Analysis and Design of a High-Rise Steel Braced Frame Core

The Pennsylvania State University
Architectural Engineering Senior Thesis Final Report

Trump Taj Mahal New Hotel Tower

Atlantic City, New Jersey

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Trump Taj Mahal Hotel

Stephen M. Reichwein

Atlantic City, New Jersey

Structural

http://www.engr.psu.edu/ae/thesis/portfolios/2008/smr322/

Project Team

- ***Owner's Representative:*** *Trump Hotels and Casino Resorts*
- ***Architect/Interior Designer:*** *Friedmutter Group*
- ***Construction Management:*** Bovis Lend Lease
- ***Interior Designer:*** *Hirsch Bedner and Associates*
- ***Civil Engineer:*** *Arthur W. Ponzio & Associates*
- ***M.E.P Engineer:*** *Giovanetti, Shulman Associates*
- ***Structural Consultant:*** *The Harman Group*
- ***Parking Consultant:*** *Schoor Depalma*
- ***Lighting Consultant:*** *John Levy Lighting Productions*
- ***Building Envelope Consultant:*** *Edwards and Company*
- ***Acoustical Consultant:*** *Chips Davis Designs*
- ***Low Voltage Wiring Consultant:*** *Michael Raiser Associates*
- ***Vertical Transportation Consultant:*** *Lerch, Bates Associates*
- ***Landscape Architect:*** *Cairone and Kaupp*

Structural System

- *Cast-in-place **concrete core** acts as **shear wall**, providing **lateral force resistance***
- ***10" Filigree** flat slab floor system outside of concrete core*
- ***12" Flat plate concrete** floor system inside of concrete core*
- ***Steel framed** bridge with **composite metal deck** connects the new tower to the existing tower*
- ***6' to 9' deep** reinforced concrete **mat foundation** system*
- ***Wind tunnel test** performed for wind loading*

Mechanical/Plumbing System

- *Individual International **fan coil units** provide heating and cooling for each guest suite*
- *Guest room air is exhausted into registers located in lobbies, corridors, and other common areas*
- *Common areas are supplied air via AHU units; VAV boxes are located in each of the serviced spaces*
- *Plumbing is separated into a **low** (up to level 22) and **high** (level 23 to 40) **zone***
- *Hot water is provided by Patterson Kelly hot water generators, 6 for the low zone and 9 for the high zone*
- *Water is pumped throughout the tower using one Triplex domestic water booster pump system per zone*
- *Chilled water is supplied from the existing hotel*

General

- ***Cost:*** *$250 Million*
- ***Size:*** *730, 000 Square Feet*
- ***Height:*** *430 ft*
- ***Occupancy:*** *Hotel/Resort*
- ***Function:*** *Expansion to Existing Hotel*
- ***Construction:*** *July 2006 to Summer 2008*

Architecture

- ***Iconic** style architecture*
- ***Square, centralized** floor plan*
- *Short-story **core and shell** concrete high-rise hotel*
- *Reflective glass curtain wall encompasses the shaft of the tower*
- *Architectural precast concrete panels form a solid base*
- *Metal crown and Trump sign at the top of the tower*
- *Large, bold **signage** spans the vertical of the east and west corners*
- *Located on the **Boardwalk** of Atlantic City*

Construction

- *Bovis Lend Lease is acting as the **CM at Risk**, all of the work is being sub-contracted*
- *One tower crane is located on the north side of the tower*
- ***Self-jacking slip forms** will be used to form the concrete core*
- *Staging areas are located on the northwest area of the site, where a parking lot will be later constructed*

Lighting/Electrical System

- ***120/208V and 277/480V** 3 phase 4 wire systems*
- *Main power is fed from a **23kV switchgear station** located at the adjacent Xanadu Building*
- *Main power is split between four unit sub-stations, 1500kVA and 750kVA stations on the 1st level and 1000kVA and 2000kVA stations on the 40th level*
- ***Six (6) 100 to 200 amp panel boards** service each floor*
- *Diesel fueled 1,000kW/1240kVA 480V emergency generator*
- *Guest room lighting fixtures are typically incandescent lamps*

The Pennsylvania State University
Department of Architectural Engineering

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Executive Summary

This report is the culmination of a yearlong study on the Trump Taj Mahal Hotel tower, a 40 story luxury hotel located on the 1000 block of the boardwalk in Atlantic City, New Jersey. Given the architectural layout of the guest room spaces, a core only lateral force resisting system and flat slab concrete floor system were designed to accommodate the architectural requirements of the project. With only the core resisting the lateral forces acting on the tower, reinforced concrete shear walls with coupling beams were designed to in such a way as to limit the wind drift and effectively dissipate the hurricane force winds of Atlantic City. A concrete shear wall core of this nature was found to be extremely stiff and rigid. These properties will eliminate any torsional flexibility issues that usually result from a slender core only system.

The purpose of this study is to determine why a concrete shear wall core and filigree flat slab floor system were selected as the structural system of the tower. The proposed lateral force resisting system redesign consists of a core of steel braced frames, the majority of which will be concentric inverted "V" braces. Eccentric braced frames will be avoided as much as possible in order to benefit from the greater stiffness provided by concentric braced frames. The proposed gravity system redesign consists of a non-composite steel frame and precast concrete plank floor system; this floor system offers the key benefit of fast erection. Both systems were chosen on a basis to determine why a steel structural system was not chosen, given its superior erection time compared to that of a concrete system. With a steel system, the construction cost and erection time can be reduced; the hotel can open at an earlier date, thereby generating revenue sooner.

The braced frames in the core of the tower were designed to effectively limit the building drift to H/400, while providing enough strength capacity to meet the requirements of AISC LRFD 3rd Edition. To meet the recommended drift limitation of H/400, large built-up column sections were required at the lower levels of the tower. These built-up sections were pivotal in reducing the overall building drift because column axial deformations had the greatest effect on overall drift.

Minor architectural impacts resulted from this structural redesign. The elevator/service core at the center of the tower required redesigning in order to allow for more flexibility while determining the geometry of the braced frames. The core redesign involved the relocation of openings, elevators, and spaces. The floor to floor height of the tower was increase by 10 inches in order to accommodate the deeper steel structure; this 10 inch increase has many cost implications. Soffits are required in order to conceal the steel frame, particularly the spandrel beams and columns. These soffits will be visible in various guest rooms throughout the hotel. As these architectural impacts seem minor in the grand scheme of things, it is at the owner's discretion to determine the acceptability of such changes. However, for the purposes of this study these changes were deemed acceptable

Despite all of the architectural impacts, construction management breadth studies left me with the conclusion that the cost of the steel structure is $1.5 million less than the concrete/filigree system. It was also found that the steel structure would top out almost a month before the concrete schedule. It seems like all design goals have been met.

However, drift and strength are not the only issues that need to be addressed in the preliminary design of a high-rise lateral force resisting system. Motion perception of building occupants can sometimes control the design of a structural system. In order to fully understand the structural dynamics of a building, complex wind tunnel studies must be performed.

For the purposes of this study, a parametric RMS acceleration study was performed in order to determine whether or not accelerations due to wind would be an issue. To better grasp the effects of accelerations due to wind, the concrete shear wall core was analyzed as a way of comparing the two systems. The concrete shear wall core was found to be an acceptable design based on this parametric study. However, the steel braced frame core RMS resultant accelerations at the top floor of the hotel were found to exceed the acceptable limit by a factor of 2.0. As the steel member sizes are already large, increasing the sizes of columns, braces, and girders is not an option and will not be a viable enough solution to the acceleration issue. Although nothing can truly be determined unless wind tunnel studies are performed, this still indicates the presence of acceleration issues.

Therefore, the proposed solution of replacing the concrete shear wall core with a core of steel braced frames is not directly feasible. Only with further investigations involving complex wind tunnel studies, the acceleration problem may be solved utilizing a liquid-tuned column damper or tuned mass damper. Keep in mind that such a solution will add upwards of $2 to $3 million to the project cost and will cause the steel structural redesign to cost more than the current concrete and filigree system by about $1 million. Therefore, for the purposes of this study the reinforced concrete shear wall core will be the accepted structural system of the Trump Taj Mahal Hotel.

It is important to keep in mind that high-rise design involves many factors that are best solved by that of a design professional with years of experience. This study has served more as a learning experience to the student and may shed some light on the advanced design topics of high-rise design.

Credits and Acknowledgements

To all those who have helped me throughout the course of the project who have taken time out of their busy schedules to help answer my questions, provide me with insight, and explain uncertain topics………
I thank you……..

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KPFF

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Bovis Lend Lease

Bill Lankford

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AE Faculty Consultant

Dr. Andres Lepage

AE Faculty

Professor M. Kevin Parfitt

Professor Robert Holland

AE Students

Chris Shipper

Sam Jannotti

Jason Sambolt

Will Cox

To my Family and Friends…..

Last but not least, I owe all of my success now and in the future to you. I don't know how I would've completed this project without you by my side and still enjoy countless memories together…..

