Letter of Transmittal

September 28, 2015

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Structural Thesis Advisor

The Pennsylvania State University

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Dear Dr. Hanagan,

The attached document Notebook A contains a detailed analysis of the structural loading conditions for The Health Centre in the southeastern United States. All calculations follow the applicable building codes specified by the local governing body.

Enclosed in Notebook A is a building abstract, site plans, and calculations for the gravity, snow, wind, and seismic loads. A combination of excel spreadsheets and hand calculations were used to determine the vertical and horizontal forces on the building. The appendix contains typical floor plans to further describe the loading conditions in The Health Centre.

Thank you for taking the time to review my analysis and calculations. I look forward to your comments and discussing my work with you in the future.

Regards,

Hannah N. Valentine

NOTEBOOK SUBMISSION A

THE HEALTH CENTRE

LOCATION | SOUTHEASTERN US

Hannah N Valentine

STRUCTURAL OPTION | ADVISOR: DR. HANAGAN

THE HEALTH CENTRE

HANNAH VALENTINE | STRUCTURAL
ADVISOR | DR. LINDA HANAGAN

GENERAL INFORMATION

Location	Southeastern US
Occupancy	Healthcare
Height	166 ft
Total Levels	14 (above + below grade)
Size	450,000 SF of program space
Cost	$168-203 million
Construction	January 2012-2016 (projected)
Project Delivery	CM At-Risk

PROJECT TEAM

Architecture	SmithGroupJJR
Structural	Walter P. Moore
Lighting/Mechanical	ccrd
Construction	McCarthy Building Construction
Civil/Site	Kimley-Horn and Associates, Inc
Wind Consultant	RWDI Consulting Engineers

ARCHITECTURE

The Health Centre is a new "core-and-shell" university hospital expansion project featuring a nine-story hospital bed tower and state-of-the-art technical facilities. Inspired by the concept of lifelines, it takes architectural cues from surrounding classical campus buildings. A variety of health facilities are offered in the building, including operating rooms, an intensive care unit, emergency department, clinical facilities, and med-surg patient rooms.

STRUCTURAL SYSTEMS

Framing.......... Cast-in place concrete with one-way floor slabs are used for framing above grade. Post-tensioned two-way concrete slabs are used in the parking garage.

Foundations..... Slab on grade is connected by grade beams. Below grade are cast-in-place spread footings & drilled piers.

Lateral .... Concrete moment frames resist wind lateral loads. Parking garage shear walls resist seismic/soil loads.

MECHANICAL SYSTEMS

Two mechanical rooms service the building on the 5th and penthouse floors. Three large cooling towers go up to the roof. Fan coil units are used to heat the building. Custom central-station air-handling units utilizing split system air conditioners are used to cool the building.

LIGHTING/ELECTRICAL SYSTEMS

Interiors are lit with linear T8 and T5 LEDs fixtures, and energy efficient lamps. Surge protective devices were installed for low-voltage equipment. Both photoelectric switches and daylight-harvesting switching controls contribute to energy savings.

CONSTRUCTION

Special efforts have been made to ensure a sustainable construction process. Dirt and filling material from digging the foundations was used to build a new soccer field in the community. All trees removed during the building process are scheduled to be replanted.

RENDERINGS AND INFORMATION COURTESY OF:

SMITHGROUPJJR

WALTER P MOORE

Table of Contents

2 | General Information

2.1 Executive Summary

The Health Centre is a 450,000 square foot university hospital expansion project located in the southeastern United States. Located adjacent to existing hospital facility ‘Clinic B,’ this nine story L-shaped building is connected by two bridges to the surrounding campus. Demand for new, state-of-the-art medical technology, additional research space, and extra hospital beds prompted the design and construction the Health Centre. At a height of 163 feet, the Health Centre will be by far the tallest building in the surrounding area when its construction is complete in 2016.

As a nod to the heritage and character of the surrounding university campus, The Health Centre takes its architectural cues from classical Italian and contemporary sources. Façade materials used on the building include stucco, metal panels, and a glass curtain wall. A green roof and four story underground parking garage contribute towards its goal of LEED silver certification. This building was designed as a “core-and shell,” necessitating a structural consideration for flexibility of spaces and future expansion.

The structure of the Health Centre is mainly cast-in-place concrete on drilled piers and spread footings. Its floor system in the hospital bed tower consists of cast-in-place one-way concrete slabs and beams. Concrete moment frames spread throughout the structure resist the building’s lateral loads. Below grade, parking garage floor slabs consist of two-way post-tensioned concrete slabs. The parking garage has its own lateral system of concrete shear walls. Some structural steel components exist in the building, including roofing and bridges connecting to other buildings on campus.

Governing codes for the design of the Health Centre required the use of IBC 2012. However, an exemption was obtained to allow the structural design to use IBC 2006 requirements. ASCE 7-05 provides the minimum design loads for live, snow, wind, and seismic considerations. Due to the life safety importance associated with hospital structures, a conservative approach was used to determine building loads.

2.2 Site Plan

The Health Centre is located on a university campus in the southeastern United States. Adjacent to the site is 'Clinic B,' the existing hospital building. Bridges connect the hospital facilities to the surrounding campus. A new entry drive allows patients and emergency vehicles direct access to the new Health Centre. Figure 1 shows the site plans from SmithGroupJJR documents.

Terrain around the site is extremely flat. As the tallest building in the immediate area, The Health Centre will be fully impacted by wind loads.

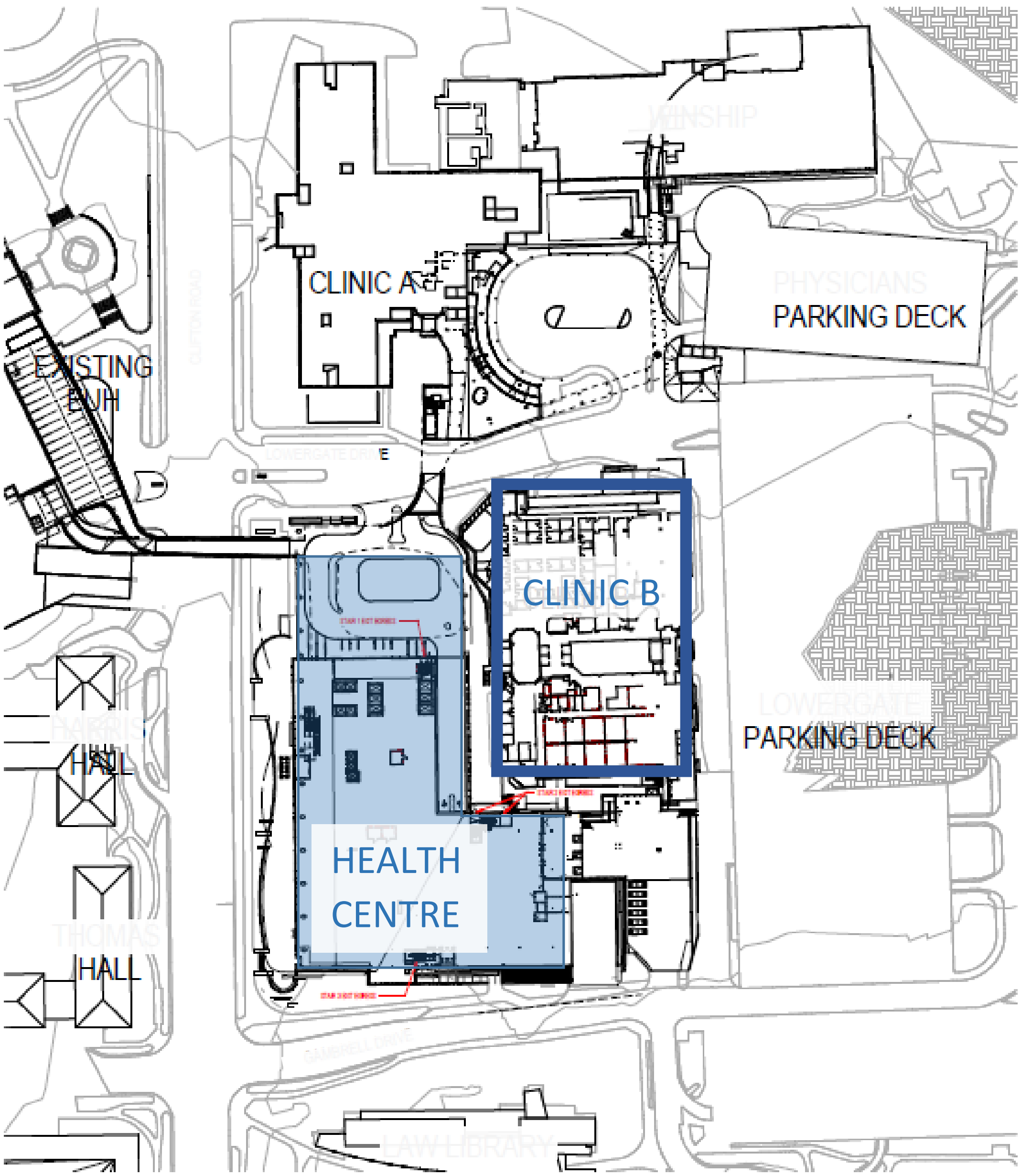


Figure 1 | Site Plan of Surrounding Area

2.3 References

The following table is a list of documents referenced during the preparation of Notebook A to determine building loads.

Organization	Reference
International Building Code	2006 International Building Code
American Society of Civil Engineers	ASCE 7-05 | Minimum Design Loads for Buildings and Other Structures
American Concrete Institute	ACI 318 | Building Code Requirements for Structural Concrete
American Institute of Steel Construction	Steel Construction Manual, 14th Edition
United States Geological Survey	Seismic Design Maps
Penn State	Architectural Engineering Course Notes
Vulcraft	Deck Catalog
Walter P. Moore	Health Centre General Notes Sheet

Table 1 | Notebook A References

3 | Gravity Loads

This section details the building gravity loads due to dead, live, and snow, and perimeter loads. Loads were determined using structural documentation from Walter P. Moore and the references listed in the previous section. A full list of design gravity loads used by the original structural engineer may be found in Appendix A.

3.1 Roof Loads

Three roof gravity load cases exist for this building: typical concrete roof, penthouse roof, and green roof. Figures 2-4 depict the roof sections that correspond with each load case.

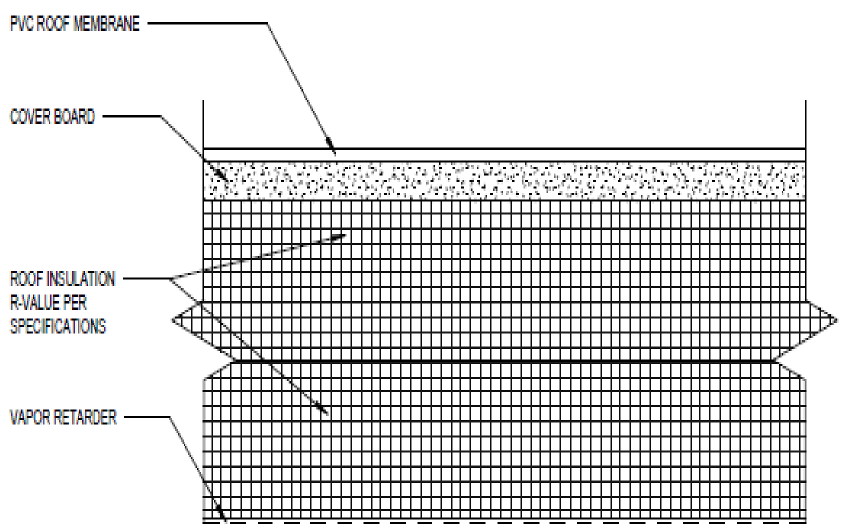


Figure 2 | Typical Concrete Roof Section (SmithGroupJJR)

