ct=	1.0		Thermal Factor - Section 1608.3.2
	I		Importance Category - Table 1604.5
I =	1.0		Importance Factor - Table 1609.5
Pf =	20.0	psf	Flat Roof Snow Load, Pf = 0.7 * Ce * Ct * Is * Pg - Section 1608.3
D =	17.25	pcf	Snow density,D = 0.13Pg +14 <= 30 pcf - 1608.7
hb =	1.16	ft	Height of minimum roof snow load, (Default, Pf/D) - 1608.7
hr =	18.50	ft	Difference in height between upper and lower roofs
hc =	17.3	ft	Difference in height between upper roof and top of flat roof snow
lu, high =	36	ft	Horizontal dimension of upper roof normal to the line of change of roof level
lu, low =	48	ft	Horizontal dimension of lower roof normal to the line of change of roof level

Ct = 1.0, All Structures except as indicated below
Ct = 1.1, Structures kept just above freezing and others with cold ventilated roofs (R>25)
Ct = 1.2, Unheated structures
Ct = 0.85, For continuously heated green houses with roof R<2

Drift Calculations

Drift location	Calc. hd (ft)	Corrected hd (ft)	Pd (psf)	Pmax (psf)	Wd
Windward Drift	1.73	1.73	29.77	49.77	6.90
Leeward Drift	1.95	1.95	33.70	53.70	7.81
Design Drift	***1.95***	***1.95***	***33.7***	***53.7***	***7.8***



Configuration of Snow Drift on Lower Roof

Stepped Snow Load in 2 ft Increments

X	Y	A1 (psf)	A2 (psf)	Total (psf)
2.0	45	45	4	**49**
4.0	36	36	4	**41**
6.0	28	28	4	**32**
7.8	20	20	4	**24**

Snow Drift Load Calculation
Title

Gateway Plaza
Project Name

Per IBC 2003 and ASCE 7-02
Reference

Drift Location: **Location 2 on diagram**

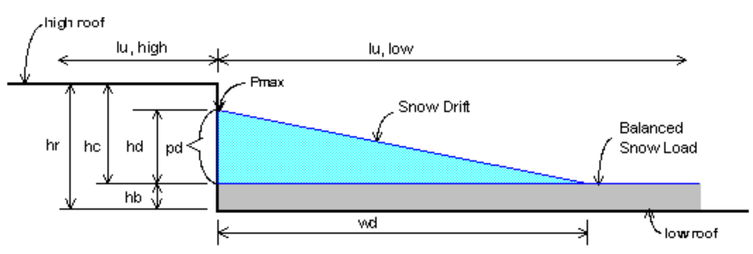
Design Parameters

Pg =	25	psf	Ground Snow Load - Figure 1608.2
	Above Tree Line		Terrain Category - Section 1609.4
	Fully Exposed		Roof Exposure - Table 1608.3.1b
Ce =	0.7		Exposure Factor - Table 1608.3.1
Ct=	1.0		Thermal Factor - Section 1608.3.2
	I		Importance Category - Table 1604.5
I =	1.0		Importance Factor - Table 1609.5
Pf =	20.0	psf	Flat Roof Snow Load, Pf = 0.7 * Ce * Ct * Is * Pg - Section 1608.3
D =	17.25	pcf	Snow density,D = 0.13Pg +14 <= 30 pcf - 1608.7
hb =	1.16	ft	Height of minimum roof snow load, (Default, Pf/D) - 1608.7
hr =	18.50	ft	Difference in height between upper and lower roofs
hc =	17.3	ft	Difference in height between upper roof and top of flat roof snow
lu, high =	44	ft	Horizontal dimension of upper roof normal to the line of change of roof level
lu, low =	130	ft	Horizontal dimension of lower roof normal to the line of change of roof level

Ct = 1.0, All Structures except as indicated below
Ct = 1.1, Structures kept just above freezing and others with cold ventilated roofs (R>25)
Ct = 1.2, Unheated structures
Ct = 0.85, For continuously heated green houses with roof R<2