Building Information

General Building Data

Building Name: Trump Taj Mahal New Hotel Tower
Building Location: Atlantic City, New Jersey on the 1000 block of the Boardwalk
Building Owner/Occupant: Trump Hotels and Casino Resorts
Building Function: Hotel that serves as an expansion to the existing Taj Mahal hotel
Building Size: 732,231 square feet
Number of Stories above Grade: 40
Height of Building above Grade: 460'-10" (Structural Redesign: 490'-10")

Project Team:

- **Owner's Representative:** *Trump Hotels and Casino Resorts*
- **Architect/Interior Designer:** *Friedmutter Group*
- **Construction Management:** *Bovis Lend Lease LMB, Inc.*
- **Interior Designer:** *Hirsch Bedner and Associates*
- **Civil Engineers and Fire Suppression:** *Arthur W. Ponzio and Associates*
- **M.E.P Engineers and Fire Suppression:** *Giovanetti, Shulman Associates*
- **Structural Engineering Consultant:** *The Harman Group*
- **Parking Consultant:** *Schoor Depalma*
- **ADA Consultant:** *Endelman and Associates*
- **Lighting Consultant:** *John Levy Lighting Productions, Inc.*
- **Building Envelope Consultant:** *Edwards and Company*
- **Technical Specifications:** *Focus Collaborative, Inc.*
- **Reflective Glare Consultant:** *University of Michigan, College of Architecture and Urban Planning, Advance Monitoring and Control Management, Inc.*
- **Code Consultant:** *Rolf Jensen and Associates, Inc.*
- **Acoustical Consultant:** *Chips Davis Designs*
- **Low Voltage Wiring Consultant**: *Michael Raiser Associates, Inc.*
- **Vertical Transportation Consultant:** *Lerch, Bates Associates, Inc.*
- **Landscape Architect:** *Cairone and Kaupp, Inc.*

Construction Dates:

- **Start Date:** July 31, 2006
- **End Date:** July - September 2008

Overall Project Cost: $200 Million
Project Delivery Method: CM at Risk

Taj Mahal Hotel Architecture

History and Overview

Atlantic City is known as the "Las Vegas" of the east coast. It is home to some of the largest and finest hotels, resorts, and casinos, as well as one of the largest boardwalks in the world. Donald Trump came to Atlantic City with a vision to create one of the world's finest casinos along with Atlantic City's most luxurious hotels. At the 900 block of the Atlantic City boardwalk in 1990, Trump unveiled the first Taj Mahal Hotel, unprecedented in craftsmanship and opulence. Its stern use of iconic architecture, rich with lights and signage, matches that of the rest of Atlantic City.

***Figure 1*: Rendering of the New Trump Taj Mahal Hotel Tower (Right)**

Architectural Styles

The Taj Mahal Hotel Tower resembles a powerful type of iconic architecture, signifying the power and wealth of Donald Trump along with the luxury you can expect from such a hotel. Such iconic characteristics that are clearly expressed on the building include large, bold signage (Both the Taj Mahal running down the east and west sides of the building and Trump across the top of the building.), a unique and pure geometric plan that rivals its neighboring predecessor, and it's overwhelming height as compared to the neighboring buildings along the ocean front skyline. The facade of the building is constructed with mostly modern materials, comprised of a reflective glass curtain wall, metal panels, and architectural pre-cast concrete panels.

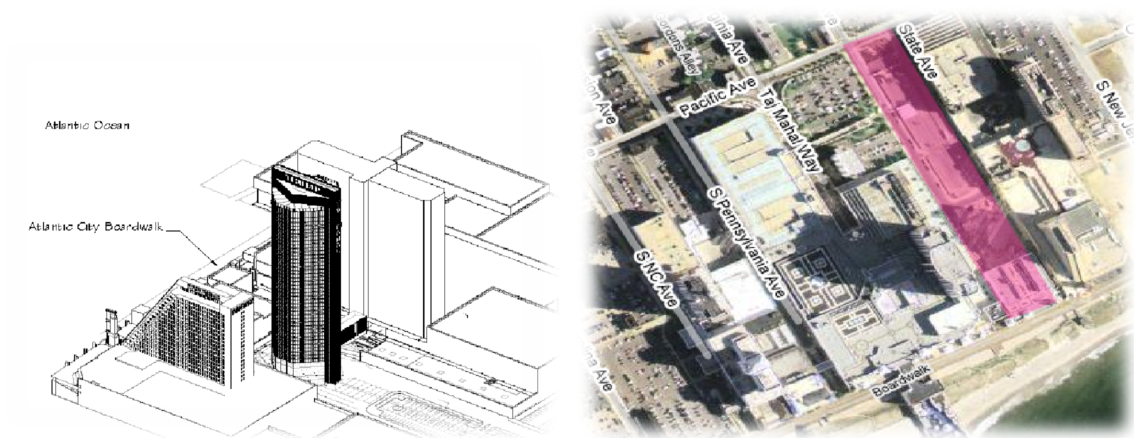


***Figure 2:* Layout and Site of the Trump Taj Mahal Hotel (provided by The Harman Group, Friedmutter Group, and Google Earth)**

Spaces and Functionality

The hotel will serve as an expansion to Trump's older Taj Mahal tower and will be connected to the older hotel via a steel framed bridge. Floors 1 thru 2 contain some the tower's mechanical and electrical equipment, loading docks, and housekeeping services. Floor 3 serves as the main lobby and has several meeting areas. Floors 4 thru 39 contain the guest rooms. And finally, floor 40 furnishes the remaining mechanical and electrical equipment. There are services, such as laundry and housekeeping, located in the central concrete core on every floor of the tower.

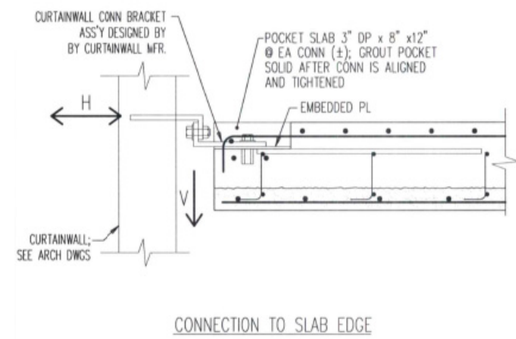


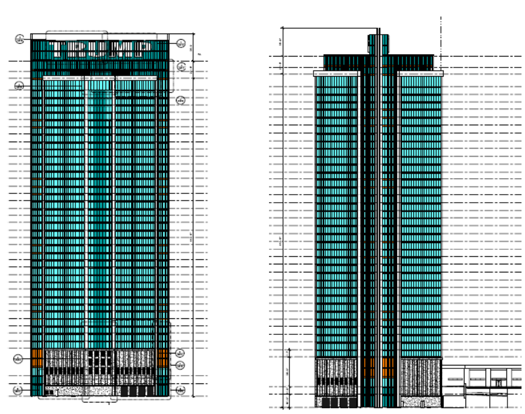
Figure 3: Curtain Wall Connection Detail

The new hotel will provide an additional 786 rooms, ranging from single and double rooms to 3 bay super suites. Some of these rooms will provide special accessibilities for handicapped and hearing impaired, per ADA. Circulation throug located within the concrete core of the building. This circulation service elevators.

Building Envelope

The building envelope utilizes two different systems; a curtain wall and architectural pre-cast concrete panels. The curtain wall system houses most of the exterior of the building, from the 1st level all the way to the top of the large Trump sign on the roof. The architectural pre-cast concrete panels are used only at the base of the building, located around the building entrances and the loading docks.

The curtain wall system uses four different types of glazing; a clear and slightly reflective glass, an opaque glass finished in light blue, an opaque glass finished in orange, and metal wall panels. Panels of the glazing are framed out using horizontal and vertical mullions. These mullions are attached to the structural framing system using a series of embeds that must be furnished during construction of the structure. At each level, metal panels or opaque glass is used to conceal the concrete structure of the building within. These spandrel panels also provide continuity and fuse the different levels of the curtain wall together. Metal panels are also used on the east and west sides of the building to form the sharp corners.



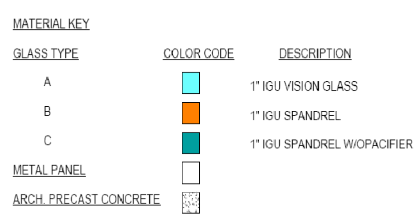


Figure 4: North and west elevations, respectively, illustrating the different elements of the building envelope (Elevations provided by Friedmutter Group)

Roof Description

The roof will be framed using the same concrete floor system as the hotel floors below. A 3" layer of insulation is applied on top of the concrete roof deck, followed by a single-ply fully adhered roofing membrane on 5/8" gypsum sheathing. The roofing membrane will form the exposed surface of the roof, providing protection from water and other environmental elements. To provide rainwater drainage, the roof is sloped at ¼" per foot and two roof drains are located within each valley.