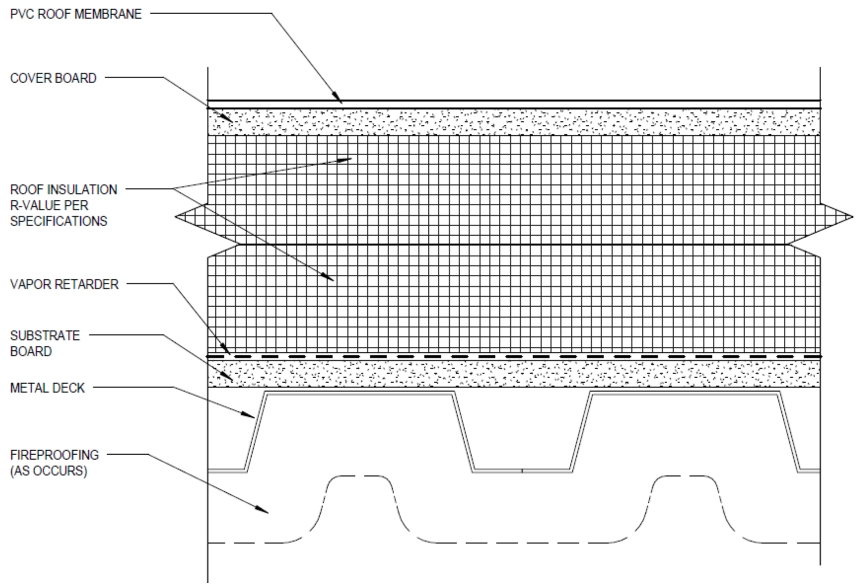


Figure 3 | Penthouse Roof Section (SmithGroupJJR)

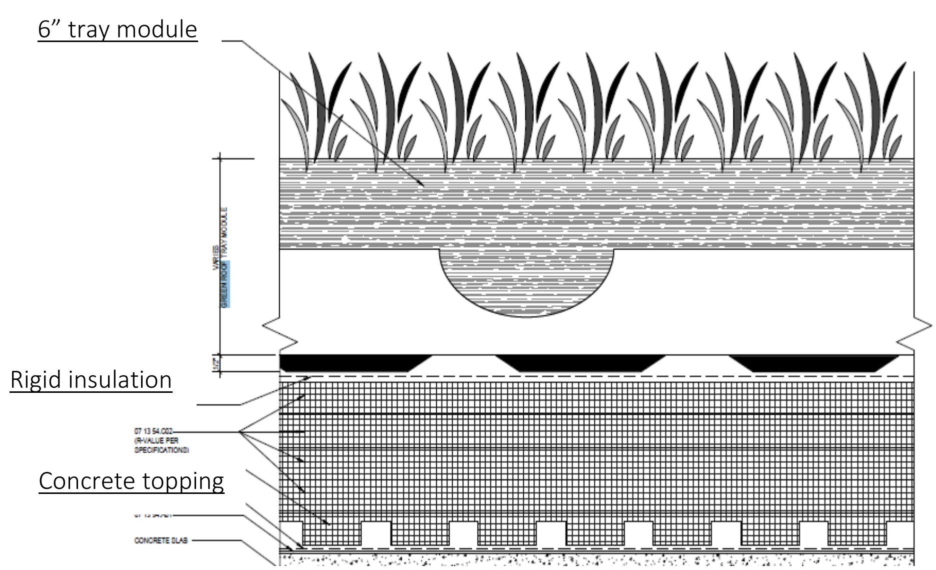


Figure 4 | Green Roof Section (SmithGroupJJR)

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

Roof Loads 1

Gravity Loads - Roof

Dead Loads:

1) Green Roof System

6" Green Roof Tray Module	30 psf
Landscaping Stone	5 psf
Insulation	5 psf
Concrete Slab + Framing*	95 psf
	135 psf

* See floor loads for 5" conc slab + framing values

2) Typical Concrete Roof

Roof Finishes + Insulation	5 psf
Concrete Slab + Framing	95 psf
MEP	15 psf
	115 psf

3) Penthouse Roof

Roof Finishes + Insulation	5 psf
Steel Framing	15 psf
MEP	15 psf
Deck - 1.5" 22GA Type B	1.78 psf
Misc	3 psf
	40 psf

Live Loads:

1) Green Roof System — 100 psf
Yards + Terraces, pedestrian - Not Reduced

2) Typical Roof — 20 psf
Ordinary Flat Roof - Not Reduced

3) Penthouse Roof — 20 psf
Ordinary Flat Roof - Not Reduced

Live Loads from ASCE 7-05 Table 4-1

Below is a summary of the roof gravity dead and live load values determined in this section.

Load Type	Dead	Live
Typical Roof	115 psf	20 psf Not reduced
Penthouse Roof	40 psf (50 psf SDL from structural drawings)	20 psf Not reduced
Green Roof	135 psf	100 psf Not reduced

Table 2 | Roof Gravity Load Summary

A flat roof snow load for the building is calculated below, but will not control design. Snow drift will be considered for the green roof and lower 6th level roof due to the large height difference between these levels and the penthouse roof. The 6th level is designed for future expansion and may become an enclosed floor in the future. Floor live loads for the 6th level roof will likely control.

Roof Loads 2

Snow Loads:

$p_f = 0.7 C_e C_t I p_g$ (7-1)

$p_g = 5$ psf (Fig. 7-1)

$C_e = 0.9$ (Table 7-2)

$C_t = 1.0$ (Table 7-3)

$I = 1.2$ (Table 7-4)

$p_f = 0.7(0.9)(1.0)(1.2)(5) = 4$ psf

Section 7-7 – Drifts on Lower Roofs

1) Snow Drift on 4th Floor Green Roof From Penthouse Level (117 ft)

$h_d = \left| \begin{array}{l} 2 \text{ ft (leeward)} \\ <1 \text{ ft (windward)} \end{array} \right._{max}$ (fig 7-9) $= 2$ ft (section 7-7)

$\gamma = 0.13 p_g + 14 = 0.13(5) + 14 = 14.65$ (7-2)

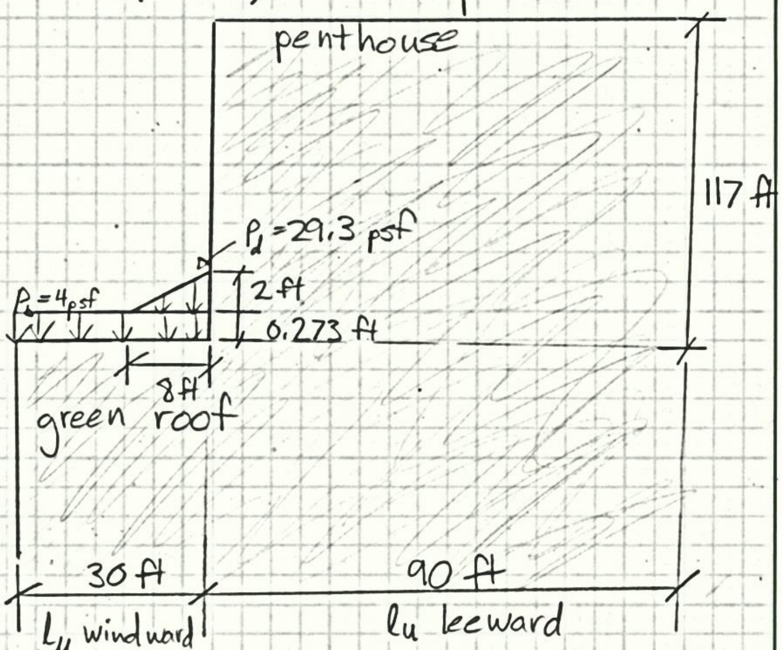
$h_b = P_o / 14.65 = 4/14.65 = 0.273$ ft

$h_c \approx 117$ ft

$h_c / h_b > 0.2$ ∴ Must calculate drift

$h_d < h_c$ ∴ $W = 4 h_d = 4(2) = 8$ ft

$P_d = h_d \gamma = 2(14.65) = 29.3$ psf



2) Snow Drift on 6^{th} Floor From Penthouse Roof Level (68 ft)

$\gamma = 14.65$

$h_b = 0.273$

$h_c \approx 68$ ft

$h_c/h_b > 0.2$ ∴ Must calculate drift

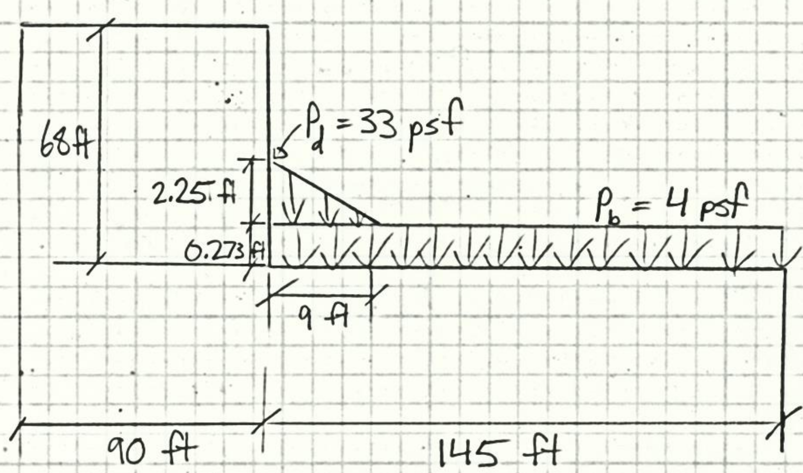
$h_d = \left| \begin{array}{l} 2 \\ 3/4(3) = \underline{2.25 \text{ ft}} \end{array} \right._{max}$ 145 ft

$l_u = 90$ ft leeward

$l_u = 145$ ft windward

$h_d < h_c$ ∴ $w = 4h_d = 4(2.25) = 9$ ft

$P_d = h_d \gamma = (2.25)(14.65) = 33$ psf



3.2 Floor Loads

Floor dead and live loads will be determined for both the bed tower and parking garage floor systems in this report. On the following page, Figures 6 shows typical details for the floor slabs under consideration for this report. Concrete floor slabs in the bed tower are typically 5 or 7 inches. All dead load values are based on the typical bay pictured in Figure 5.

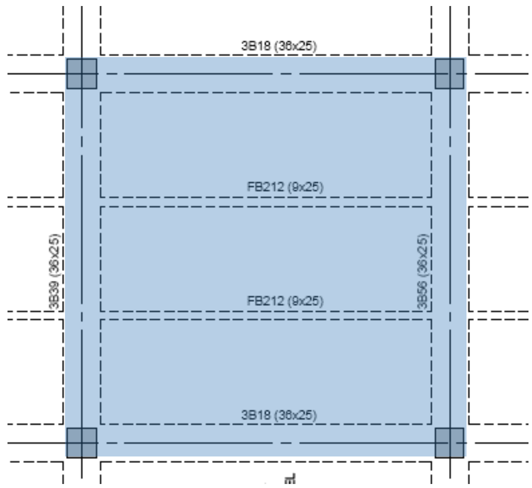


Figure 5 | Typical Bay from Third Floor Area D Floor Plan (Walter P. Moore)