Drift Calculations

Drift location	Calc. hd (ft)	Corrected hd (ft)	Pd (psf)	Pmax (psf)	Wd
Windward Drift	2.85	2.85	49.14	69.14	11.39
Leeward Drift	2.19	2.19	37.82	57.82	8.77
Design Drift	***2.85***	***2.85***	***49.1***	***69.1***	***11.4***



Configuration of Snow Drift on Lower Roof

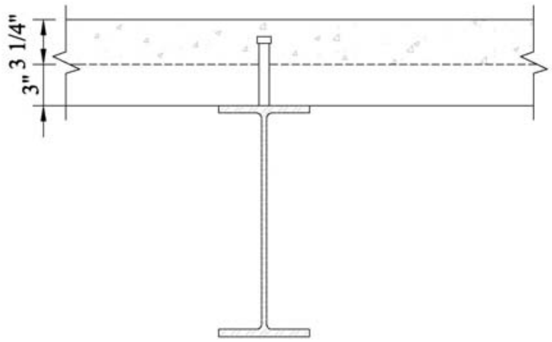
Stepped Snow Load in 2 ft Increments

X	Y	A1 (psf)	A2 (psf)	Total (psf)
2.0	61	61	4	**65**
4.0	52	52	4	**56**
6.0	43	43	4	**48**
8.0	35	35	4	**39**
10.0	26	26	4	**30**
11.4	20	20	3	**23**

Appendix C: Spot-Checks

C.1 Hand Calculations

Beam Check



Given

$f_y = 50ksi$

$f'_c = 3000ksi$ LWT. concrete

$q_n = 17.7k$

Factored Load: $w_u = 1.2(66) + 1.6(100) = 239.2\,psf$

Factored Moment:

$$M_u = \frac{239.2\,psf\,(10')(52'-2")^2}{8} = 813.7'k$$

Assuming: $a = 1"$

$Y2 = 6.25" - .5" = 5.75"$

Use 5.5"

Trial Sizes:

Size	ΦM$_p$	ΦM$_{pc}$	ΣQ$_n$	# Studs	Weight (k)
W21x55	473	827	595	68	3549
W21x57	484	819	515	60	3034
W21x62	540	828	408	46	3694
W24x55	506	854	461	54	3409
W24x62	578	884	364	42	3654

Try W 24x55

$$b_{eff} = \min\begin{cases} \frac{l}{4} = \frac{52'-2"}{4} = 156.5" \\ s = 10' = 120" \end{cases} = 120"$$

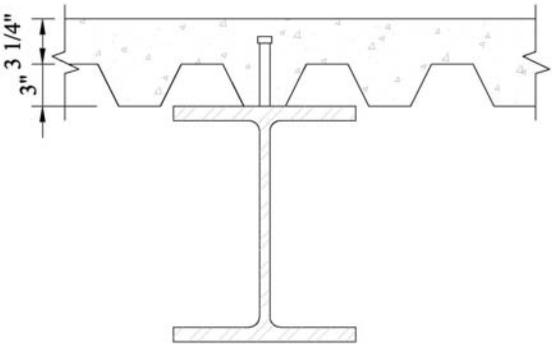
$$a = \frac{461k}{.85(3)(120")} = 1.51" > 1"$$

$$Y2 = 6.25" - \frac{1.51"}{2} = 5.5"$$

$\Phi M_n (Y2 = 5.5") = 854'k$ ✓ W24x55 [54] okay for prescribed loading

$\Phi M_n > M_u = 813'k$

Girder Check



$$b_{eff} = \min\begin{cases} \dfrac{l}{4} = \dfrac{30'}{4} = 90" \\ s = \dfrac{(52'-2"+36')}{2} = 529" \end{cases} = 90"$$

Factored Load:

$P_u = [1.2(66)+1.6(100)](10')(44.08') = 105.4k$

Factored Moment: $M_u = 105.4k(10') = 1054'k$

Assuming: $a = 1"$

$Y2 = 6.25" - .5" = 5.75"$

Use 5.5"

Trial Sizes:

Size	ΦM_p	ΦM_{pc}	ΣQ_n	# Studs	Weight (k)
W24x62	578	1080	811	92	2780
W24x68	664	1080	611	70	2740
W24x76	750	1070	394	46	2740