Governing Building Codes

- 2000 International Building Code, New Jersey Edition
- International Mechanical Code, 2003 Edition
- International Standard Plumbing Code, 2003 Edition
- National Electrical Code, 2005 Edition

Zoning Occupancy Group

- Non-separated mixed use types R-1 and B
- Storage and assembly area accessory to main type A-2

Construction Type 1A

Building Systems

Construction

Bovis Lend Lease is acting as the Construction Manager at Risk on the Trump Taj Mahal Hotel. All of the work is being subcontracted. Bovis Lend Lease has two superintendants on site at all times; a general superintendant and a concrete superintendant. Groundbreaking of the new Taj Mahal Hotel Tower commenced on July 31st, 2006 and is scheduled for completion in the third quarter of 2008. The estimated cost of the building is valued at $250 Million.

Figure 5: Construction Photo

For extra quality control assurance, The Harman Group is providing an in house inspector on site at all times. This inspector is used to better the quality and construction of the structural system.

One tower crane is located on the north side of the tower and a mechanical lift on the west side of the tower. A staging area will be located to the northwest of the tower, where a proposed parking lot will be located once construction is complete. A roadway with direct access from Pacific Avenue will provide an easy delivery route into the staging area. Project trailers and a storage area are located in the lot adjacent to the staging area, where another parking lot will exist once construction is complete. Jacking gang forms are being used to construct the concrete core of the building.

Mechanical

The HVAC system of the guest rooms of the Trump Taj Mahal Hotel are comprised of individual International Environmental fan coil units, ranging in output from 330cfm to 870cfm. Each unit is supplied with a hot and chilled water supply. Air is exhausted from each level using ceiling registers located in the hallways, lobbies, and other common/service areas. The exhaust air travels down ducts located in the central core and exits the building at the north side of the building on the 3rd floor.

Service areas, such as corridors; lobbies; mechanical rooms; etc, are supplied and exhausted via air handling units. Units gather supply air at the roof and exhaust at the north side of the building on the 3rd floor. VAVs are used to distribute the air at different temperatures for each supplied spaces.

Bathrooms for the guest rooms are exhausted by local ceiling vents. The air travels through ducts enclosed in the walls between adjacent guest rooms. The exhaust air travels down to the 3rd level, where it exits the building on the north face. Small kitchens in some of the larger suites are exhausted in a similar manner.

The hot water will be produced from four boilers located in the 1st level mechanical room. The supply water is circulated throughout the tower via four water pumps, two 345gpm pumps for the low-rise and two 1680gpm pumps for the hi-rise. These pumps are located in the mechanical room on the 1st level.

Electrical/Lighting

The main electrical room of the Trump Taj Mahal Hotel is located on the 1st level of the building. Main power is fed from a 23 kV primary switchgear station located in the adjacent Xanadu Building. Main power is split between four unit sub-stations, 1500kVA and 750kVA stations on the 1st level and 1000kVA and 2000kVA stations on the 40th level.

The typical floor of the Taj Mahal Hotel has two electrical rooms located in the central core of the building, at the north and south sides. Typical panel boards used have a 200amp main breaker and a 22,000 ampere interrupting capacity. Bus ducts are used to feed the panel boards located in these electrical rooms. All risers and penetrations for the electrical system for the low and hi-rise portions of the building are only located in the core.

Emergency power is generated via a 1,000kW/1240kVA 480V diesel fired emergency generator, located in the generator room of the 1st level. The emergency power is distributed throughout the building using three switchgears, two located in the 1st level electrical room, the other in the 40th level electrical room. From the switchgears, emergency power is fed to separate panel boards on every level of the tower. Emergency power is primarily used for fire pull stations and emergency lighting (including strobe lights) supplied on every floor of the tower, installed and per building code.

Fire Protection System

Fire protection of the Trump Taj Mahal Hotel tower is provided by a sprinkler system. These sprinklers are installed per NFPA standards.

Siamese fire department connections line the perimeter of the tower when located more than 50 feet from the nearest fire hydrant. 6 inch standpipes with 2 ½ inch fire hose connections are located on each of level of the tower. Standpipes are provided in each of the 3 stairwells and raise the entire height of the building.

Transportation

The main entrance of the Trump Taj Mahal Hotel is located on the south end of the 3rd level. A new bridge will connect the existing hotel to the new hotel. This bridge and entrance open into the hotel lobby.

Straight ahead of the lobby are the guest elevator lobbies, located in the central core of the building. A total of twelve electric elevators will service the hotel. Eight passenger elevators provide guest transportation to the tower. Four elevators are designated to serve levels 3 - 21, the other four for levels 3, 22 - 39. Four service elevators provide transportation to levels 1 – 39.

Two stairwells at the east and west corner of the central core service all levels of the hotel. One stairwell located on the east side of the 1st and 2nd levels provides employee access to sensitive service areas of the building. Access to the roof is gained via stairs.

Structural System Description

The proceeding section contains detailed descriptions of the various structural systems that have been incorporated into the design of the Trump Taj Mahal Hotel. Descriptions of the foundation system, columns, floor systems, miscellaneous systems, and lateral system are provided and follow in that respective order. Figure 6 provides an illustration of the framing plan of a typical level of the tower.

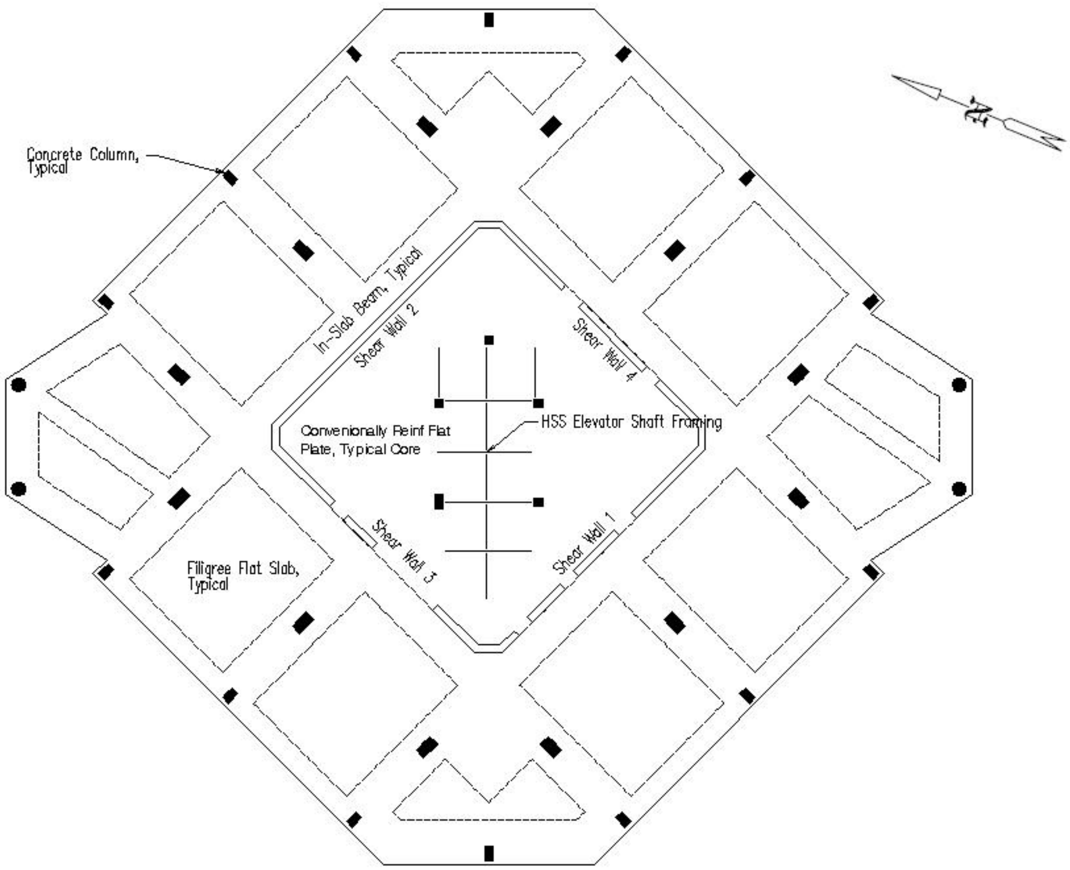


***Figure 6*: Typical Framing Plan**

Foundation System

The foundation system of the Trump Taj Mahal Hotel is comprised of a mat foundation, as recommended by the geotechnical report. The perimeter of the mat foundation is 6’-0” thick, the center 9’-0” thick. #11 bars at 10” each way, top and bottom are provided for the 9’-0” thick section and #11 at 15” each way, top and bottom are provided for the 6’-0” thick section. Additional reinforcing is provided around openings and columns. The mat foundation acts as the floor system of level one, a topping slab is provided.