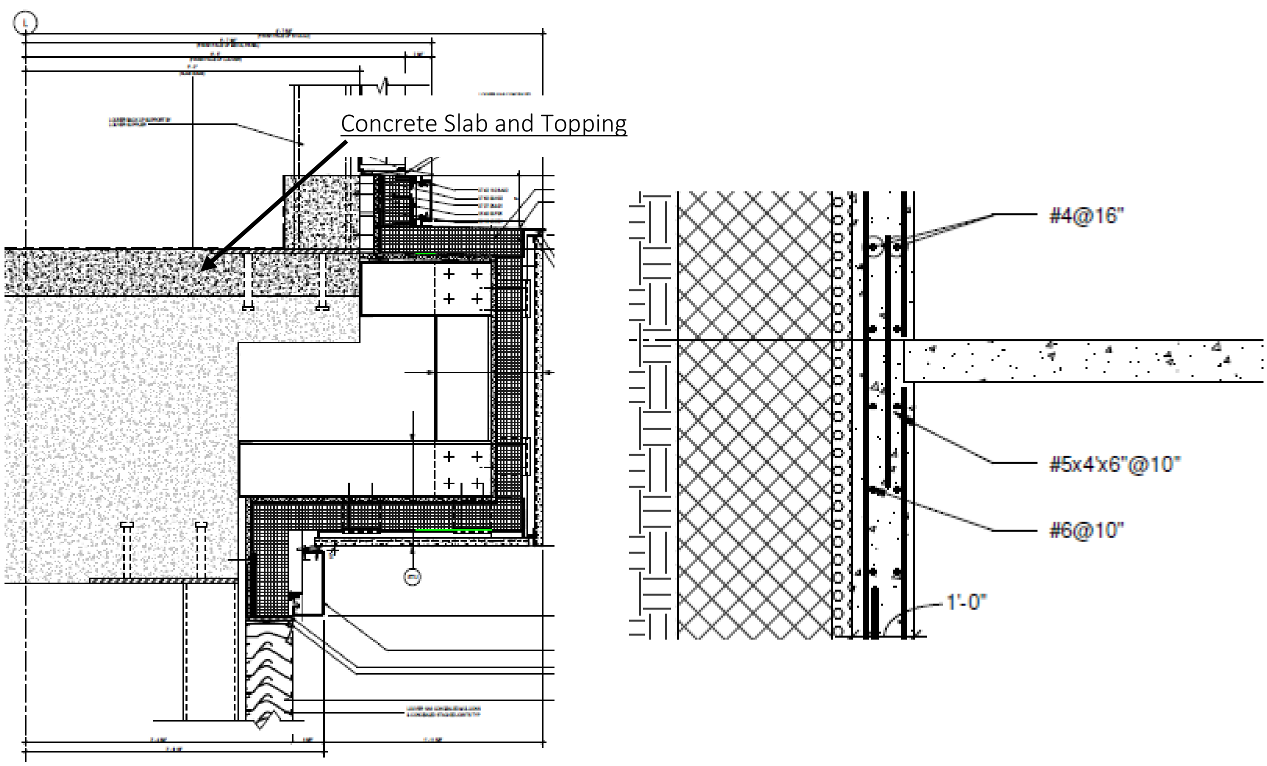


Figure 6 | Floor Section in Bed Tower (left, SmithGroupJJR) and Parking Garage (right, Walter P. Moore)

Floor Loads 1

Bed Tower Dead Loads – Concrete

Thickness	Area & Floors	Slab Wt	Total Wt.
5"	2B,C,D 3B,C,D 4A,B,C,D 5A,B,C,D 6A,B,C,D 7(all), 8(all) 9(all), penthouse	$5" \cdot 1ft/12" \times 150$ $= 62.5$ psf	117.5 psf ≈ 120 psf
7"	2B, 3B, 4B 5A/B, 6A/B 7A/B, 8(all) 9(all)	$7" \cdot 1ft/12" \times 150$ $= 87.5$ psf	142.5 psf ≈ 145 psf

Occurances of all other slab thicknesses are infrequent and in small areas

5000 psi NWC → 150 pcf

Typical Bay: $4 \times ((36" \times (25-5)" \times 1\,ft^2/144\,in^2 \times 30') = 150\,ft^3$
$2 \times ((9" \times (25-5)" \times 1\,ft^2/144\,in^2 \times 30') = 37.5\,ft^3$

Beam Wt $(150 + 37.5\,ft^3)(150\,pcf) = 28125$ lbs

$$\frac{28125 \text{ lbs}}{30' \times 30' \text{ bay}} = 32 \text{ psf}$$

Concrete Framing	32 psf
Finishes + Ceiling	5 psf
Concrete Slab	see above
MEP	15 psf
Misc.	3 psf
	55 psf + slab

Floor Loads 2

Bed Tower Dead Loads - Elevator Machine Room

3 ½" LWC on 2" Deep 20GA Composite Deck
Vulcraft Value: 57 psf

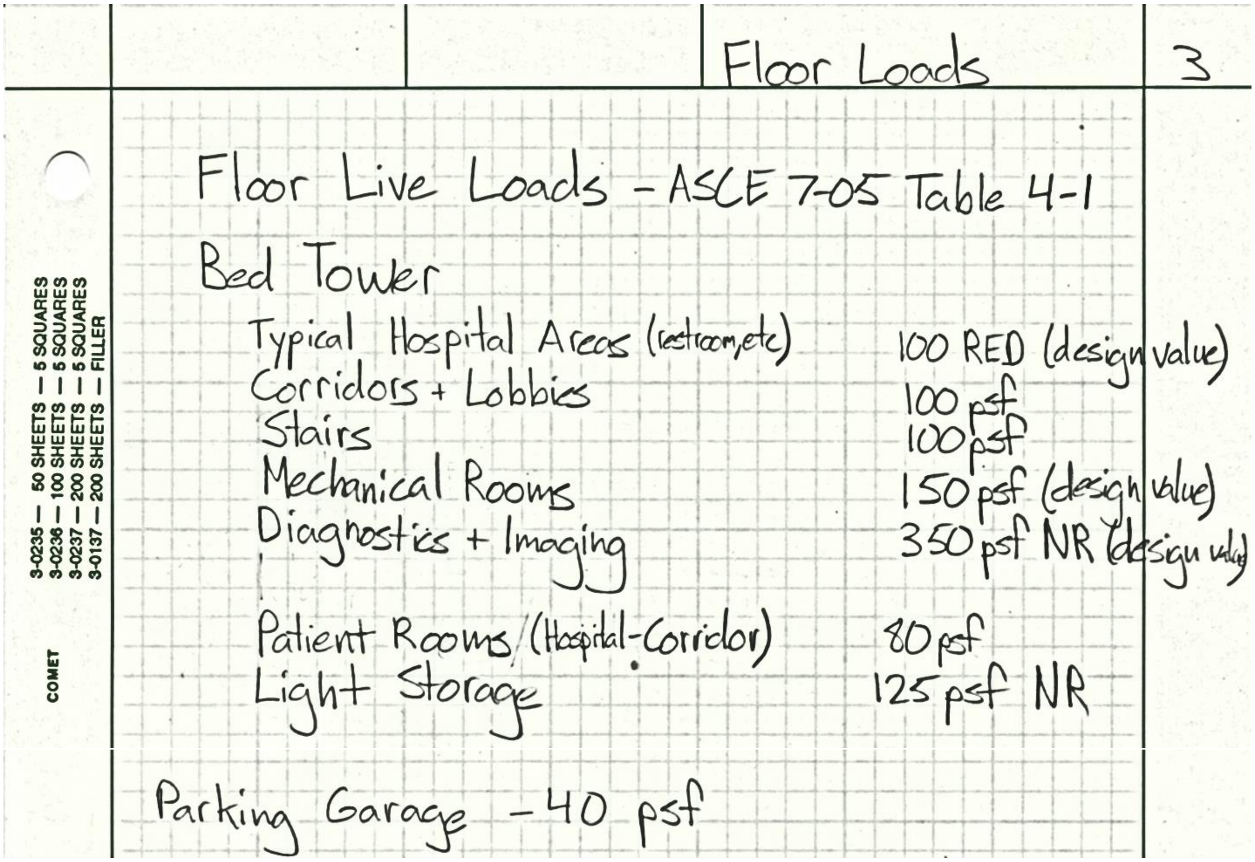
Steel Framing	15 psf
Finishes + Ceiling	5 psf
Metal Deck	57 psf
MEP	15 psf
Elev. Equip	70 psf
Misc.	3 psf
	165 psf

Parking Garage Dead Loads

Typical Depth = 8" NWC (structural plan notes)

Slab Wt = 8" · 1/12 · 150 pcf = 100 psf

Concrete Slab	100 psf
Post-Tension System	5 psf
Parked Cars	20 psf
Misc. (lighting, etc)	5 psf
	130 psf



Floor Loads 3

Floor Live Loads – ASCE 7-05 Table 4-1

Bed Tower

Typical Hospital Areas (restroom, etc)	100 RED (design value)
Corridors + Lobbies	100 psf
Stairs	100 psf
Mechanical Rooms	150 psf (design value)
Diagnostics + Imaging	350 psf NR (design value)
Patient Rooms (Hospital-Corridor)	80 psf
Light Storage	125 psf NR

Parking Garage – 40 psf

Floor Use	Dead		Live
Typical Hospital Areas	5” slab – 120 psf 7” slab – 145 psf		100 psf – reduced (design value)
Corridors + Lobbies	5” slab – 120 psf 7” slab – 145 psf		100 psf
Stairs	5” slab – 120 psf 7” slab – 145 psf		100 psf
Mechanical Rooms	5” slab – 120 psf 7” slab – 145 psf	+ 200 K mech. equip	150 psf
Diagnostics + Imaging	5” slab – 120 psf 7” slab – 145 psf	+ 80 K diagnostic equip.	350 psf – not reduced (design value)
Patient Rooms (Designed as Hospital – Corridor)	5” slab – 120 psf 7” slab – 145 psf		80 psf
Parking Garage	5” slab – 120 psf 7” slab – 145 psf		40 psf

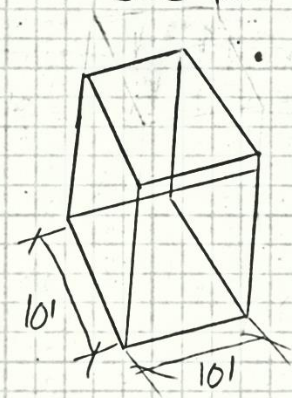
Table 3 | Floor Gravity Loads Summary

Non-typical Loads

Non-typical Loads Considered:

- Green roof (see roof loads)
- Diagnostic Equipment
  - 350 psf design live load in some diagnostic areas.
  - Equip. weight unknown from specs
  - Assume 10'x10' machine...

$$350 \text{ psf} \times (10 \text{ ft})^2 = \underline{35 \text{ k}}$$



3.3 Perimeter Loads

The building perimeter enclosure produces a linear dead load through its attachment to the main building structure. The Health Centre has three main enclosure systems: curtain wall, stucco panels, and metal panels. Figures 7-8 depict the methods of attachment for each system.

Each system has a different load path that is dependent on its connection to the structure. The curtain wall's framing system is connected to the main structure by a structural steel plate and embedded metal stud.

Loads transfer from the stucco wall via continuous light gauge angles attached to continuous light gauge zees. The light gauge zees are connected by a fiberglass thermal spacer clip to gypsum sheathing, which takes the load to the main structure via another light gauge zee.

A light gauge zee connects the metal wall panels to the main structure, and load is transferred through steel bolts.