Try W 24x76

$$a = \frac{394k}{.85(3)(90")} = 1.72" > 1"$$

$$Y2 = 6.25" - \frac{1.72"}{2} = 5.4"$$

$\Phi M_n (Y2 = 5.4") = 1067.5'k$ ✓ W24x76 [46] okay for prescribed loading

$\Phi M_n > M_u = 1054'k$

Column Check

Given: LL=100psf
DL=66psf

Reductions: $LL = L_o\left(0.25 + \dfrac{15}{\sqrt{A_I}}\right) \geq 0.4L_o$

$$A_T = 30' \times \frac{(52.166'+30')}{2} = 1232sf$$

Floors above 8: 8 (including roof)

$A_T = 1232sf \times 8 = 9856sf$

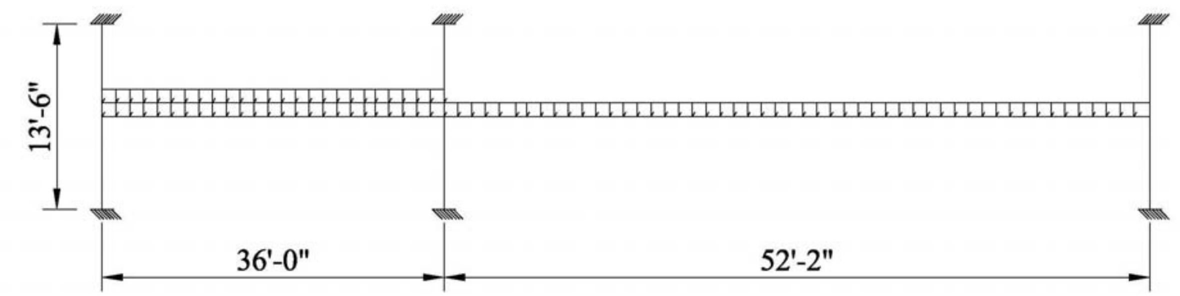
$A_I = 9856sf \times 4 = 39{,}424sf$

Reduction factor= $\left(0.25 + \dfrac{15}{\sqrt{39{,}424}}\right) = .326 < 0.4 \therefore$ Use 0.4

Loads: $LL = 0.4(100\,psf) = 40\,psf$

$$1.4DL = 1.4(66\,psf) = 92.4\,psf$$
$$1.2DL + 1.6LL = 1.2(66) + 1.6(40) = 143.4\,psf$$
$$P = 143.4\,psf\,(9856\,sf) = 1413k$$

To account for moments imposed on the column from patterned loading, fixed end moments are used to determine an approximate moment on the column. This approximate moment is found by taking half the difference between the fixed end moments from both beams. This is assuming that half the moment goes above and half goes below the column.



$$FEM_{3-2} = \frac{\omega l^2}{12} = \frac{7.17klf\,(36')^2}{12} = 775'k$$
$$FEM_{2-1} = \frac{\omega l^2}{12} = \frac{2.38klf\,(52.166')^2}{12} = 539'k$$

$$M_2 = \frac{(775 - 539)}{2} = 118'k$$

Equivalent Load: For quick calculation purposes, assume a W14 shape and that an equivalent compressive force can be found using the following equation:

$$P_{equiv} = P + \frac{24}{d}M_2 = 1413k + \left(\frac{24}{14}\right)118'k = 1616k$$

Use W14x159, $\Phi P_n = 1740k$

Lateral Element Check

Since this is a preliminary check, assume:

- Lateral distribution by method of rigidity is valid.
- The building is modeled as it was for wind loading, as a 270’x88’ rectangle.
- Center of mass is at the center of rectangle.
- All of the lateral frames have equal stiffnesses.
- The story force acts at the center of mass, but the diaphragm rotates about the center of rigidity.