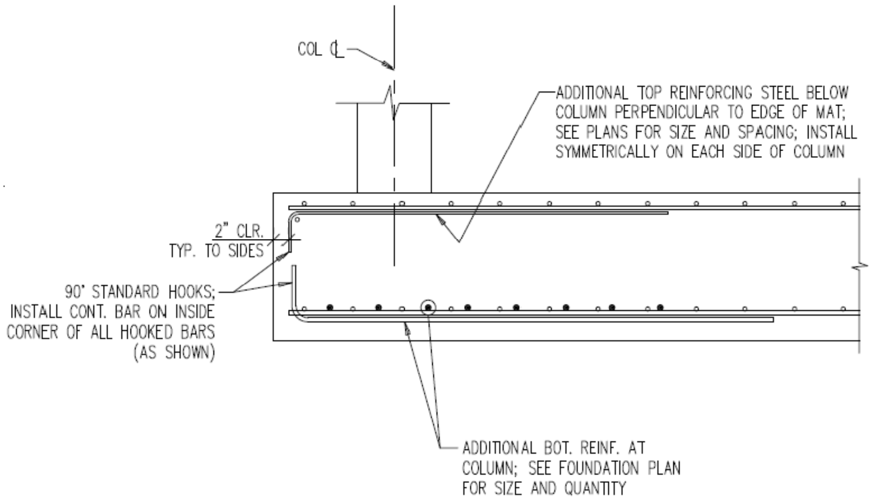


***Figure 7*: Typical Section at Mat Foundation**

Columns

Square, rectangular, and round reinforced concrete columns are used throughout the hotel tower, with a wide range of sizes and reinforcing arrangements. Figure 8 provides a typical detail that illustrates the tie arrangements, vertical reinforcing steel arrangements, and dimensions of the columns that are found throughout the tower. Specified compressive strength of concrete used for the columns varies by level, generally higher at lower levels.

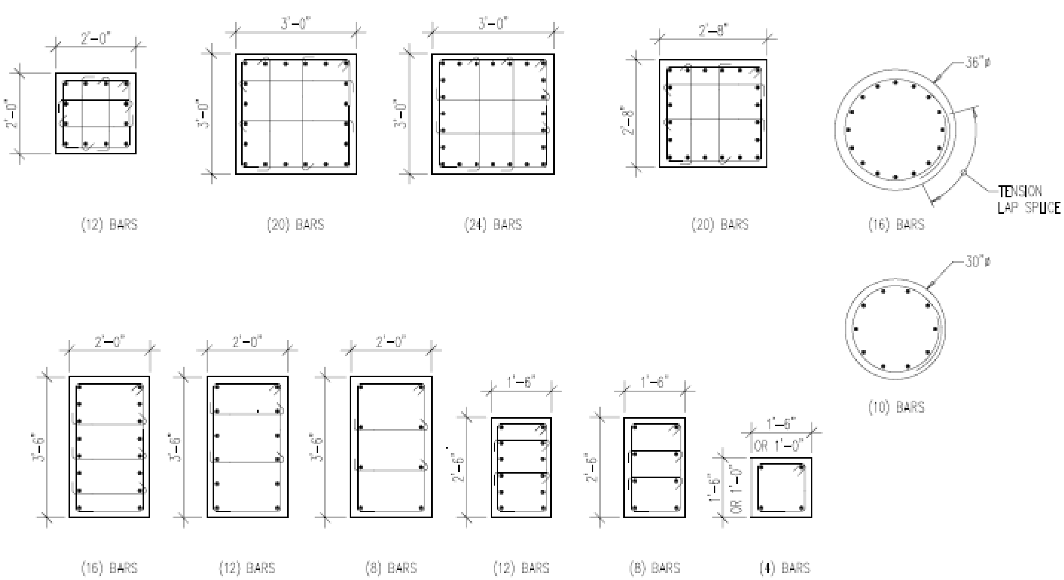


***Figure 8*: Detail of Typical Column Types**

Floor Systems

Two types of floor systems are used on a typical level of the hotel tower. A one-way pre-stressed filigree flat plate system is utilized in the areas outside of the central elevator core. Inside of the core, a conventionally reinforced flat plate system is utilized. 5000psi is the specified 28 day concrete compressive strength of both systems.

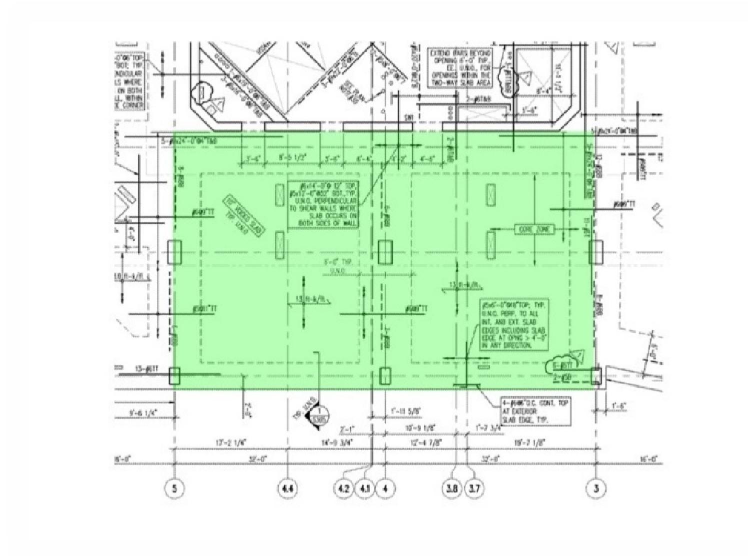


Figure 9: **Typical Filigree Bay**

A filigree flat plate floor slab acts as a composite system, utilizing both pre-cast and cast-in-place components. 8'-0" wide 2 ¼" thick pre-stressed planks form the base of the system. Foam voids are cast on top of the planks, lowering the dead weight of the system. However, some floors of the tower with higher loads may have solid slabs instead of voided slabs. A layer of concrete is poured on top of the planks and 2 ¼" on top of the voids, if present. 10x10 W4xW4 Welded Wire Fabric is used as temperature reinforcing for the cast –in-place concrete.

The loads of the filigree flat slab are transferred to the columns via 8'-0" wide conventionally reinforced in-slab beams that run 32'-0" x 16'-0" bays, typically. The filigree flat slabs are connected to the in-slab beams by reinforcing dowels, typically #7 bars on the top layer. The base of the beams are formed using the filigree planks, however the prestressed tendons are not utilized in the design strength of the beam.

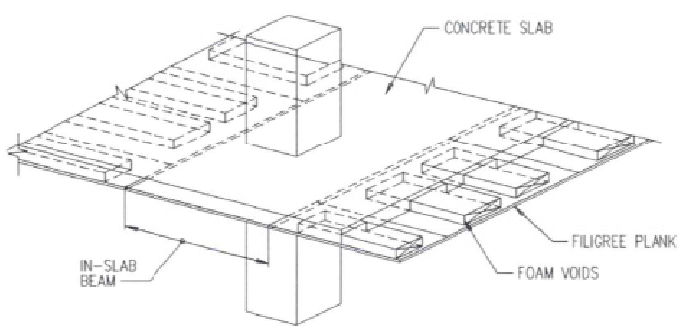


Figure 10: **Filigree Flat Plate System**

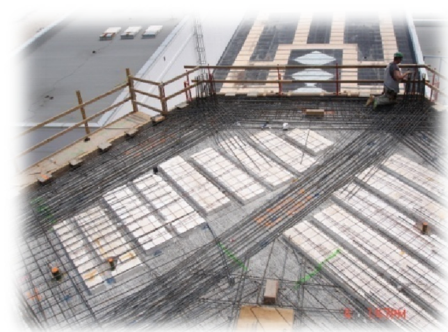


Figure 11: **Filigree Construction Photo**

Filigree Flat Slab System (Non-Core)

The proceeding diagram describes the various filigree flat slabs, by level number.

Level Number	Solid or Voided	Total Depth (inches)
2, 3	Voided	12
4	Solid	10
5 thru 39	Voided	10
40	Solid	12
41	Solid	10

Table 1: Filigree Slab Properties

Conventionally Reinforced Flat Plate System (Core)

The proceeding diagram describes the various conventionally reinforced flat plate slabs, by level number.

Level	Reinforcing	Thickness (inches)
2, 3	#6 @ 12" Bottom, Each Way	12
4	#7 @ 12" Bottom, Each Way	10
5 thru 39	#6 @ 12" Bottom, Each Way	10
40	#6 @ 12" Bottom, Each Way	12
41	#7 @ 12" Bottom, Each Way	10

Table 2: Conventional Flat Plate Slab Properties

Miscellaneous Framing

Level 3 – Catwalk

A catwalk that houses mostly MEP equipment above level 3 that encompasses the elevator core of the tower is framed using W shape beams. This steel framing is supported by both the concrete shear walls and concrete columns. The steel beams are connected to the concrete using embed plates with shear studs. 2" of bar grating serves as a floor for the catwalk.

Sign Support Framing (Level 41 to Top of Sign)

The Trump sign at the top of the hotel tower is supported by HSS girts, supporting the sign weight of 550plf. Two lines of columns, typically W14x61, post up from the concrete floor system of the 41st level, forming the perimeter lines of the system. Another line of columns, typically W24x68, posts up at the center of the original two lines from transfer girders, making three column lines. W16x67 and W24x68 are the typical girder sizes. There are a total of 7 bays, varying in span length.