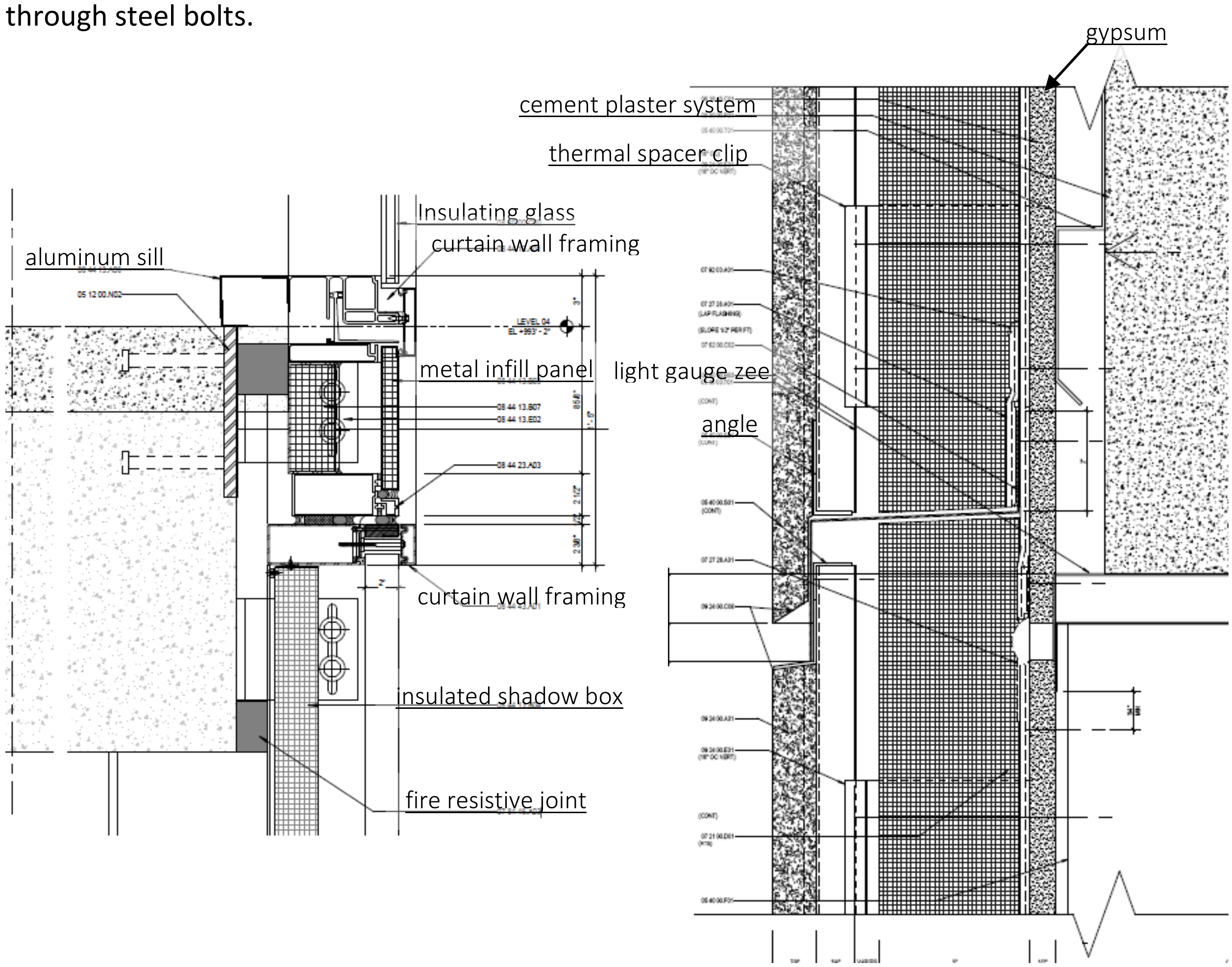


Figure 7 | Curtain Wall Connection Detail (left) and Stucco Panel Wall Envelope (right) from SmithGroupJJR

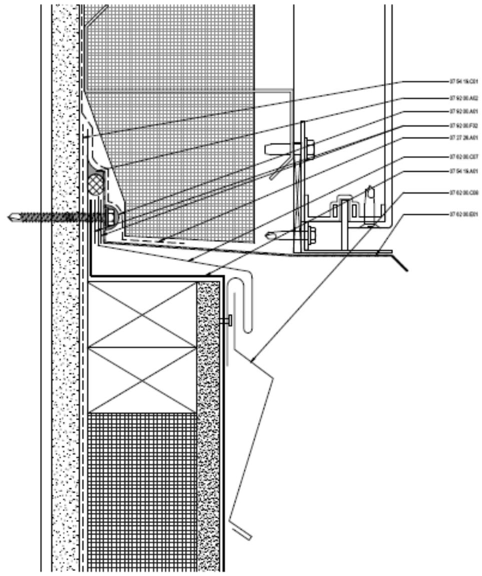


Figure 8 | Metal Panel Connection Detail (SmithGroupJJR)

Perimeter Loads 1

Perimeter Enclosure Dead Loads

Curtain Wall

2" Insulating Glass	1 psf
Curtain Wall Framing	4 psf
Insulating Shadow Box	
3" Rigid Insulation	5 psf
Interior Sheathing ½"	2 psf
Misc. (sealants for joints etc)	4 psf
	16 psf

Panel Systems

Stucco/Metal Panels (⅞")	10 psf
3" Rigid Insulation	4 psf
½" Gypsum Interior	2 psf
Metal Framing	2 psf
Air Gap	0 psf
	18 psf

4 | Wind Loads

The following section calculates wind loads perpendicular and parallel to The Health Centre using criteria from chapter 6 of ASCE 7-05 for a flexible building. Excel and hand calculations were used to determine load values and gust effect factors. Both building and parapet loads are included in this section.

4.1 Perpendicular Loads

Building Geometry

B =	421.25	ft
L =	285	ft
h =	166	ft
z_{bar} =	99.6	ft

Variables Used

Basic Wind Speed	V =	90	mph	(Figure 6-1)
Directionality Factor	K_d =	0.85		(Table 6-4)
Occupancy Category		IV		(Table 1-1)
Importance Factor	I =	1.15		(Table 6-1)
Topographic Factor	K_{zt} =	1		(Walter P. Moore)
Exposure Category		B		(Walter P. Moore)

Calculation of K_z and q_z

$q_z = 0.00256K_zK_{zt}K_dV^2I$ (6-15)

Story	Height (ft)	K_z - Case 1	K_z - Case 2	q_z - Case 1 (psf)	q_z - Case 2 (psf)
2	16	0.7	0.58	14.1886	11.7563
3	32	0.712	0.712	14.4318	14.4318
4	49	0.805	0.805	16.3169	16.3169
5	66	0.874	0.874	17.7155	17.7155
6	83	0.939	0.939	19.0330	19.0330
7	98	0.984	0.984	19.9451	19.9451
8	113	1.0225	1.0225	20.7255	20.7255
9	128	1.06	1.06	21.4856	21.4856
penthouse	143	1.096	1.096	22.2153	22.2153
roof/q_h	166	1.142	1.142	**23.1477**	**23.1477**

*Note: Only discrepency between Case 1 and 2 values occurs at 16 ft

Gust Effect Factor G_f

See pages 1-3 of wind calcs for detailed calculations and code references.

Natural Frequency	n_1 =	0.437	Hz	(C6-15)
Resonant Response Factor	g_R =	3.987		(6-9)
Background & Wind Factor	g_v, g_Q =	3.4		(6-9)
Mean Hourly Wind	$V_{z,bar}$ =	78.3	mph	(6-14)
Turbulence Length	$L_{z,bar}$ =	462.45		(6-7)
Reduced Frequency	N_1 =	2.581		(6-12)
Resonant Responcse Factor	R =	0.1958		(6-10)
Turbulence Intensity	I_z =	0.25		(6-5)
Background Response Factor	Q =	0.76		(6-6)
Flexible Gust Effect Factor	**G_f =**	**0.8123**		(6-8)

External Pressure Coefficient C_p

See pages 3 of wind calcs for detailed calculations.

	L/B =	0.6766	
	h/L =	0.5825	
	Θ =	< 10	degrees
Windward Wall	C_p =	0.8	
Leeward Wall	C_p =	-0.5	
Side Wall	C_p =	-0.7	
Roof - 0 to h/2	C_p =	-0.9	-0.18
Roof - h/2 to h	C_p =	-0.9	-0.18
Roof - h to 2h	C_p =	-0.5	-0.18
Roof - >2h	C_p =	-0.3	-0.18

(Figure 6-6)

Design Wind Pressure P

$p = qG_fC_p - q_i(Gc_{pi})$ (6-19)

Location	z (ft)	q_z / q_h (psf)	C_p	G_f	q_zG_fCp (psf)	GC_{pi}	Net Pressure (psf) $q_zG_fC_p - q_h(+GC_{pi})$	$q_zG_fC_p - q_h(-GC_{pi})$
Windward	16 - Case 1	14.1886	0.8	0.8123	11.3509	0.18	7.1843	15.5175
	16 - Case 2	11.7563	0.8	0.8123	9.4050	0.18	5.2384	13.5716
	32	14.4318	0.8	0.8123	11.5455	0.18	7.3789	15.7121
	49	16.3169	0.8	0.8123	13.0535	0.18	8.8869	17.2201
	66	17.7155	0.8	0.8123	14.1724	0.18	10.0058	18.3390
	83	19.0330	0.8	0.8123	15.2264	0.18	11.0598	19.3930
	98	19.9451	0.8	0.8123	15.9561	0.18	11.7895	20.1227
	113	20.7255	0.8	0.8123	16.5804	0.18	12.4138	20.7470
	128	21.4856	0.8	0.8123	17.1885	0.18	13.0219	21.3551
	143	22.2153	0.8	0.8123	17.7722	0.18	13.6057	21.9388
	166	23.1477	0.8	0.8123	18.5182	0.18	14.3516	22.6847
Leeward	All	23.1477	-0.5	0.8123	-11.5739	0.18	-15.7404	-7.4073
Side	All	23.1477	-0.7	0.8123	-16.2034	0.18	-20.3700	-12.0368
Roof (0'-83')	166	23.1477	-0.9	0.8123	-20.8329	0.18	-24.9995	-16.6663
Roof (83'-166')	166	23.1477	-0.9	0.8123	-20.8329	0.18	-24.9995	-16.6663
Roof (166'-332')	166	23.1477	-0.5	0.8123	-11.5739	0.18	-15.7404	-7.4073
Roof (> 332')	166	23.1477	-0.3	0.8123	-6.9443	0.18	-11.1109	-2.7777

4.2 Parallel Loads

Building Geometry

B =	285	ft
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penthouse	143	1.096	1.096	22.2153	22.2153
roof/q_h	166	1.142	1.142	**23.1477**	**23.1477**

*Note: Only discrepency between Case 1 and 2 values occurs at 16 ft

Gust Effect Factor G_f

See pages 6-7 of wind calcs for detailed calculations and code references.

Natural Frequency	n_1 =	0.437	Hz	(C6-15)
Resonant Response Factor	g_R =	3.987		(6-9)
Background & Wind Factor	g_v, g_Q =	3.4		(6-9)
Mean Hourly Wind	$V_{z,bar}$ =	78.3	mph	(6-14)
Turbulence Length	$L_{z,bar}$ =	462.45		(6-7)
Reduced Frequency	N_1 =	2.581		(6-12)
Resonant Responcse Factor	R =	0.1958		(6-10)
Turbulence Intensity	I_z =	0.25		(6-5)
Background Response Factor	Q =	0.76		(6-6)
Flexible Gust Effect Factor	**G_f =**	**0.8123**		(6-8)

External Pressure Coefficient C_p

See pages 7 of wind calcs for detailed calculations.

	L/B =	1.4781		
	h/L =	0.3941		
	Θ =	< 10	degrees	
Windward Wall	C_p =	0.8		(Figure 6-6)
Leeward Wall	C_p =	-0.4044		
Side Wall	C_p =	-0.7		
Roof - 0 to h/2	C_p =	-0.9	-0.18	
Roof - h/2 to h	C_p =	-0.9	-0.18	
Roof - h to 2h	C_p =	-0.5	-0.18	
Roof - >2h	C_p =	-0.3	-0.18	

Design Wind Pressure P

$p = qG_fC_p - q_i(Gc_{pi})$ (6-19)

Location	z (ft)	q_z / q_h (psf)	C_p	G_f	q_zG_fCp (psf)	GC_{pi}	Net Pressure (psf) $q_zG_fC_p - q_h(+GC_{pi})$	$q_zG_fC_p - q_h(-GC_{pi})$
Windward	16 - Case 1	14.1886	0.8	0.8123	11.3509	0.18	7.1843	15.5175
	16 - Case 2	11.7563	0.8	0.8123	9.4050	0.18	5.2384	13.5716
	32	14.4318	0.8	0.8123	11.5455	0.18	7.3789	15.7121
	49	16.3169	0.8	0.8123	13.0535	0.18	8.8869	17.2201
	66	17.7155	0.8	0.8123	14.1724	0.18	10.0058	18.3390
	83	19.0330	0.8	0.8123	15.2264	0.18	11.0598	19.3930
	98	19.9451	0.8	0.8123	15.9561	0.18	11.7895	20.1227
	113	20.7255	0.8	0.8123	16.5804	0.18	12.4138	20.7470
	128	21.4856	0.8	0.8123	17.1885	0.18	13.0219	21.3551
	143	22.2153	0.8	0.8123	17.7722	0.18	13.6057	21.9388
	166	23.1477	0.8	0.8123	18.5182	0.18	14.3516	22.6847
Leeward	All	23.1477	-0.4044	0.8123	-9.3609	0.18	-13.5275	-5.1943
Side	All	23.1477	-0.7	0.8123	-16.2034	0.18	-20.3700	-12.0368
Roof (0'-83')	166	23.1477	-0.9	0.8123	-20.8329	0.18	-24.9995	-16.6663
Roof (83'-166')	166	23.1477	-0.9	0.8123	-20.8329	0.18	-24.9995	-16.6663
Roof (166'-332')	166	23.1477	-0.5	0.8123	-11.5739	0.18	-15.7404	-7.4073
Roof (> 332')	166	23.1477	-0.3	0.8123	-6.9443	0.18	-11.1109	-2.7777

4.3 Parapet Loads

Building Geometry

B =	285	ft
L =	421.25	ft
h =	166	ft
z_{bar} =	99.6	ft

Variables Used

Basic Wind Speed	V =	90	mph	(Figure 6-1)
Directionality Factor	K_d =	0.85		(Table 6-4)
Occupancy Category		IV		(Table 1-1)
Importance Factor	I =	1.15		(Table 6-1)
Topographic Factor	K_{zt} =	1		(Walter P. Moore)
Exposure Category		B		(Walter P. Moore)

Calculation of K_z and q_z

$q_p = 0.00256K_zK_{zt}K_dV^2I$ (6-15)

Parapet	Height (ft)	K_z - Case 1	K_z - Case 2	q_p - Case 1 (psf)	q_p - Case 2 (psf)
Mech Roof	170	1.15	1.15	23.3099	23.3099
Green Roof	54	0.826	0.826	16.7426	16.7426
Penthouse	147	1.104	1.104	22.3775	22.3775
q_h	166	1.142	1.142	**23.1477**	**23.1477**

*Note Case 1 and 2 values are the same for all parapet types.