Center of Mass: (135’, 44’)

Center of Rigidity: $X_{cr} = \frac{(7.5'+89.83'+118.3'+179.83'+262.4')}{5} = 131.6'$

$$Y_{cr} = \frac{2(25.166'+36')}{4} = 30.5'$$

$$P = .270klf\,(270') = 72.9k$$

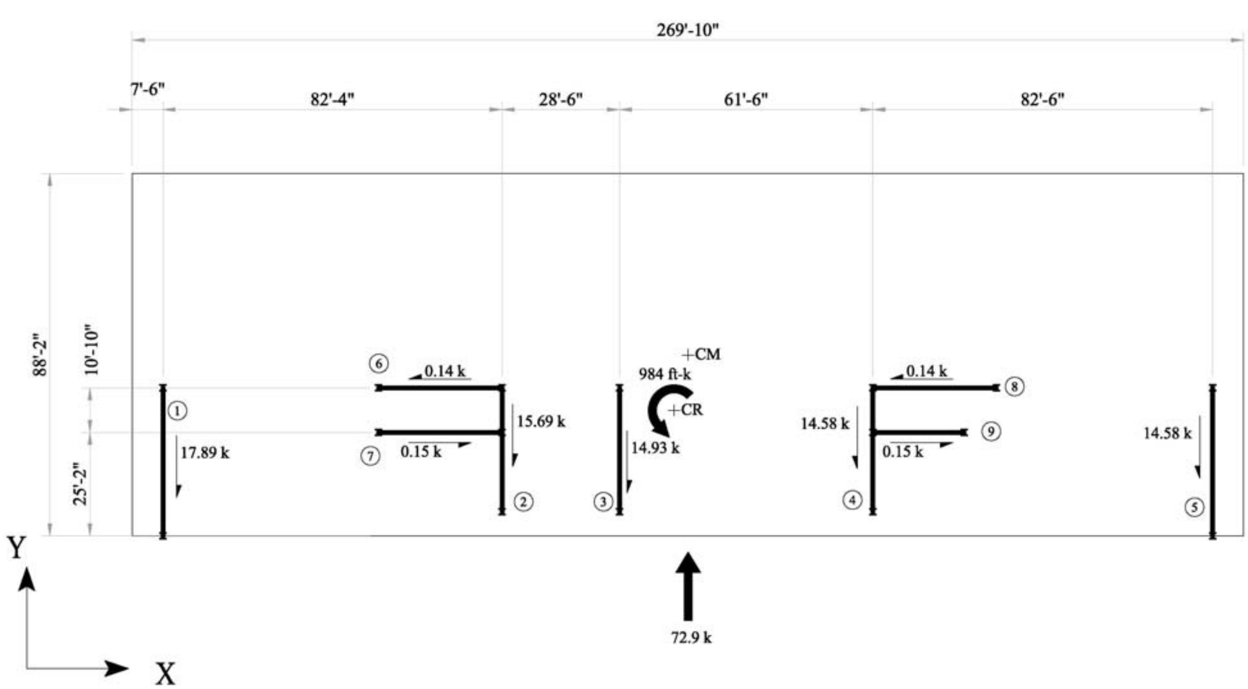
$$F_{i,direct} = 72.9k\left(\frac{1}{5}\right) = 14.58k\,/\,frame$$

$$M = 72.9k(44'-30.5') = 984'k$$

$$F_{i,torsion} = \frac{k_i d_i}{\Sigma k_i d_i^{\,2}} M$$

Frame No.	x_i	y_i	d_i	d_i^2	$F_{i,moment}$	$F_{i,direct}$	$F_{i,total}$
1	7.50 ft		124.10 ft	15,400.81	3.31 k	14.58	17.89
2	89.83 ft		41.77 ft	1,744.73	1.11 k	14.58	15.69
3	118.33 ft		13.27 ft	176.01	0.35 k	14.58	14.93
4	179.83 ft		-48.23 ft	2,326.45	-1.29 k	14.58	14.58
5	262.40 ft		-130.80 ft	17,108.64	-3.49 k	14.58	14.58
6		25.17 ft	5.33 ft	28.44	0.14 k	0	0.14
7		36.00 ft	-5.50 ft	30.25	-0.15 k	0	-0.15
8		25.17 ft	5.33 ft	28.44	0.14 k	0	0.14
9		36.00 ft	-5.50 ft	30.25	-0.15 k	0	-0.15
				36,874.03			

For information on the lateral element check, please refer to the *Appendix C.2- RAM Output*.