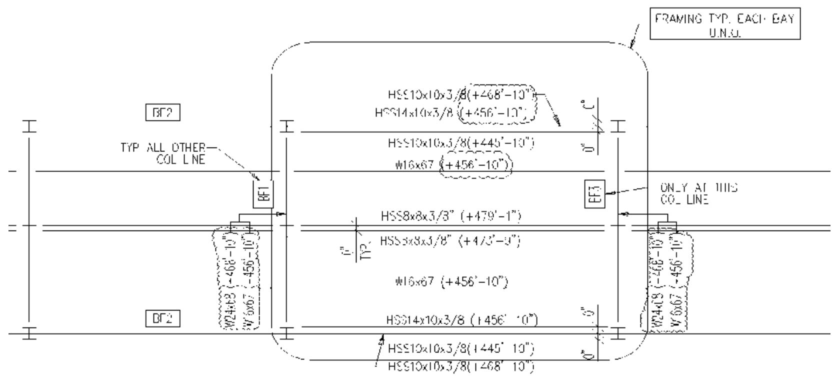


Figure 12: **Typical Framing Plan at Sign Support**

Elevator Separator/Support Framing

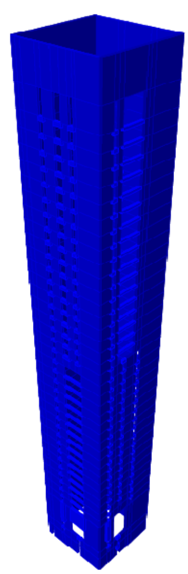
Elevator shafts are separated using a rectangular grid of HSS beams. The HSS beams are also used to resist the thrust force produced by the elevator systems. These beams tie to both the two-way slab floor system and the concrete columns by connecting to embed plates. See Appendix 2 for typical elevator separator beam framing plan.

Connection Bridge

The bridge that connects the existing hotel to the new hotel is framed using a composite steel system with slab on metal deck. The system frames into the vertical elements of the existing hotel tower and two W shape columns outside the perimeter of the new hotel. An expansion joint between the floor slab of the bridge and the concrete slab of the new hotel separates the two systems.

Lateral Systems

The primary lateral force resisting system of the hotel tower is comprised of a cast-in-place concrete shear wall core located at the geometric center of the tower's plan. The shear wall core contains various openings, coupled with concrete beams. A series of braced frames are used to stiffen the sign support structure at the top of the tower.



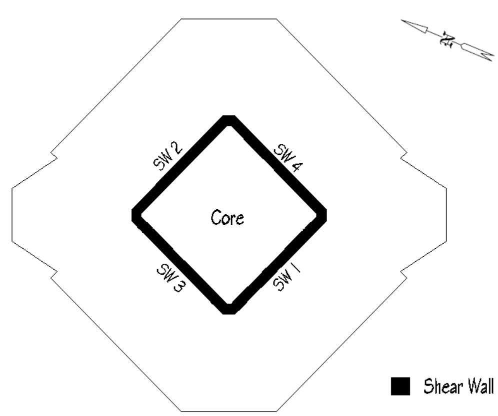


Figure 13: **Location of Concrete Shear Walls**

Reinforced Concrete Shear Walls

Four shear walls, spanning to level 41, are the primary lateral force resisting system of the Trump Taj Mahal Hotel. Two 60' long walls resist the forces in the east/west direction, as well as the north/south direction. These four walls form the elevator core that lies in the geometric center of the tower.

The shear walls decrease in thickness, 24" from levels 1 through 4 and 16" from levels 4 through 41. Because numerous openings exist, link (coupling) beams provide load transfer across the openings. Specified compressive strength of the concrete used for the shear walls varies by level and decreases from 9000psi to 5000psi; lower to upper levels respectively.

Braced Frames

Because the framing system supporting the large sign at the top of the tower is long and narrow, lateral bracing is needed to stiffen the system against strong wind forces. In the short (north/south) direction, seven X braced frames with single angle diagonals and one single strut braced frame with double angle diagonals.

The long (east/west) direction does not require much lateral stiffening because of its depth. Only two X braced frames with single angle diagonals are provided. The loads of these braced frames are transferred to the concrete floor system on the 41st level below. The concrete floor system acts as a rigid diaphragm, transferring the loads to the concrete shear walls.

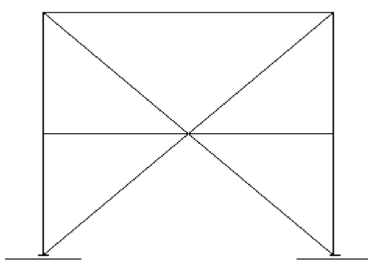


***Figure 14*: Braced Frame 1**

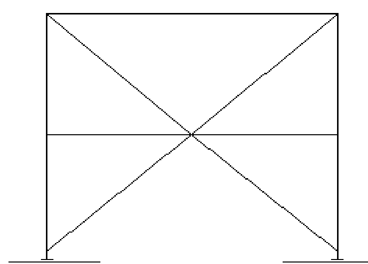


***Figure 15*: Braced Frame 2**

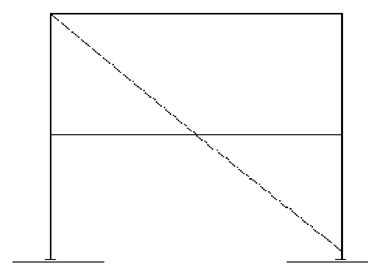


***Figure 16*: Braced Frame 3**

Problem Statement and Solution Overview

Problem Statement

Concrete structural floor systems and shear wall cores require a long erection time because they are labor intensive, require curing, and require shoring and re-shoring. However, what if Donald Trump wanted his hotel to open as soon as possible in order to generate revenue? Steel structural floor systems require much less time for erection compared to that of concrete systems. However, it was found in Technical Report Number Two (Reichwein, October 2007) that the structural depth of a steel system is often larger, requiring an increase in the building height to retain the same area of rentable space. The increase in building height will also conflict with the wind tunnel test issued by DFA because it was performed using a scale model. Can such a steel system be devised in order to retain the current height of the building?

While investigating the effectiveness of the current concrete shear wall core with the use of ETABS in Technical Report Number Three (Reichwein, December 2007), large inherent torsions were present under the wind loading specified by the wind tunnel test performed by DFA. This inherent torsion exists because the center of pressure of the wind and the center of rigidity of the shear wall core do not coincide. This occurs because each wall has a different stiffness, caused by the unsymmetrical layout of the core openings. The perimeter of the building is also not restrained torsionally, as this is a core only system.

Despite its inherent torsion, the stiffness of a concrete core shear wall was able to effectively handle the wind forces of Atlantic City, New Jersey. However, the long erection time of a concrete shear wall will delay the opening of Donald Trump's hotel. In order to reduce the construction time of the lateral force resisting system, a steel system will be considered. But, could a steel system provide adequate stiffness in order to meet the drift requirements in a hurricane prone region?

Problem Solution

In an effort to reduce the erection time of the structure, a steel redesign of the Trump Taj Mahal Hotel has been proposed as a viable alternative to the filigree floor system and concrete shear wall core system. The redesign includes both the floor system and lateral force resisting system of the tower. All steel framing will be designed in conformance with AISC Manual of Steel Construction, 13th Edition.

A core of braced steel frames will serve as the alternative to the cast-in-place concrete shear wall core. In order to meet the demands of hurricane force winds, the layout of the tower's core was redesigned to accommodate an efficient layout of braced frames. The redesign of the core will be discussed further as an architectural breadth. An ETABS model was constructed to distribute the lateral forces to each frame accordingly based on rigidity. The braced frames are designed for strength using AISC 13th Edition Manual of Steel Construction LRFD and meet a drift limitation of H/400, as recommended by both AISC Design Guide 3 – Serviceability Design Considerations; and ASCE 7-05 – Minimum Design Loads for Buildings and Other Structures. In order to provide the braced frames with adequate stiffness, built-up column sections are required at the lower levels of the tower.

The filigree flat plate floor system was redesigned as a steel frame with pre-cast concrete planks. However, it was found in Technical Report Number Two (Reichwein, 2007) that this type of system would be the deepest structurally. A deep structure will require a rise in building floor to floor height. After reviewing the mechanical and architectural requirements of the tower, it was found that a 10 inch increase in floor to floor height is required. The implications to cost of the increase in height are analyzed and evaluated.

Steel gravity frame designs were determined utilizing RAM Steel and conform to AISC 13th Edition Manual of Steel Construction LRFD and IBC 2003. The precast planks are specified by Nitterhouse, Inc. and have been designed utilizing proprietary loading charts.

The redesign of the tower in steel has affected the architecture of the tower in several ways. Because of the significant amount of changes made to the core of the tower, a study was conducted on the architectural impacts resulting from the newly designed brace frame core. The impacts to the architectural layout of the core will include alterations of the core openings, stairs, elevators, and service areas. A significant amount of changes are also being made to the floor system of the tower. In order to properly conceal the newly designed steel frame at the perimeter of the building, the addition of soffits above the windows of each guest room were required. A soffit was also provided in between some of the guest rooms in order to conceal the steel beams. A Revit model with each structural system was constructed in order to illustrate the key architectural impacts. These impacts are illustrated utilizing interior renderings and floor plans. The removal of the concrete shear wall core also created the need for fire-rated partitions. These partitions were selected from the Underwriter's Laboratory assemblies database. Additional costs incurred due to soffits, fireproofing, and partitions was analyzed using R.S. Means 2008.