Design Wind Pressure P

$p_p = q_pGC_{pu}$ (6-20)

Parapet	q_p (psf)	GC_{pu} - windward	Gc_{pu} - leeward	Net Pressure (psf) p_p - windward	p_p - leeward
Mech Roof	23.3099	1.5	-1	34.9648	-23.309856
Green Roof	16.7426	1.5	-1	25.1138	-16.74255744
Penthouse	22.3775	1.5	-1	33.5662	-22.37746176

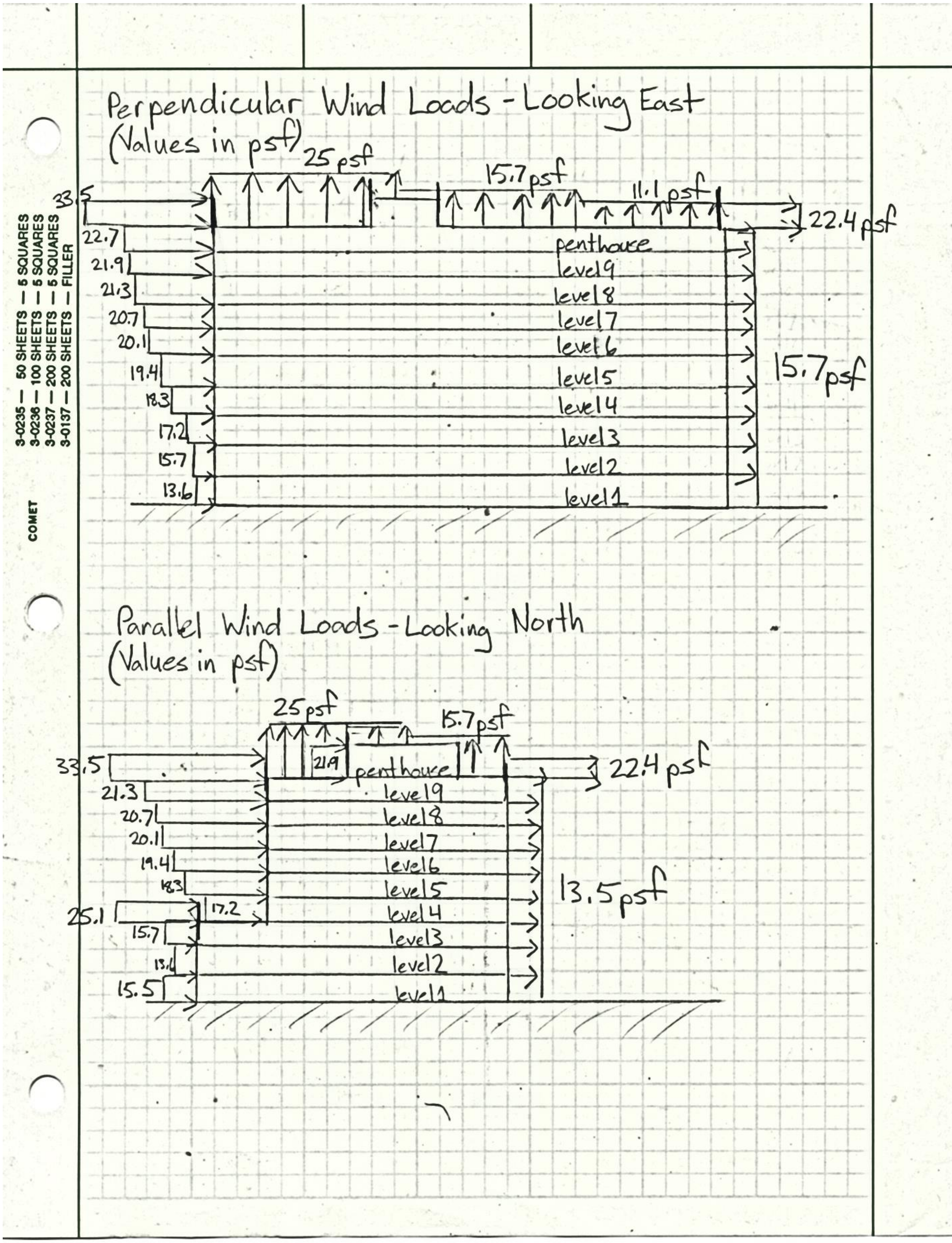
See pages 4 and 5 of hand calculations.

4.4 Summary and Hand Calculations

Below is a summary of base shear values for the perpendicular and parallel wind directions. On the following page, wind load diagrams summarize the loads on the building.

Total Base Shear Values

Level	Floor Height	Windward Pressure		Leeward Pressure		Length (ft)		Shear (K)	
	(ft)	Perpendicular	Parallel	Perpendicular	Parallel	Perpendicular	Parallel	Perpendicular	Parallel
2	16	15.51747249	15.51747249	15.74043633	13.5275162	421.25	285	210.6783054	132.445148
3	17	15.71205911	15.71205911	15.74043633	13.5275162	421.25	285	225.2391829	141.665742
4	17	17.22010545	17.22010545	15.74043633	13.5275162	421.25	285	236.0386798	148.972227
5	17	18.33897853	18.33897853	15.74043633	13.5275162	421.25	285	244.0512097	154.393167
6	15	19.39298941	19.39298941	15.74043633	13.5275162	421.25	285	221.9993339	140.735161
7	15	20.12268925	20.12268925	15.74043633	13.5275162	421.25	285	226.6101248	143.854628
8	15	20.74698801	20.74698801	15.74043633	13.5275162	421.25	285	230.5549125	146.523505
9	15	21.35507121	21.35507121	15.74043633	13.5275162	421.25	285	234.3972382	149.123061
penthouse	19	21.93883108	21.93883108	15.74043633	13.5275162	421.25	285	301.5754365	192.05027
pent. Roof	11.5	22.68474647	22.68474647	15.74043633	13.5275162	421.25	285	186.1459949	118.685691
						Base Shear (k)		**2317.290419**	**1468.4486**


Perpendicular Wind Loads - Looking East
(Values in psf)
25 psf
15.7 psf
11.1 psf
22.4 psf
33.5
22.7
21.9
21.3
20.7
20.1
19.4
18.3
17.2
15.7
13.6
penthouse
level 9
level 8
level 7
level 6
level 5
level 4
level 3
level 2
level 1
15.7 psf
Parallel Wind Loads - Looking North
(Values in psf)
25 psf
15.7 psf
33.5
21.9
penthouse
22.4 psf
21.3
20.7
20.1
19.4
18.3
25.1
17.2
15.7
13.6
15.5
level 9
level 8
level 7
level 6
level 5
level 4
level 3
level 2
level 1
13.5 psf

Hannah Valentine 1

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

Wind Loads - 6.5.3 Design Procedure

1. $V = 90$ mph. (figure 6-1)
   $K_d = 0.85$ (table 6-4)
2. $I = 1.15$ (table 6-1)
   (table 1-1)
3. $K_z = ?$ (table 6-3)
   Wind Exposure Category B
   See Table - Wind Pressures.
4. $K_{zt} = 1.0$ (figure 6-4)
5. $G = ?$

Estimating rigidity for concrete moment frames

$$n_1 = \frac{43.5}{H^{0.9}} = \frac{43.5}{(166\text{ ft})^{0.9}} = 0.437\text{ Hz} \quad (C6\text{-}15)$$

∴ Building cannot be considered rigid

$$G_f = 0.925\left(\frac{1 + 1.7 I_z \sqrt{g_Q^2 Q^2 + g_R^2 R^2}}{1 + 1.7 g_v I_z}\right) \quad (6\text{-}8)$$

$$g_R = \sqrt{2\ln(3600 n_1)} + \frac{0.577}{\sqrt{2\ln(3600 n_1)}} \quad (6\text{-}9)$$

$$= \sqrt{2\ln(3600(0.437))} + \frac{0.577}{\sqrt{2\ln(3600(0.437))}}$$

$$= 3.83689 + 0.15038$$

$$g_R = \boxed{3.987}$$

$$\bar{V}_z = \bar{b}\left(\frac{\bar{z}}{33}\right)^{\bar{\alpha}} V\left(\frac{88}{60}\right) \quad (6\text{-}14)$$

$c = 0.30$ $\quad \bar{\alpha} = \frac{1}{4.0}$ $\quad \bar{b} = 0.45$ (table 6-2)

$$\bar{z} = \max \begin{cases} 0.6h = 0.6(166) = \boxed{99.6\text{ ft}} \\ z_{min} = 30\text{ ft} \end{cases} \quad (6.5.8.1)$$

$$\bar{V}_z = 0.45\left(\frac{99.6}{33}\right)^{1/4}(90)\left(\frac{88}{60}\right) = 78.3$$

2

$$L_{\bar{z}} = \ell \left(\frac{\bar{z}}{33} \right)^{\bar{\epsilon}} \quad (6\text{-}7)$$

$$\left.\begin{aligned} \bar{\epsilon} &= 1/3.0 \\ \ell &= 320 \text{ ft} \end{aligned}\right\} \text{Table 6-2}$$

$$L_{\bar{z}} = 320 \left(\frac{99.6}{33} \right)^{1/3} = 462.45$$

$$N_1 = \frac{n_1 L_{\bar{z}}}{\bar{V}_{\bar{z}}} = \frac{(0.437)(462.45)}{78.3} = 2.581 \quad (6\text{-}12)$$

$$R_\ell = \frac{1}{n} - \frac{1}{2n^2}\left(1 - e^{-2n}\right) \text{ for } n > 0 \quad (6\text{-}13a)$$

$$R_\ell = 0 \text{ for } n = 0 \quad (6\text{-}13b)$$

R_h: $n = \frac{4.6 n_1 h}{\bar{V}_{\bar{z}}} = \frac{4.6(0.437)(166)}{78.3} = 4.262$

$$R_h = \frac{1}{4.262} - \frac{1}{2(4.262)^2}\left(1 - e^{-2(4.262)}\right) = 0.207$$

R_B: $n = \frac{4.6 n_1 B}{\bar{V}_{\bar{z}}} = \frac{4.6(0.437)(421.25)}{78.3} = 10.81$

$$R_B = \frac{1}{10.81} - \frac{1}{2(10.81)^2}\left(1 - e^{-2(10.81)}\right) = 0.0882$$

R_L: $n = \frac{15.4 n_1 L}{\bar{V}_{\bar{z}}} = \frac{15.4(0.437)(285)}{78.3} = 24.5$

$$R_L = \frac{1}{24.5} - \frac{1}{2(24.5)^2}\left(1 - e^{-2(24.5)}\right) = 0.04$$

R_n: $R_n = \frac{7.47 N_1}{(1 + 10.3 N_1)^{5/3}} = \frac{7.47(2.581)}{(1 + 10.3(2.581))^{5/3}} \quad (6\text{-}11)$

$$= 0.07656$$

3

$$R = \sqrt{\frac{1}{\beta} R_n R_h R_B (0.53 + 0.47 R_L)} \quad (6\text{-}10)$$

$$R = \sqrt{\frac{1}{0.02}(0.07656)(0.207)(0.0882)(0.53 + 0.47(0.04))} = 0.1958$$

$\beta = 2\%$ Ch 6 Commentary, pg 294

$g_Q = g_v = \boxed{3.4}$

$$I_{\bar{z}} = c\left(\frac{33}{\bar{z}}\right)^{1/6} = 0.3\left(\frac{33}{99.6}\right)^{1/6} = 0.25 \quad (6\text{-}5)$$

$$Q = \sqrt{\frac{1}{1 + 0.63\left(\frac{B+h}{L_{\bar{z}}}\right)^{0.63}}} = \sqrt{\frac{1}{1 + 0.63\left(\frac{421.25 + 166}{462.45}\right)^{0.63}}} \quad (6\text{-}6)$$

$$= 0.76$$

$$G_f = 0.925\left(\frac{1 + 1.7(0.25)\sqrt{3.4^2(0.76)^2 + (3.987)^2(0.1958)^2}}{1 + 1.7(3.4)(0.25)}\right)$$

$G_f = 0.8123$

6. Enclosure Classification: Enclosed (6.5.11.1)

7. $GC_{pi} = \pm 0.18$ (Fig. 6-5)

8. Wall Pressure Coeff. C_p

$L/B = 285/421.25 = 0.676$

$h/L = 166/285 = 0.582$

$\theta < 10°$

See excel table for all C_p Values. (Figure 6-6)

9. Velocity Pressure q_z

See excel table for all values.