C.2: RAM Output

Load Combinations

RAM Frame v8.1
DataBase: Gateway Plaza 10/05/05 12:59:29

LOAD COMBINATION CRITERIA:

Roof Live Load:	Reducible
Sds	0.312

LOAD CASE DEFINITIONS:

D	DeadLoad	RAMUSER
Lp	PosLiveLoad	RAMUSER
Ln	NegLiveLoad	RAMUSER
W1	WIND	Wind_IBC00_1_X
W2	WIND	Wind_IBC00_1_Y
W3	WIND	Wind_IBC00_2_X+E
W4	WIND	Wind_IBC00_2_X-E
W5	WIND	Wind_IBC00_2_Y+E
W6	WIND	Wind_IBC00_2_Y-E
W7	WIND	Wind_IBC00_3_X+Y
W8	WIND	Wind_IBC00_3_X-Y
W9	WIND	Wind_IBC00_4_CW
W10	WIND	Wind_IBC00_4_CCW

LOAD COMBINATIONS: ASCE 7-98 LRFD

1	*	1.400 D
2	*	1.200 D + 1.600 Lp
3	*	1.200 D + 1.600 Ln
4	*	1.200 D + 0.500 Lp + 1.600 W1
5	*	1.200 D + 0.500 Lp + 1.600 W2
6	*	1.200 D + 0.500 Lp + 1.600 W3
7	*	1.200 D + 0.500 Lp + 1.600 W4
8	*	1.200 D + 0.500 Lp + 1.600 W5
9	*	1.200 D + 0.500 Lp + 1.600 W6
10	*	1.200 D + 0.500 Lp + 1.600 W7
11	*	1.200 D + 0.500 Lp + 1.600 W8
12	*	1.200 D + 0.500 Lp + 1.600 W9
13	*	1.200 D + 0.500 Lp + 1.600 W10
14	*	1.200 D + 0.500 Lp - 1.600 W1
15	*	1.200 D + 0.500 Lp - 1.600 W2
16	*	1.200 D + 0.500 Lp - 1.600 W3
17	*	1.200 D + 0.500 Lp - 1.600 W4
18	*	1.200 D + 0.500 Lp - 1.600 W5
19	*	1.200 D + 0.500 Lp - 1.600 W6
20	*	1.200 D + 0.500 Lp - 1.600 W7
21	*	1.200 D + 0.500 Lp - 1.600 W8
22	*	1.200 D + 0.500 Lp - 1.600 W9
23	*	1.200 D + 0.500 Lp - 1.600 W10
24	*	1.200 D + 0.500 Ln + 1.600 W1
25	*	1.200 D + 0.500 Ln + 1.600 W2
26	*	1.200 D + 0.500 Ln + 1.600 W3

27	*	1.200 D + 0.500 Ln + 1.600 W4
28	*	1.200 D + 0.500 Ln + 1.600 W5
29	*	1.200 D + 0.500 Ln + 1.600 W6
30	*	1.200 D + 0.500 Ln + 1.600 W7
31	*	1.200 D + 0.500 Ln + 1.600 W8
32	*	1.200 D + 0.500 Ln + 1.600 W9
33	*	1.200 D + 0.500 Ln + 1.600 W10
34	*	1.200 D + 0.500 Ln - 1.600 W1
35	*	1.200 D + 0.500 Ln - 1.600 W2
36	*	1.200 D + 0.500 Ln - 1.600 W3
37	*	1.200 D + 0.500 Ln - 1.600 W4
38	*	1.200 D + 0.500 Ln - 1.600 W5
39	*	1.200 D + 0.500 Ln - 1.600 W6
40	*	1.200 D + 0.500 Ln - 1.600 W7
41	*	1.200 D + 0.500 Ln - 1.600 W8
42	*	1.200 D + 0.500 Ln - 1.600 W9
43	*	1.200 D + 0.500 Ln - 1.600 W10
44	*	1.200 D + 1.600 W1
45	*	1.200 D + 1.600 W2
46	*	1.200 D + 1.600 W3
47	*	1.200 D + 1.600 W4
48	*	1.200 D + 1.600 W5
49	*	1.200 D + 1.600 W6
50	*	1.200 D + 1.600 W7
51	*	1.200 D + 1.600 W8
52	*	1.200 D + 1.600 W9
53	*	1.200 D + 1.600 W10
54	*	1.200 D - 1.600 W1
55	*	1.200 D - 1.600 W2
56	*	1.200 D - 1.600 W3
57	*	1.200 D - 1.600 W4
58	*	1.200 D - 1.600 W5
59	*	1.200 D - 1.600 W6
60	*	1.200 D - 1.600 W7
61	*	1.200 D - 1.600 W8
62	*	1.200 D - 1.600 W9
63	*	1.200 D - 1.600 W10
64	*	0.900 D + 1.600 W1
65	*	0.900 D + 1.600 W2
66	*	0.900 D + 1.600 W3
67	*	0.900 D + 1.600 W4
68	*	0.900 D + 1.600 W5
69	*	0.900 D + 1.600 W6
70	*	0.900 D + 1.600 W7
71	*	0.900 D + 1.600 W8
72	*	0.900 D + 1.600 W9