The substantial differences between the construction of a steel and concrete structure merited a construction management study. Cost, scheduling, sequencing, and site conditions will all be affected by the redesign of the tower. The cost and schedule of the redesigned steel system was not easily estimated. Various interviews were conducted with contractors and design professionals in order to obtain accurate numbers. R.S. Means cost data was used to estimate the cost of additional items, such as fireproofing and the increased amount of curtain wall. Other cost data was obtained through interviews with the lead estimator on the current Trump Taj Mahal Hotel project. The estimated cost and schedule of the steel structure will be compared to the estimate and schedule provided by Bovis Lend Lease. Site conditions were also analyzed in order to determine the requirements of a steel structure.

Design Criteria

Design Methodology

The design of a high rise lateral force resisting system and gravity system poses itself as a daunting and cumbersome task. Computer modeling and analysis with the aid of ETABS and RAM was utilized in order to expedite the design process. Spot and hand checks were performed to verify computer analysis, however the size and scope of the project poses too many factors and considerations. Some errors may have gone unnoticed. Conservative assumptions were utilized as to not jeopardize the completion of this year long study and to offset any possible errors or omissions. These assumptions will be clearly stated as they are relevant.

Design Goals

The main goal of a new structural system for the Trump Taj Mahal Hotel is to replace the current concrete shear wall core with a core of braced frames. The current gravity floor system design as a filigree flat plate will be replaced with a precast concrete plank floor and steel frame. This study is being performed in order to understand why a concrete system was chosen over a steel system, considering the much faster erection time that a steel system offers. Numerous other design goals were established prior to the design of the braced frame core and steel frame. These goals are important to this study and have been strictly adhered to. The goals are as follows:

- Design a core of braced frames to effectively handle the design wind and earthquake forces imposed on the structure.
- The core of braced frames shall be provided in the exact location of the current shear wall core. A redesign of the layout of the core is permitted, but the areas of all spaces shall not deviate by more than 20% of the current. The number of elevators may not change.
- The tower's overall floor area must not change.
- The drift of the braced frames under the most severe lateral loading must not exceed H/400.
- Design a steel frame that utilizes a precast concrete plank floor system to effectively handle the gravity design loads.
- Additional columns and transfer girders shall only be provided if no affects are imposed on the layout of the guest room and meeting spaces.
- All structural systems must adhere to model code IBC 2003, ASCE 7-05, and AISC Manual of Steel Construction 13th Edition LRFD.
- Any floor to floor height increase shall be kept to a minimum and will meet the minimum demands of the mechanical and architectural systems of the tower. The use of soffits may be required to conceal the steel structure.
- Effectively reduce the erection time of the structure in order to generate revenue faster and compare to the added cost of the structure, if applicable.

Design Loads - Gravity

The self weight of the concrete planks with a 2 inch topping was taken as 93psf, as specified by Nitterhouse, Inc.

Superimposed dead loads for the tower are taken directly from the load maps provided by the structural engineer of record. Snow loads were calculated using ASCE 7-05. Live loads are taken directly from Table 4-1 of ASCE 7-05. A summary is provided in the following table.

Level	Superimposed Dead Load	Live Load	Live Load Reduction Comments (ASCE 7-05)
1	Partitions: 15psf	100psf	Not Applicable
2	Non-Core Suspended Ceiling: 10psf Suspended MEP: 10psf Floor Finishes: 10psf Core Suspended Ceiling: 10psf Suspended MEP: 10psf Floor Finishes: 10psf	Non – Core: 150psf Core: 100psf	4.8.5 Limitations on One-Way Slabs
3	Non-Core Suspended Ceiling: 5psf Suspended MEP: 10psf Floor Finishes: 5psf Topping Slab: 10psf Core Suspended Ceiling: 5psf Suspended MEP: 10psf Floor Finishes: 5psf Topping Slab: 10psf	Non-Core: 150psf Core: 100psf	4.8.5 Limitations on One-Way Slabs
4	Non-Core & Core Partitions: 15psf Suspended MEP: 15psf	40psf	4.8.5 Limitations on One-Way Slabs
5 Thru 38	Non-Core & Core Partitions: 15psf	40psf	4.8.5 Limitations on One-Way Slabs
39	Non-Core Partitions: 15psf Floor Finishes: 10psf Core Partitions: 15psf	40psf	4.8.5 Limitations on One-Way Slabs
40	Non-Roof Suspended MEP 30psf Roof Snow Load 11.2psf	MEP: 150psf Roof: 20psf	4.8.5 Limitations on One-Way Slabs 4.9.1 Flat, Pitched and Curved Roofs
41	Non-Roof Suspended MEP 30psf Roof Snow Load 11.2psf	20psf	4.9.1 Flat, Pitched and Curved Roofs

Table 3: Superimposed Dead and Live Loads

Design Loads – Lateral

Wind Loads

Wind loads for the Trump Taj Mahal were computed using a wind tunnel test performed by DFA based on a 50 year wind speed. The wind tunnel test loads are compared to the tabulated ASCE 7-05 MWFRS loads, as shown in Figure 17. Detailed calculations of the wind loads can be found in Appendix A. For the purposes of this study, only the wind tunnel test loads will be considered because the concrete shear wall core was designed using these loads (See Note 1 following Figure 17). The wind tunnel loads are permitted to be used despite being smaller overall compared to the wind loads calculated per ASCE 7-05. The wind tunnel loads consider 20 different load cases that include a force in both directions with an applied torsion. The wind tunnel load cases and corresponding loads for each case can be found in Appendix A.

Level	Height	Wind Tunnel Results					ASCE 7-05 Wind Loads			
		East/West (Kips)	North/South (Kips)	Torsion (in-kips)	Ovt Mom E/W (kip-ft)	Ovt Mom N/S (kip-ft)	North/South (kips)	East/West (kips)	Ovt Mom N/S (kip-ft)	Ovt Mom E/W (kip-ft)
Roof	460	139	191.4	20520	63940	88044	132.58	137.57	2121.26	2201.07
40	437.583	169.3	233.3	31920	138022.802	190132.114	138.86	144.08	5731.50	5947.14
39	422.583	103.2	142.1	19920	181633.368	250181.158	152.24	157.97	14561.39	15109.25
38	412.167	96.3	132.7	18960	221325.05	304875.719	76.11	78.98	19768.92	20512.70
37	401.75	100.2	138	20040	261580.4	360317.219	77.30	80.21	25863.04	26836.11
36	391.333	97.6	134.5	19560	299774.5	412951.508	78.38	81.33	32858.39	34094.65
35	380.917	95.1	131	19080	335999.707	462851.635	79.35	82.34	40767.20	42301.02
34	370.5	92.5	127.5	18480	370270.957	510090.385	80.25	83.27	49601.52	51467.72
33	360.083	90	124	18000	402678.427	554740.677	81.09	84.14	59372.84	61606.67
32	349.667	87.4	120.5	17520	433239.323	596875.55	81.87	84.95	70090.37	72727.43
31	339.25	84.9	116.9	17040	462041.648	636533.875	82.60	85.70	81764.02	84840.29
30	328.833	82.3	113.4	16440	489104.604	673823.537	83.29	86.42	94403.44	97955.25
29	318.417	79.9	110.1	15960	514546.122	708881.249	83.94	87.10	108015.89	112079.85
28	308	77.4	106.6	15480	538385.322	741714.049	84.56	87.74	122609.92	127222.97
27	297.583	74.8	103.1	15000	560644.531	772394.856	85.16	88.36	138194.02	143393.40
26	287.167	72.3	99.6	14520	581406.705	800996.69	85.72	88.95	154774.01	160597.19
25	276.75	69.7	96	13920	600696.18	827564.69	86.26	89.51	172357.52	178842.26
24	266.333	65.8	90.6	13440	618220.891	851694.459	86.79	90.06	190952.25	198136.59
23	255.917	63.3	87.2	12960	634420.437	874010.422	87.29	90.57	210562.87	218485.04
22	245.5	60.8	83.7	12360	649346.837	894558.772	87.77	91.07	231196.38	239894.86
21	235.083	58.3	80.3	11880	663052.176	913435.937	88.24	91.56	252859.92	262373.46
20	224.667	55.8	76.9	11400	675588.595	930712.829	88.69	92.03	275557.19	285924.69
19	214.25	53.3	73.4	10920	687008.12	946438.779	89.13	92.48	299294.75	310555.35
18	203.833	50.9	70.1	10440	697383.219	960727.472	89.56	92.93	324079.31	336272.39
17	193.417	48.4	66.7	9840	706744.602	973628.386	89.96	93.35	349913.76	363078.83
16	183	45.9	63.3	9360	715144.302	985212.286	90.36	93.76	376804.30	390981.10
15	172.583	43.4	59.8	8880	722634.404	995532.75	90.76	94.17	404757.36	419985.85
14	162.167	40.9	56.4	8400	729267.035	1004678.97	91.13	94.56	433775.09	450095.34
13	151.75	38.4	53	7800	735094.235	1012721.72	91.50	94.94	463863.45	481315.74
12	141.333	35.9	49.5	7320	740168.089	1019717.7	91.86	95.32	495028.64	513653.48
11	130.917	33.4	46.1	6840	744540.717	1025752.98	92.21	95.68	527272.14	547110.10
10	120.5	31	42.6	6360	748276.217	1030886.28	92.56	96.04	560599.74	581691.61
9	110.083	28.5	39.2	5760	751413.583	1035201.53	92.90	96.39	595017.46	617404.25
8	99.667	26	35.8	5280	754004.925	1038769.61	93.22	96.73	630526.19	654248.95
7	89.25	23.6	32.5	4800	756111.225	1041670.23	93.54	97.06	667131.56	692231.56
6	78.833	21.1	29.1	4320	757774.601	1043964.27	93.86	97.39	704839.51	731358.23
5	68.417	18.6	25.6	3840	759047.157	1045715.75	94.16	97.71	743650.33	771629.26
4	58	29.8	41.1	4680	760775.557	1048099.55	115.25	119.58	792351.32	822162.56
3	26	9.2	12.6	1800	761014.757	1048427.15	140.26	145.54	853727.65	885848.09
2	16	6.4	8.8	1200	761117.157	1048567.95	84.58	87.76	892632.82	926217.02
		2500.6	3445		761117.157	1048567.95	3725.14	3865.29	892632.82	926217.02