10. $q_z = 0.00256 K_z K_{zt} K_d V^2 I$ (6-15)

For 16ft: Case 1 $= 0.00256(0.7)(1)(0.85)(90)^2(1.15) = 14.1886$ psf

4

Hand calculations for q_z verify excel value.

10. Design Wind Pressure p

For flexible buildings...

$$p = qG_fC_p - q_i GC_{pi} \quad (6\text{-}19)$$

See excel table for all values

For Windward direction at height h, 166 ft

$$p = qG_fC_p - q_i(GC_{pi})$$

Parapets

$$p_p = q_p GC_{pn} \quad (6\text{-}20)$$

GC_{pn} = +1.5 for windward
−1.0 for leeward

Parapet 1: Detail 30, A5.1.6
Height = 4 ft from mech roof

Parapet 4C: Detail 27, A5.1.44
Height = 2'−2 3/32" from mech roof

Parapet Green Roof: Detail 72, A5.2.4
Height = 5' from green roof

Parapet Type 8: Detail 69, A5.3.19
Height = 4', L Block from penthouse

Parapets
Mech Roof 1
Mech Roof 2
Green Roof

5

Parapets – MWFRC

$P_p = q_p GC_{pn}$ (6-20)

Parapet Types:

K_z values almost identical combine to Mech Roof type

- Mech Roof 1: 4 ft above mech roof
  height = 170 ft
  Detail 30 sheet A5.1.6
- Mech Roof 2: 2'-2 3/32" above mech roof
  height = 168'-2"
  Detail 27 sheet A5.1.44
- Green Roof: 5 ft above 4th floor
  height = 54 ft
  Detail 72/A5.2.4
- Penthouse: 4 ft above mech penthouse
  height = 147 ft
  Detail 69/A5.3.19

1. Find K_z
   Mech 1: $K_z = 1.15$
   Mech 2: $K_z = 1.146$ ⇒ Use 1.15 for both
   Penthouse: $K_z = 1.104$ (Figure 6-6)
   Green Roof:

2. Calculation of q_p
   Mech Roof:
   $q_p = (0.00256)(1.15)(1)(0.85)(90)^2(1.15)$
   $= 23.3099$ psf ⇒ Matches excel
   See Excel for all q_p values.

3. Calculation of Design Wind Pressure
   Mech Roof – Windward
   $P_p = (23.3099)(1.5) = 34.96$ psf
   See excel for all q_p values

Wind Loads - Direction 2

New G_f Value - see pages 1-3 for additional calcs

$g_R = 3.987$

$\bar{z} = 99.6\text{ ft}$

$\bar{V}_{\bar{z}} = 0.45\left(\frac{99.6}{33}\right)^{1/4}(90)\left(\frac{88}{60}\right) = 78.3$

$L_{\bar{z}} = 462.45$

$N_1 = \frac{n_1 L_{\bar{z}}}{\bar{V}_{\bar{z}}} = 2.581$

R_h: 0.207 → dependent on height

R_B: $\eta = \frac{4.6 n_1 B}{\bar{V}_z} = \frac{4.6(0.437)(285)}{78.3} = 7.317$

$R_B = \frac{1}{7.317} - \frac{1}{2(7.317)^2}\left(1 - e^{-2(7.317)}\right) = 0.1273$

R_L: $\eta = \frac{15.4 n_1 L}{\bar{V}_z} = \frac{15.4(421.25)(0.437)}{78.3} = 36.206$

$R_L = \frac{1}{36.206} - \frac{1}{2(36.206)^2}\left(1 - e^{-2(36.206)}\right) = 0.0272$

R_n: $R_n = 0.07656$ → dependent on N_1

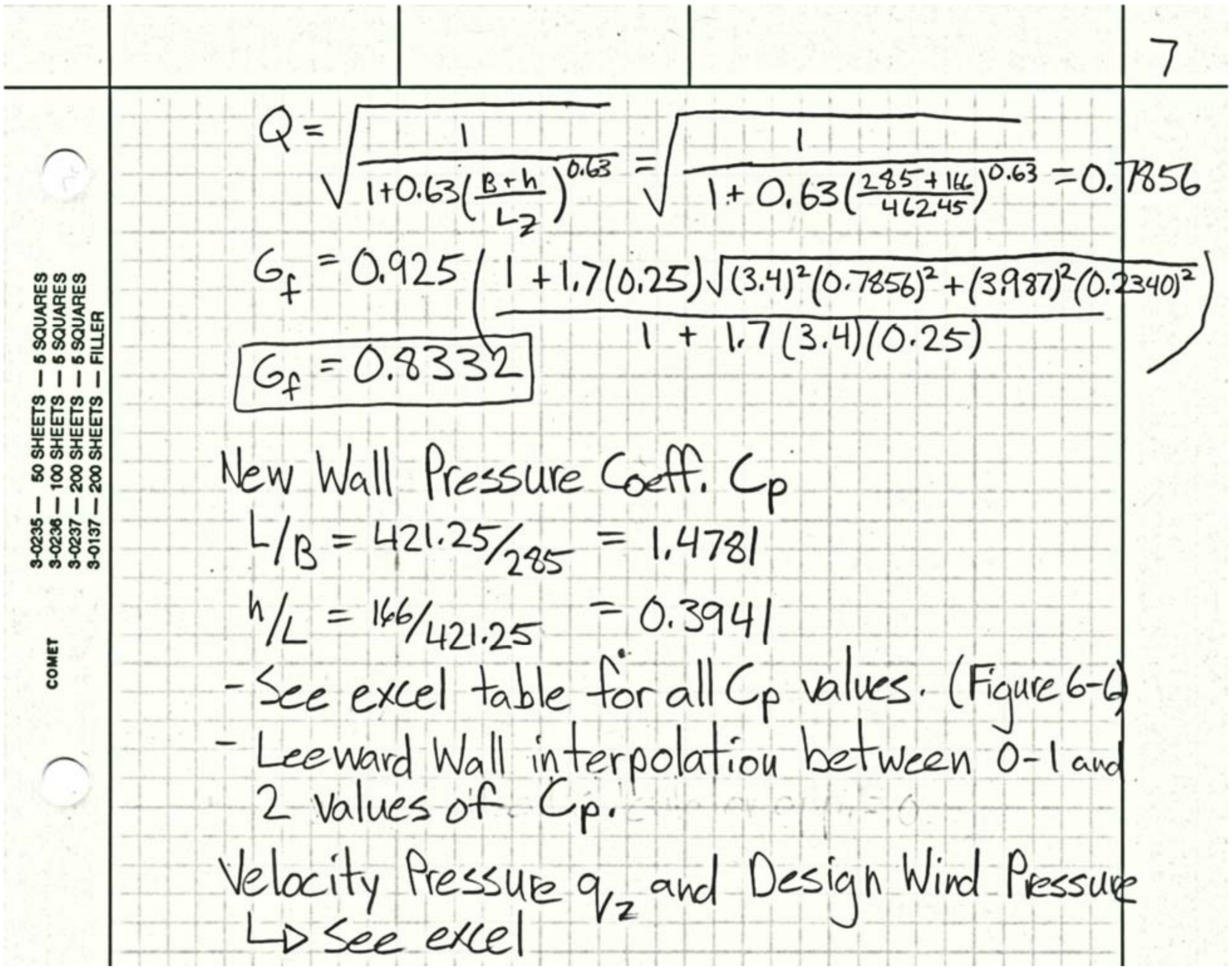
$R = \sqrt{\frac{1}{\beta} R_n R_h R_B (0.53 + 0.47 R_L)}$ (6-10)

$R = \sqrt{\frac{1}{0.02}(0.07656)(0.207)(0.1273)(0.53 + 0.47(0.0272))}$

$R = 0.2340$

$g_Q = g_v = 3.4$

$I_{\bar{z}} = 0.25$



7

$$Q = \sqrt{\frac{1}{1+0.63\left(\frac{B+h}{L_z}\right)^{0.63}}} = \sqrt{\frac{1}{1+0.63\left(\frac{285+166}{462.45}\right)^{0.63}}} = 0.7856$$

$$G_f = 0.925\left(\frac{1+1.7(0.25)\sqrt{(3.4)^2(0.7856)^2+(3.987)^2(0.2340)^2}}{1+1.7(3.4)(0.25)}\right)$$

$$\boxed{G_f = 0.8332}$$

New Wall Pressure Coeff. C_p

$L/B = 421.25/285 = 1.4781$

$h/L = 166/421.25 = 0.3941$

- See excel table for all C_p values. (Figure 6-6)
- Leeward Wall interpolation between 0-1 and 2 values of C_p.

Velocity Pressure q_z and Design Wind Pressure

→ See excel

5 | Seismic Loads

The following section calculates seismic loads for The Health Centre using the Equivalent Lateral Force (ELF) method provisions from ASCE 7-05 chapters 11 and 12.

Seismic Loads 1

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

Design Criteria from Structural Dwgs

$S_s = 0.228g$
$S_1 = 0.086g$
$F_a = 1.2$
$F_v = 1.7$
$S_{DS} = 0.18g$
$S_{D1} = 0.10g$
Occupancy Category IV
Importance Factor = 1.5
SDC = C
Site Class = C

* Structure not exempt under 11.1.2

1) Bed Tower Seismic Loads

Lateral System - Intermediate Reinforced Concrete Moment Frames (table 12-2-1)

$R = 5$
$\Omega = 3$
$C_d = 4\frac{1}{2}$
Perimitted in SDC C

$S_{MS} = F_a S_s$ (11.4-1)
$= (1.2)(0.228g) = 0.2736g$

$S_{M1} = F_v S_1$ (11.4-2)
$= (1.7)(0.086g) = 0.1462g$

$S_{DS} = \frac{2}{3} S_{MS}$ (11.4-3)
$= \frac{2}{3}(0.2736g) = 0.1824g$

$S_{D1} = \frac{2}{3} S_{M1}$ (11.4-4)
$= \frac{2}{3}(0.1462g) = 0.09747g$

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

2

Seismic Design Response Spectrum

Fundamental Period: $T = C_t h_n^x$ (12.8-7)

$C_t = 0.028$, $x = 0.8$ (Table 12.8-2)

$T = 0.028(166\text{ ft})^{0.8} = 1.672\text{ s}$

$T_0 = 0.2\frac{S_{D1}}{S_{DS}} = 0.2\frac{0.09747}{0.1824} = 0.1069\text{ s}$ (11.4-7)

$T_s = \frac{S_{D1}}{S_{DS}} = \frac{0.09747}{0.1824} = 0.5344\text{ s}$ (11.4-7)

Long transition period: $T_L = 12\text{ s}$ (Fig 22-15)

Equivalent Lateral Force Procedure (12.8)

*permitted under table 12.6-1

Seismic Response Coefficeint

$C_s = \frac{S_{DS}}{\left(\frac{R}{I}\right)} = \frac{0.1824}{\left(\frac{5}{1.5}\right)} = 0.05472$ (12.8-2)

⇒ Need not exceed...