Load Combinations

73	*	0.900 D + 1.600 W10
74	*	0.900 D - 1.600 W1
75	*	0.900 D - 1.600 W2
76	*	0.900 D - 1.600 W3
77	*	0.900 D - 1.600 W4
78	*	0.900 D - 1.600 W5
79	*	0.900 D - 1.600 W6
80	*	0.900 D - 1.600 W7
81	*	0.900 D - 1.600 W8
82	*	0.900 D - 1.600 W9
83	*	0.900 D - 1.600 W10

* = Load combination currently selected to use

Building Story Shears

RAM Frame v8.1
DataBase: Gateway Plaza 10/05/05 12:53:49

CRITERIA:

Rigid End Zones:		Ignore Effects	
Member Force Output:		At Face of Joint	
P-Delta:	Yes	Scale Factor:	1.00
Diaphragm:	Rigid		
Ground Level:	Base		

Load Case: D DeadLoad RAMUSER

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	0.08	0.08	0.29	0.29
15	0.20	0.12	0.79	0.50
14	0.27	0.07	1.20	0.41
13	0.36	0.09	1.62	0.42
12	0.36	-0.00	1.80	0.18
11	0.42	0.07	2.03	0.23
10	0.38	-0.04	2.08	0.04
9	0.41	0.03	2.15	0.07
8	0.32	-0.09	2.18	0.03
7	0.32	-0.00	2.17	-0.02
6	0.19	-0.13	1.96	-0.21
5	0.14	-0.06	1.56	-0.40
4	-0.04	-0.17	1.09	-0.47
3	-0.05	-0.02	0.91	-0.18
2	-0.64	-0.59	0.35	-0.56

Load Case: Lp PosLiveLoad RAMUSER

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	0.14	0.14	-1.67	-1.67
15	0.33	0.19	-1.35	0.32
14	0.54	0.21	0.55	1.89
13	0.53	-0.01	0.04	-0.50
12	0.75	0.22	2.47	2.43
11	0.63	-0.11	1.97	-0.51
10	0.79	0.16	3.64	1.68
9	0.60	-0.20	3.04	-0.60
8	0.72	0.12	4.10	1.06
7	0.43	-0.29	2.69	-1.41
6	0.49	0.06	5.73	3.05
5	0.29	-0.20	3.60	-2.14
4	-0.01	-0.30	2.45	-1.14
3	-0.04	-0.03	2.14	-0.31
2	-1.03	-0.99	0.46	-1.67

Building Story Shears

Load Case: Ln NegLiveLoad RAMUSER

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00

Load Case: W1 WIND Wind_IBC00_1_X

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	24.45	24.45	0.00	0.00
15	49.74	25.28	0.00	0.00
14	73.86	24.13	-0.01	-0.01
13	97.61	23.75	-0.02	-0.01
12	120.92	23.31	-0.02	-0.00
11	143.81	22.89	-0.02	-0.00
10	166.00	22.19	-0.01	0.01
9	187.79	21.79	0.00	0.01
8	208.61	20.82	-0.01	-0.01
7	229.10	20.50	-0.02	-0.01
6	248.35	19.24	-0.01	0.01
5	267.44	19.09	-0.01	-0.00
4	286.16	18.72	-0.01	0.00
3	304.65	18.49	0.00	0.01
2	323.71	19.05	0.00	0.00