***Figure 17*: Wind Loads per DFA Wind Tunnel Test and ASCE 7-05 MWFRS Method 2**

Note 1: Height increase will alter wind tunnel results, however this will be neglected for the purpose of this study.

Seismic Loads

Seismic loads for the Trump Taj Mahal were calculated using ASCE 7-05, Equivalent Lateral Force Procedure. The details of the calculations, parameters, and seismic load cases can be found in Appendix A of this report. The base shear for both directions was calculated to be approximately 720kips. Seismic forces can be seen below in Figure 18.

Seismic Forces ASCE 7-05 Lateral Force Procedure			
Level	Height	Shear Per Floor (kips)	Overturning Moment
Roof	460	40.93	18829.93
40	437.583	55.56	43143.44
39	422.583	43.18	61391.68
38	412.167	41.08	78323.55
37	401.75	39.03	94003.79
36	391.333	37.03	108495.66
35	380.917	35.09	121860.89
34	370.5	33.19	134159.32
33	360.083	31.35	145449.29
32	349.667	29.57	155787.59
31	339.25	27.83	165229.17
30	328.833	26.15	173827.44
29	318.417	24.52	181634.26
28	308	22.94	188699.67
27	297.583	21.41	195072.16
26	287.167	19.94	200798.65
25	276.75	18.52	205924.29
24	266.333	17.15	210492.65
23	255.917	15.84	214545.70
22	245.5	14.57	218123.70
21	235.083	13.36	221265.28
20	224.667	12.21	224007.51
19	214.25	11.10	226385.70
18	203.833	10.05	228433.60
17	193.417	9.05	230183.32
16	183	8.10	231665.29
15	172.583	7.20	232908.31
14	162.167	6.36	233939.58
13	151.75	5.57	234784.61
12	141.333	4.83	235467.29
11	130.917	4.14	236009.88
10	120.5	3.51	236432.99
9	110.083	2.93	236755.57
8	99.667	2.40	236994.98
7	89.25	1.93	237166.89
6	78.833	1.50	237285.36
5	68.417	1.13	237362.81
4	58	0.93	237416.73
3	26	0.22	237422.56
2	16	0.077823311	237423.80
		718.5	237423.80

***Figure 18*: Seismic Loads per ASCE 7-05 Equivalent Lateral Force Procedure**

Comparison

The following graph, Figure 19, compares the lateral loads of the Trump Taj Mahal Hotel. It can be seen that the wind tunnel loads in the north/south direction have the largest wind forces overall. The wind loads calculated according to ASCE-7-07 MWFRS Method 2 appear to be more uniform and yield higher base shears compared to the wind tunnel loads. Seismic forces appear to be well below that of the wind forces and will probably not govern design.

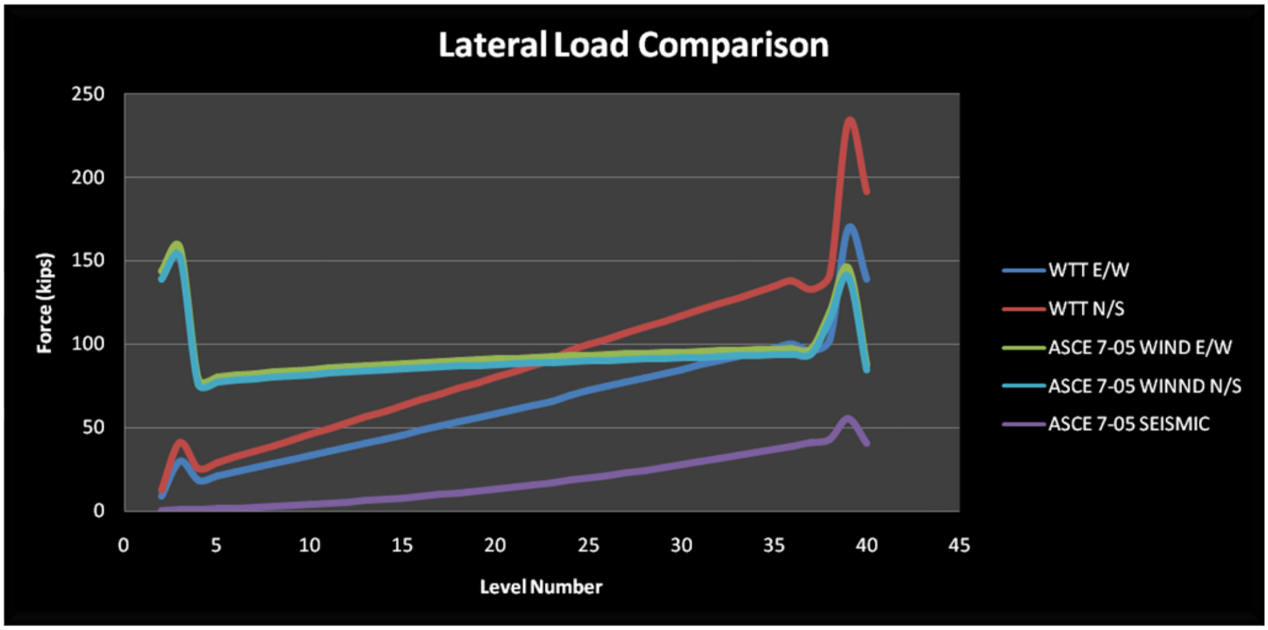


***Figure 19*: Lateral Load Comparison**

Structural Depth Studies

Solutions that are presented in this portion of the report are in response to the problem statement and design criteria as stated. The structural redesigns presented herein have been designed with many simplifying assumptions as to expedite the analysis and design process and not compromise the integrity of this year long study. The goal of the structural redesign is to replace the current reinforced concrete shear wall core with a core of braced frames. This includes the redesign of the current filigree flat plate floor system as a steel frame with precast concrete planks. The overall design of the steel system will be ultimately compared to the current concrete system. Conclusions will be based upon performance, cost, schedule, architectural impacts, and construction impacts.

Material Strength Specifications

Unless otherwise noted, the following grades and material strengths will be used for the redesigned structural components from here within:

Structural Steel W-Shapes……………………….……………………………………………….….A992
Structural Plates and Angles……………………………………………………………………….…A36
Built-up Section Plates…………………………………………………………...…………..A572-Gr 50
Bolts (Basic Beam to Girder Connections)........…………………………………..……….3/4" - A490N
Bolts (Column Splices and Girder to Column Connections)……………….……3/4" – A490 Slip Critical
Shear Studs……………………………………..………………………………..3/4" – ASTM A108
Anchor Bolts………..……………………………………………………………………A449-Gr 120
Topping Slab 28 Day Strength…………………………………………………………………...3000psi
Mat Foundation 28 Day Strength……………………………………………………………...5000psi
Precast Plank Prestressing Strands…………………………………………..0.6"Φ270ksi Lo-Relaxation
Precast Plank 28 Day Strength………...……………………………………………………….6000psi

Gravity System Redesign

Introduction

The proposed gravity system redesign consists of replacing the filigree flat plate system with a non-composite steel frame with precast plank and topping slab. This type of system was chosen due to its superior erection time and cost savings, the main goals of this study are such.

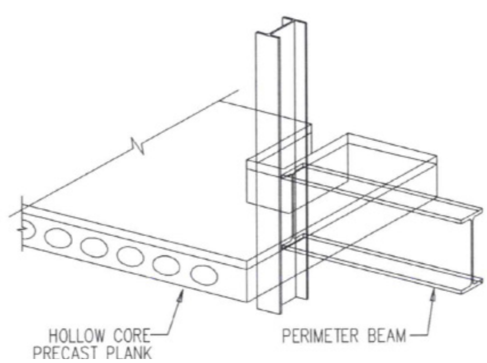


***Figure 20*: Precast Plank and Steel Frame Isometric Diagram**

Methodology

This system utilizes precast pre-stressed hollow core concrete planks as the floor slab and steel girders as supports. Precast planks with a 2" topping span the length of the floor, transferring the floor load to the steel W-shape girders. The girders then transfer the load to W-14 steel columns. Finally, the load is transferred from the columns to the mat foundation.