$C_s = \frac{S_{D1}}{T\left(\frac{R}{I}\right)} = \frac{0.09747}{1.672\left(\frac{5}{1.5}\right)} = \boxed{0.01749}$ (12.8-3)

Vertical Distribution of forces - 12.8.3

$F_x = C_{vx} V$ (12.8-11)

$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k}$ (12.8-12), where k = linear interpolation between T=0.5s, 1; T=2.5s, 2 for T=1.672s

$V = C_s W$

$k = 1.586$

3

Total Effective Seismic Weight

1) Penthouse Roof – 18,522 ft²

Area Loads = (150 psf)(18522 ft²) = 926.1k

Perim Loads = (16 psf)(6.4 ft)(420 ft) = 43.0k
(6.4 ft = height, 420 ft = length)

W = 926.1 k + 43.0 k = <u>969.1 k</u>

2) Penthouse Level – 35,430 ft² + 983' perim

Area Loads = (120 psf)(18522 ft²) + (115 psf)(35,430 – 18522) = 4167.1k
(120 psf = penthouse, 115 psf = roof)

Perim Loads = 16 psf(6.4)(420) + 16(7.5)(983) = 161.0k

Mechanical Equip. ≐ 200 k

W = 4167.1 + 161 + 200 = <u>4528.1 k</u>

3) Levels 7–9 – 35,430 ft² + 983' perim

Area Loads = (120 psf)(35,430 ft²) = 4251.6 k

Perim Loads = (16 psf)(15 ft)(983') = 235.9 k

W = 4251.6 k + 235.9 k = <u>4487.5k</u>

4) Levels 5–6 – 51,455 ft² + 1324' perim

Area Loads = (120 psf)(51,455 ft²) = 6174.6k

Perim Loads = (16 psf)(15 ft)(1324 ft) = 317.8k

W = 6174.6 + 317.8 k = <u>6492.4k</u>

* Roof designed as floor for expansion

5) Level 4 + Green Roof – (GR = 12,177 ft²), 59,228 ft² + 1388' perim

Area Loads = (120 psf)(59228 ft²) + (135 psf)(12177 ft²) = 8757.3k

Perim Loads = (16 psf)(15 ft)(1388') = 333.1 k

Hospital Equip Allowance** = 80k

W = 8757.3 k + 333.1 k + 80 k = <u>9164.4 k</u>

* 5" slab labeled typical for all floors. Used value for seismic hand calcs.

** Levels 1–4 contain diagnostic equipment, allowance

4

6) Levels 1-3 - 57,245 ft² + 1,178.5 ft perim

Area Loads = (120 psf)(57,245 ft²) = 6869.4 K

Perim Loads = (16 psf)(15 ft)(1178.5 ft) = 282.8 K

Hospital Equip. Allowance = 80 K

$w = 6869.4\text{ k} + 282.8\text{ k} + 80\text{ k} = \underline{7232.2\text{ k}}$

$W = 969.1\text{ k} + 4528.1\text{ k} + 2(6492.4\text{ k}) + 9164.4\text{ k} + 3(7232.2\text{ k}) = 49{,}343\text{ K}$

$V = C_s W = (0.01749)(49343) = \underline{863\text{ K}}$

Base Shear

See excel for story shear values

Base considered ground level based on figure C11-1. Commentary states seismic is evaluated based on system performance, moment frame system begins at grade. (C11, ASCE 7-05 pg 352)

Below in Table 4 are values for Seismic Story Shear V_x (12.8.4). The corresponding story and floor forces are depicted in the diagram in Figure 8.

Level	**h_x (ft)**	**w_x (k)**	**k**	**$w_x h_x^k$**	**C_{vx}**	**F_x (k)**	**h_x*F_x (ft-k)**
Penthouse Roof	166	969.1	1.586	3217066.4	0.055075	47.5	7889.9
Penthouse Level	143	4528.1	1.586	11865306.6	0.203129	175.3	25067.9
Level 9	128	4487.5	1.586	9863691.3	0.168862	145.7	18653.2
Level 8	113	4487.5	1.586	8094441.2	0.138573	119.6	13513.5
Level 7	98	4487.5	1.586	6457865.8	0.110556	95.4	9350.1
Level 6	83	6492.4	1.586	7178986.3	0.122901	106.1	8803.3
Level 5	66	6492.4	1.586	4991165.3	0.085447	73.7	4866.9
Level 4	49	9164.4	1.586	4392937.5	0.075205	64.9	3180.2
Level 3	32	7232.2	1.586	1763755.1	0.030195	26.1	833.9
Level 2	16	7232.2	1.586	587495.7	0.010058	8.7	138.9
					Overturning Moment		**92297.8** **ft-k**

Table 4 | Seismic Story Forces

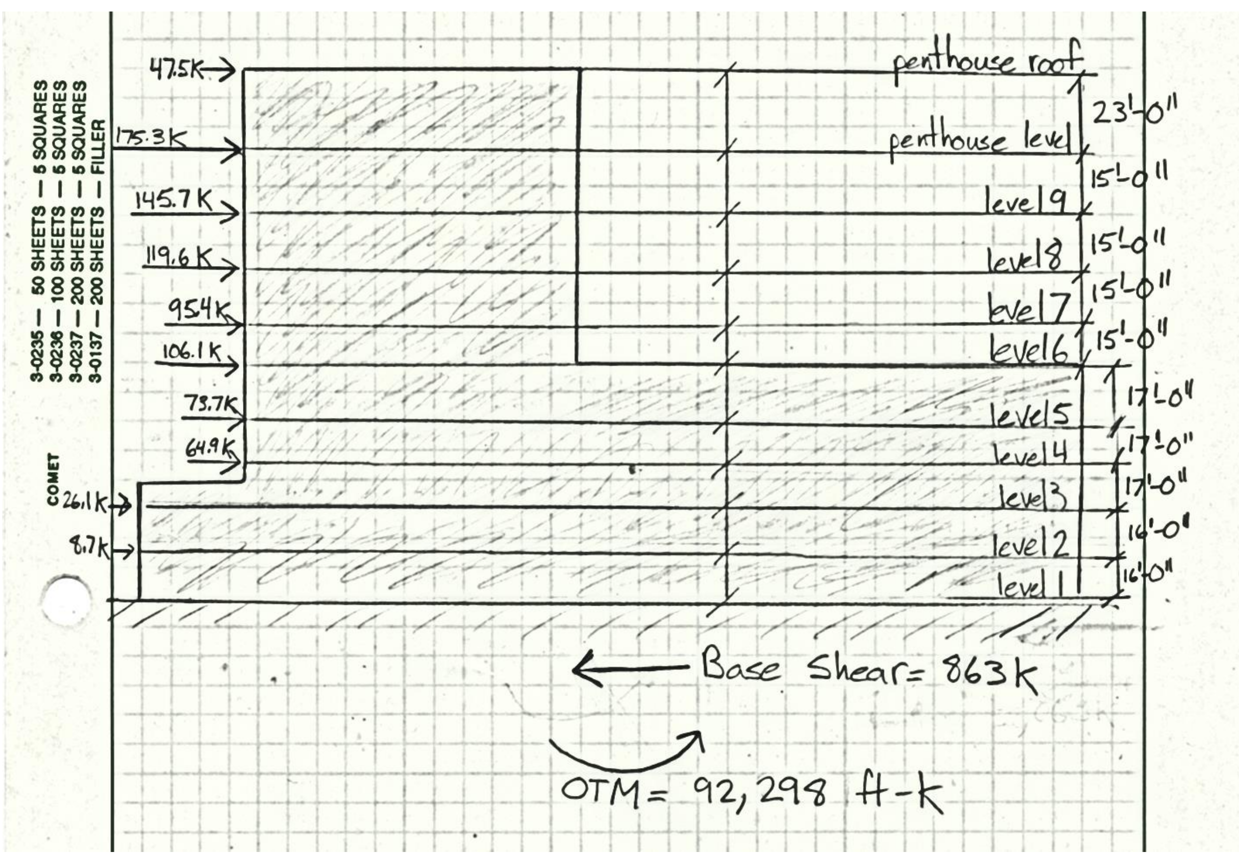


Figure 8 | Seismic Story Forces Diagram

6 | Appendix A

Design building loads from the load key plan on structural documentation are listed in Table 5. The table includes superimposed dead loads, live loads, and concentrated live loads. Superimposed dead loads do not account for the total dead load of the structure.

LOAD KEY TABLE SUPERIMPOSED DEAD AND LIVE LOAD				SENSITIVE EQUIPMENT VIBRATION CRITERIA
OCCUPANCY	SUPER IMPOSED DEAD LOAD (PSF)	UNIFORM LIVE LOAD (PSF)	CONCENTRATED LIVE LOAD (LB)	
AHU 1 = AIR HANDLING UNIT	15CMEP + 60TOPPING = 75	150 NR	15,000 LBS	-
CEPR1 = CENTRAL ENERGY PLANT ROOF	80CMEP	40 NR	3,000	-
CEPR2 = CENTRAL ENERGY PLANT ROOF	80CMEP + 80RAMP = 160	40 NR	3,000 △8	-
CT = COOLING TOWER	50	150 NR	52,800 LBS (EACH CELL) THREE CELL LOCATIONS	-
DROP = DROP OFF AREA	300	100 NR	2,000	-
EXT1 = EXTERIOR PLAZA ALONG CLIFTON RD	230	100 NR	2,000	-
EXT2 = EXTERIOR SOIL ALONG GRID 13.5	1,180	200 NR	2,000	-
HOS1 = TYPICAL HOSPITAL AREAS	15	100 RED	2,000	8,000 MIPS @ 85 PPM
HOS2 = HOSPITAL DIAGNOSTICS AND IMAGING	15CMEP + 60TOP = 75	350 NR	106 KIPS OR EQUIP. WGT	1000 MIPS @ 100 PPM
HOS 3 = HOSPITAL DIAGNOSTICS AND SURGICAL SUITES	15	100 RED	2,000 OR EQUIP. WGT	4,000 MIPS @ 85 PPM
KIT = KITCHEN	15CMEP + 40TOP + 40CMU = 95	150 NR	2,000	-
LD = LOADING DOCK	15	250 NR	-	-
MEC = MECHANICAL/ELECTRICAL ROOMS	15CMEP + 60TOPPING = 75	150 NR	2,000 OR EQUIP. WGT	60 TOPPING NOT APPLIED AT LEVEL 3 PNEUMATIC TUBE ROOM
MRI ACC	TYPICAL SDL FLOOR LOADS PER FINAL USE	150 NR	-	-
MU1 = MIXED USE 1	15CMEP + 40CMU = 55	100 RED	2,000	-
MU2 = MIXED USE 2	15CMEP + 5 FIN = 20	100 RED	2,000	-
MU3 = MIXED USE 3	15CMEP + 40 TOP + 40CMU = 95	100 RED	2,000	-
PAT = TYPICAL PATIENT ROOMS	15	80 RED (+)	1,000	-
PK1 = TYPICAL PARKING	5	40 NR	3,000	-
PK2 = PARKING WITH CURB ALLOWANCE	5CMEP + 40TOP = 45	40 NR	3,000	-
PUB1 = PUBLIC AREAS, LOBBIES, AND CORRIDORS	15	100 NR	2,000	-
PUB2 = PUBLIC AREAS, LOBBIES, AND CORRIDORS w/ THICK SET TILE/TOPPING	15CMEP + 25TILE = 40	100 NR △4	2,000	-
RF1 = ROOF WITH INSULATED CONCRETE TOPPING	15CMEP + 25TOP + 10ROOF = 50	20 NR	-	-
RF2 = GREEN ROOF/OUTDOOR PUBLIC AREA	15CMEP + 25TOP + 10ROOF + 50GREEN ROOF/PAVERS = 100	100 NR △4	-	-
RF3 = TYPICAL ROOF	25	20 NR	-	-
RFPH = PENTHOUSE ROOF	25CMEP + 25 ROOF = 50	20 RED	-	-
RR = RESTROOM	15CMEP + 25FIN = 40	100 RED	-	-
STA = METAL STAIR	60	100 NR	-	-
STO = LIGHT STORAGE	15	125 NR	2,000	-
TVROOF = TRANSFORMER VAULT ROOF	-	-	-	-

Table 5 | Load Key Plan Values

Figures 9-11 show different floorplate shapes typical for The Health Centre.