Load Case: W2 WIND Wind_IBC00_1_Y

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	-0.12	-0.12	86.57	86.57
15	-0.32	-0.20	176.44	89.87
14	-0.55	-0.23	262.35	85.91
13	-0.77	-0.22	347.20	84.85

Building Story Shears

12	-0.99	-0.21	430.44	83.24
11	-1.15	-0.16	512.39	81.95
10	-1.27	-0.12	592.19	79.81
9	-1.35	-0.08	670.73	78.54
8	-1.36	-0.01	745.90	75.16
7	-1.47	-0.12	822.00	76.11
6	-1.47	0.00	894.29	72.28
5	-0.69	0.78	954.13	59.85
4	-0.49	0.20	1019.44	65.31
3	-0.45	0.04	1083.52	64.08
2	-0.22	0.23	1155.75	72.23

Load Case: W3 WIND Wind_IBC00_2_X+E

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	21.41	21.41	0.00	0.00
15	43.56	22.14	0.00	0.00
14	64.69	21.14	0.00	0.00
13	85.50	20.81	-0.01	-0.01
12	105.92	20.42	-0.01	0.00
11	125.97	20.05	-0.01	0.00
10	145.40	19.43	0.00	0.01
9	164.48	19.08	0.01	0.01
8	182.70	18.22	0.00	-0.01
7	200.65	17.95	-0.01	-0.01
6	217.48	16.84	0.00	0.01
5	234.08	16.60	-0.01	-0.01
4	250.44	16.36	-0.01	0.00
3	266.61	16.17	0.00	0.01
2	283.25	16.64	0.00	0.00

Load Case: W4 WIND Wind_IBC00_2_X-E

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	21.38	21.38	0.00	0.00
15	43.48	22.10	0.00	0.00
14	64.57	21.08	-0.01	-0.01
13	85.32	20.75	-0.02	-0.01
12	105.69	20.37	-0.02	-0.00
11	125.70	20.00	-0.02	-0.00
10	145.10	19.40	-0.02	0.00
9	164.15	19.05	-0.01	0.01
8	182.36	18.22	-0.02	-0.01
7	200.28	17.92	-0.03	-0.01
6	217.12	16.84	-0.02	0.00

Building Story Shears

5	233.94	16.82	-0.02	0.00
4	250.35	16.41	-0.01	0.00
3	266.53	16.18	-0.01	0.01
2	283.24	16.71	0.00	0.01

Load Case: W5 WIND Wind_IBC00_2_Y+E

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	-0.27	-0.27	75.74	75.74
15	-0.68	-0.41	154.36	78.62
14	-1.16	-0.48	229.52	75.16
13	-1.64	-0.48	303.76	74.24
12	-2.10	-0.46	376.57	72.82
11	-2.48	-0.39	448.26	71.69
10	-2.77	-0.28	518.08	69.82
9	-2.99	-0.23	586.78	68.70
8	-3.01	-0.02	652.54	65.76
7	-3.28	-0.27	719.14	66.60
6	-3.27	0.01	782.38	63.24
5	-1.36	1.90	834.82	52.43
4	-0.94	0.42	891.97	57.15
3	-0.86	0.08	948.03	56.06
2	-0.28	0.58	1011.25	63.22

Load Case: W6 WIND Wind_IBC00_2_Y-E

Level	Shear-X kips	Change-X kips	Shear-Y kips	Change-Y kips
16	0.05	0.05	75.76	75.76
15	0.11	0.06	154.41	78.65
14	0.19	0.08	229.60	75.19
13	0.29	0.09	303.85	74.25
12	0.37	0.08	376.69	72.85
11	0.48	0.11	448.41	71.72
10	0.55	0.07	518.26	69.84
9	0.64	0.09	587.00	68.74
8	0.64	0.01	652.78	65.78
7	0.71	0.06	719.37	66.59
6	0.69	-0.01	782.62	63.25
5	0.15	-0.54	834.92	52.30
4	0.08	-0.08	892.05	57.13
3	0.08	-0.00	948.13	56.08
2	-0.10	-0.17	1011.31	63.18