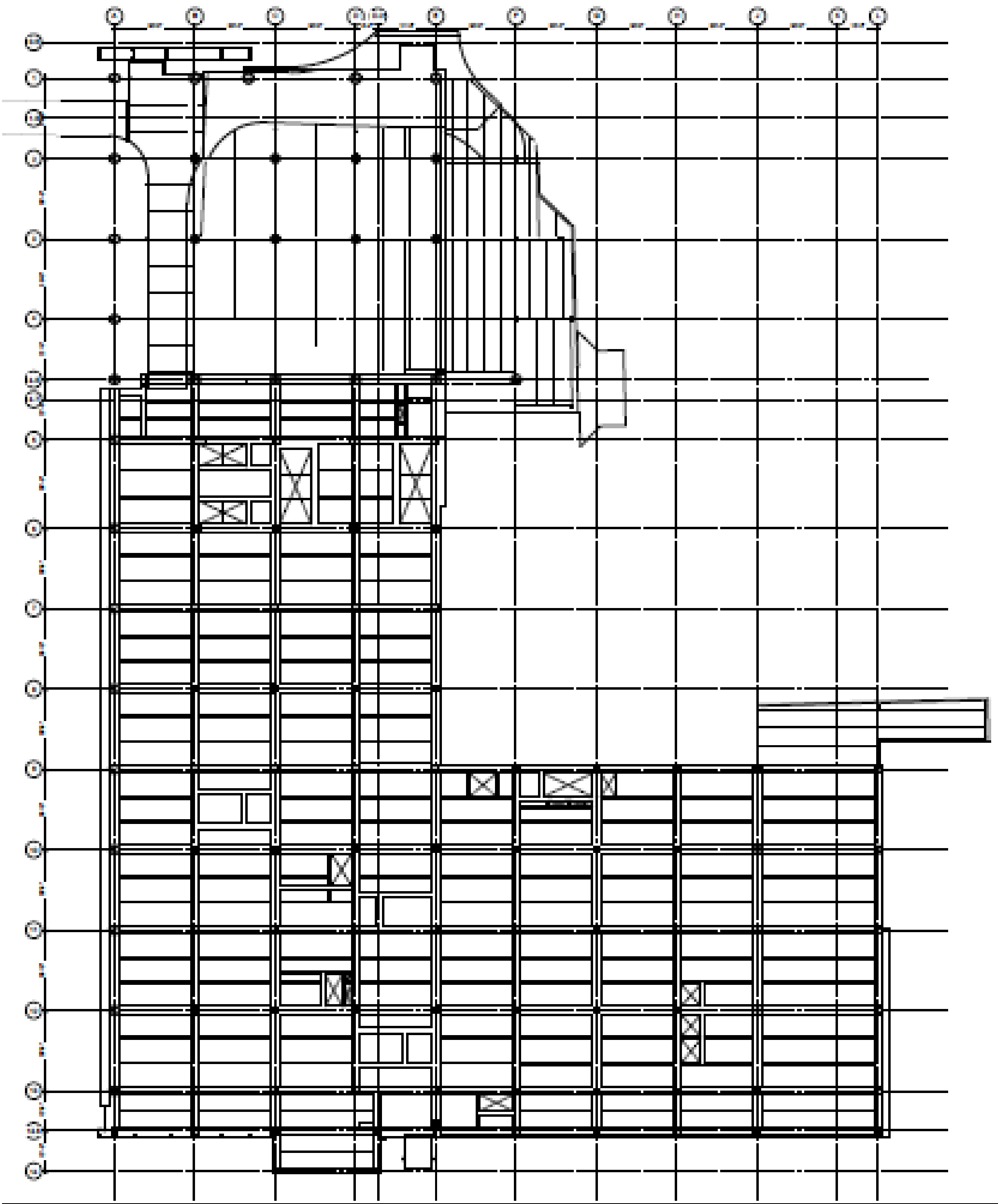


Figure 9 | Typical Structural Floor Plan for Floors 1-3 (Walter P. Moore)

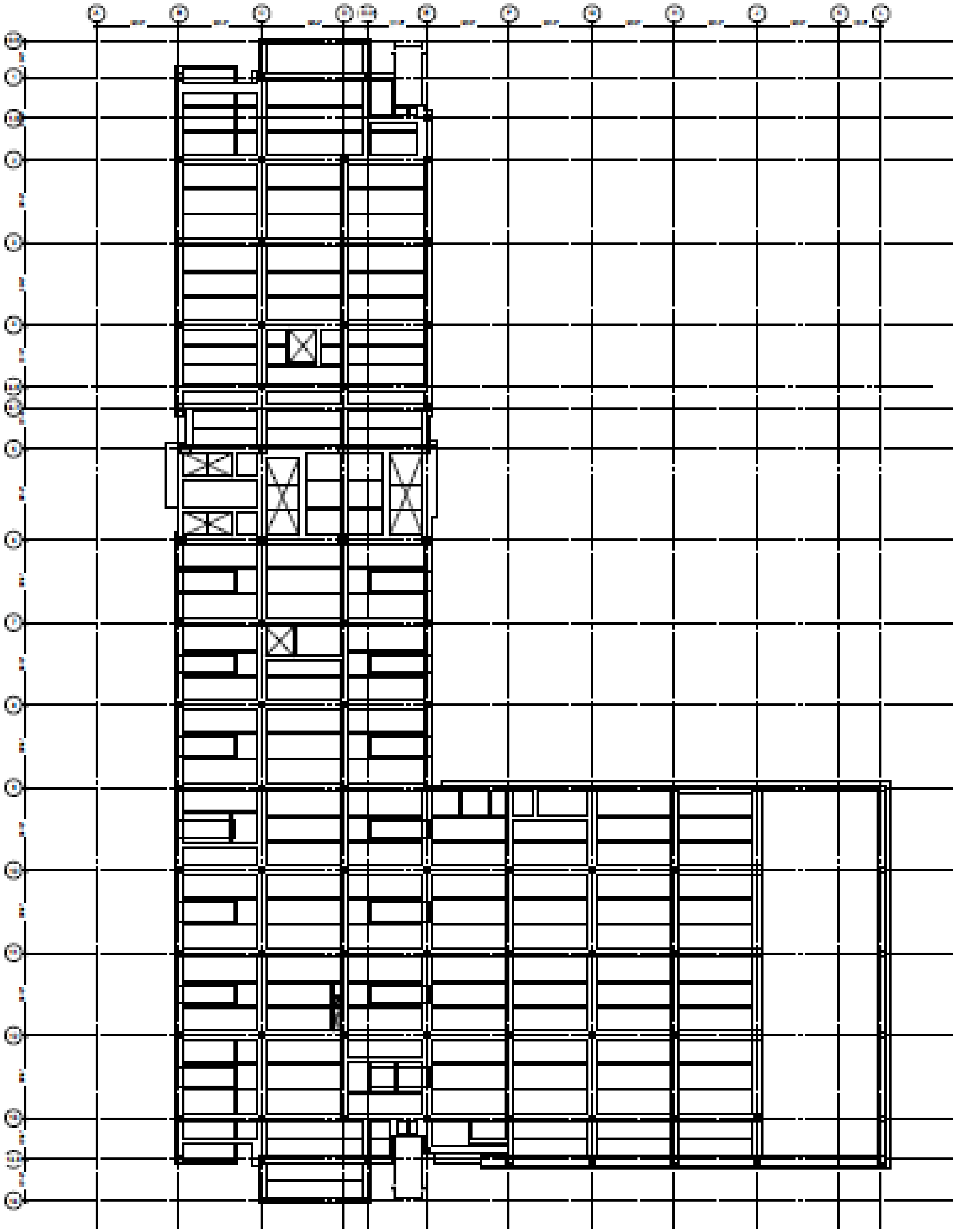


Figure 10 | Typical Structural Floor Plan for Floors 5-6 (Walter P. Moore)

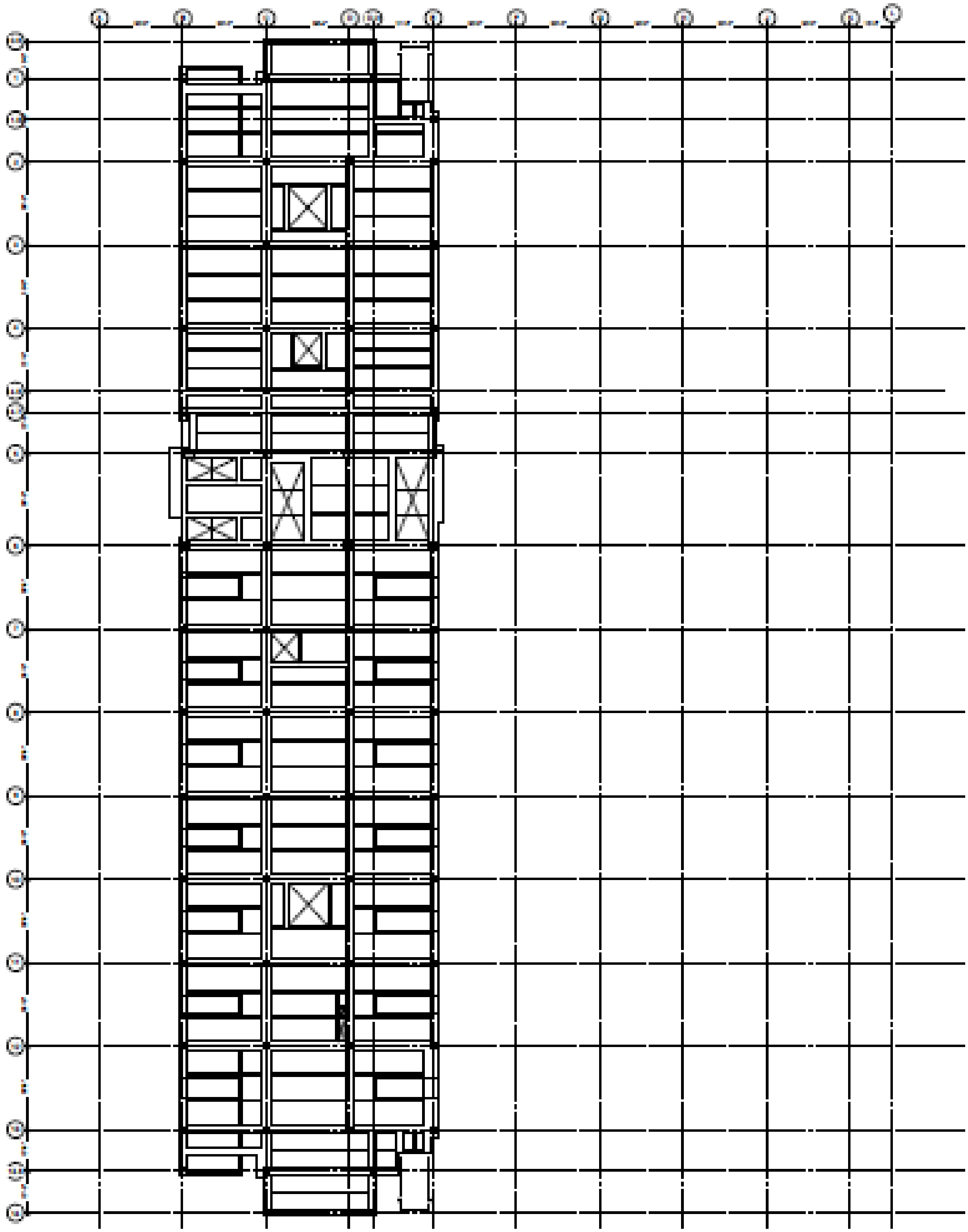


Figure 11 | Typical Structural Floor Plan for Floors 7-9 (Walter P. Moore)