Load Case: W7 WIND Wind_IBC00_3_X+Y

Level	Shear-X	Change-X	Shear-Y	Change-Y

	kips	**kips**	**kips**	**kips**
16	18.23	18.23	65.07	65.07
15	37.04	18.81	132.58	67.51
14	54.96	17.92	197.12	64.54
13	72.60	17.64	260.86	63.74
12	89.93	17.32	323.39	62.53
11	106.97	17.05	384.95	61.56
10	123.52	16.55	444.91	59.96
9	139.81	16.28	503.92	59.01
8	155.41	15.61	560.38	56.46
7	170.70	15.29	617.55	57.17
6	185.13	14.43	671.86	54.31
5	200.04	14.91	716.82	44.96
4	214.23	14.19	765.88	49.06
3	228.13	13.90	814.02	48.14
2	242.59	14.46	868.29	54.27

Load Case: W8 WIND Wind_IBC00_3_X-Y

Level	Shear-X	Change-X	Shear-Y	Change-Y
	kips	kips	kips	kips
16	18.41	18.41	-65.07	-65.07
15	37.52	19.11	-132.59	-67.52
14	55.79	18.27	-197.13	-64.55
13	73.77	17.98	-260.88	-63.75
12	91.41	17.64	-323.42	-62.53
11	108.70	17.28	-384.98	-61.57
10	125.43	16.73	-444.93	-59.95
9	141.83	16.40	-503.93	-59.00
8	157.45	15.62	-560.40	-56.47
7	172.91	15.46	-617.58	-57.18
6	187.34	14.43	-671.88	-54.30
5	201.08	13.74	-716.84	-44.96
4	214.97	13.89	-765.90	-49.06
3	228.80	13.83	-814.03	-48.13
2	242.92	14.12	-868.29	-54.26

Load Case: W9 WIND Wind_IBC00_4_CW

Level	Shear-X	Change-X	Shear-Y	Change-Y
	kips	kips	kips	kips
16	16.01	16.01	56.94	56.94
15	32.57	16.56	116.02	59.08
14	48.36	15.79	172.50	56.47
13	63.91	15.55	228.27	55.77
12	79.18	15.26	282.99	54.72
11	94.19	15.01	336.86	53.87

10	108.74	14.55	389.33	52.47
9	123.05	14.31	440.97	51.64
8	136.71	13.66	490.38	49.41
7	150.15	13.44	540.40	50.02
6	162.77	12.62	587.92	47.52
5	175.33	12.56	627.24	39.31
4	187.65	12.32	670.16	42.93
3	199.80	12.15	712.29	42.13
2	212.31	12.51	759.76	47.47

Load Case: W10 WIND Wind_IBC00_4_CCW

Level	Shear-X	Change-X	Shear-Y	Change-Y
	kips	kips	kips	kips
16	15.88	15.88	56.93	56.93
15	32.25	16.37	116.00	59.07
14	47.82	15.57	172.46	56.47
13	63.15	15.33	228.23	55.77
12	78.20	15.05	282.94	54.71
11	93.01	14.82	336.80	53.86
10	107.43	14.41	389.26	52.46
9	121.61	14.18	440.89	51.62
8	135.26	13.65	490.29	49.40
7	148.58	13.31	540.31	50.03
6	161.21	12.63	587.83	47.52
5	174.73	13.52	627.20	39.36
4	187.25	12.52	670.13	42.93
3	199.43	12.18	712.25	42.12
2	212.23	12.80	759.74	47.49

RAM Frame V8.1 - AISC LRFD
DataBase: Gateway Plaza 10/05/05 12:59:29
Code Check - Standard Provisions
<0.40 .40-.50 .50-.60 .60-.70 .70-.80 .80-.90 .90-.95 .95-1.00 >1.00