The 2" topping slab is required for both fire protection and floor leveling purposes, but it is also necessary to provide an adequate bond between the planks to ensure that the floor system acts as a rigid diaphragm under lateral loading. Because precast planks were chosen as the floor system, a composite steel frame was not an option and a non-composite steel frame was used. A non-composite steel frame is not able to utilize the compressive strength of a concrete slab; therefore the members are often heavier and/or deeper.

Design Goals and Assumptions

The overall design goal is to convert the current filigree flat plate system with a non-composite steel frame and precast plank floor system. Other goals and assumptions are as follows:

Design Goals

- Develop a steel framing plan that adequately meets the requirements of the Trump Taj Mahal Hotel without causing alterations to the architecture of the tower.
- Develop a floor system that utilizes the strength of the precast planks efficiently.
- Limit member depths as to not interfere with the architecture and mechanical requirements of the Trump Taj Mahal Hotel.
- Develop a RAM Steel model in input live and dead loads to obtain steel sizes that conform to the strength and serviceability requirement of both ASCE 7-05 and AISC Manual of Steel Construction 13th Edition LRFD.
- Beam deflection shall be limited to L/240 for dead + live load, L/360 for live load, and ½" for spandrel beams per curtain wall requirements.
- Check over RAM Steel designs and optimize design by using similar W-shapes.
- Spot check a typical exterior girder to verify RAM designs.
- Develop typical details of the non-composite steel frame with precast plank system.

Design Assumptions

- Columns will be braced by not only steel framing, but precast concrete planks as well; this detail was verified by a representative of Nitterhouse, Inc.
- The sign structure at the top of the tower has been omitted for simplicity.
- Elevator and stair framing has not been designed due to unknown load requirement. Cost will be considered based on the design of the structural engineer of record.
- Additional bracing and design requirements for the torsional resistance of spandrel beams have not been accounted for. Numerous design solutions exist, however impact towards cost and schedule will not be impacted enough to merit consideration for this study.

Design Process

The initial design process began with countless hours of sketching, delicately placing steel framing as to not inhibit the architecture or mechanical systems of the tower. Both typical tower levels and atypical levels of the tower were framed. Upon completing the steel framing layout, the precast planks were designed for the longest span and loading for a typical floor of the tower. Planks were designed using the loading tables provided by Nitterhouse, Inc. The planks of atypical levels were also verified to meet strength requirements. Calculations and loading tables can be found in Appendix B.

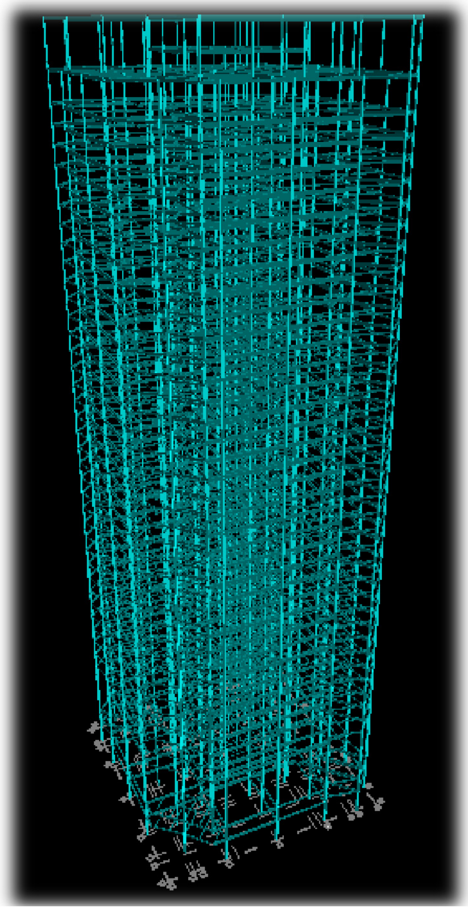
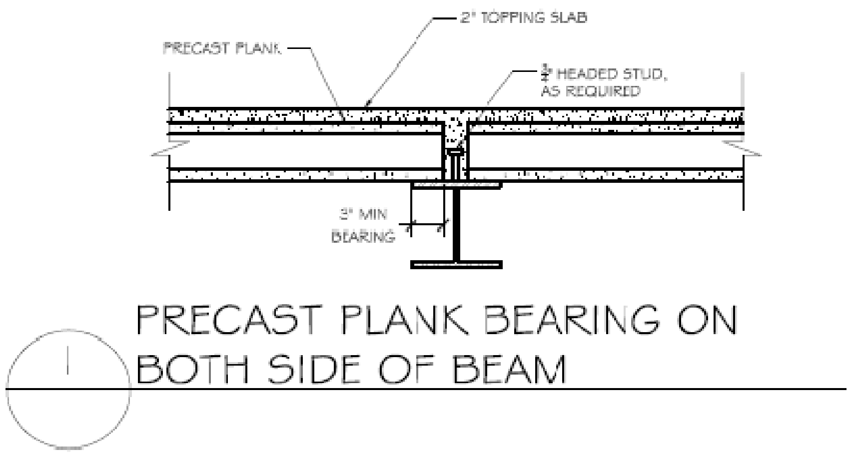


Figure 21: **3D RAM Model Isometric**

After completing the framing layout and plank design, a RAM Steel model was created to size steel members. RAM was used because it is widely recognized in practice as one of the best steel gravity design and analysis programs. Layouts of all floors of the tower were created, including atypical levels. Dead and live loads were input into the RAM model, live load reduction in accordance with ASCE 7-05 and model code IBC 2003 were incorporated for column design only. A linear load to account for the weight of the curtain wall was placed along the perimeter of the diaphragm. Again, spandrel beams were not designed for torsion for simplification purposes. Snow loads were calculated per ASCE 7-05; however for simplicity drifting was not a consideration as it poses little ramifications to the overall cost of the frame. As a small note, the 10" floor to floor height increase has been taken into account prior to the design of the steel frame.

Upon completion of the model layout, the model was run in order to obtain steel designs. Girders were not cambered in order to accommodate easier connection constructability. All members were reviewed and sized by the user according to repetitive member selection, connection constructability (i.e. beams were not permitted to be deeper than girders), and depth restrictions imposed by mechanical and architectural requirements. The results of the steel gravity design for a typical bay and the core are shown below in Figure 23 and Figure 24, respectively. Framing plans and member sizes for all levels of the tower can be found in Appendix B.

Typical details of the framing system were developed to illustrate plank connections to the steel frame. These details are important in understanding the load path of both the gravity and lateral loads, as well as getting a sense of how the system is constructed.



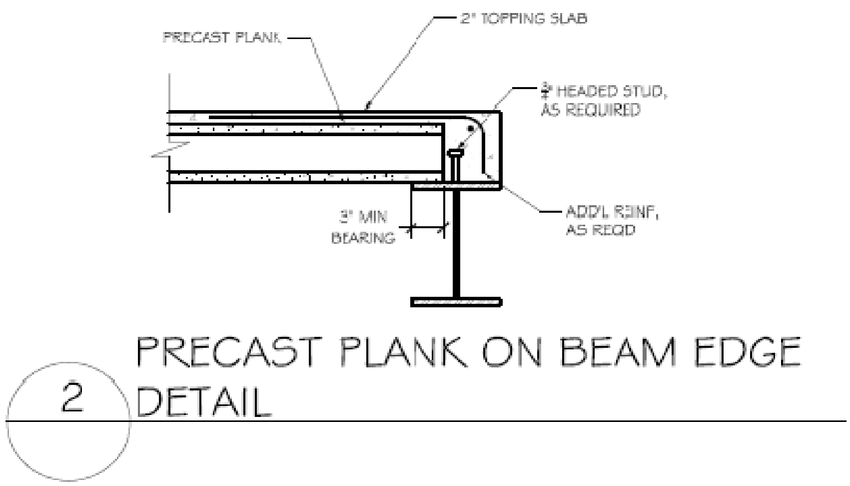


***Figure 22*: Non-Composite Steel Frame with Precast Plank Details**
Note: Shear Studs Provided for Transfer of Lateral Loads

After completing the beam design, the steel columns were designed. Columns were designed on the basis that weak and strong axis buckling would be fully restrained by both steel framing members as well as the precast concrete planks and topping. Columns were typically spliced every 4 levels to accommodate faster steel erection. This results in approximately 42' long steel columns. Column splices will be discussed further in the construction management breadth of this study. All column sizes can be found in Appendix B.

The weight of each floor was calculated by RAM Frame. Each floor approximately weighs 2000 kips. This weight can be converted to a unit mass for input into ETABS by:

$$\text{Mass Per Unit Area} = \frac{\text{Wt.of Floor (kips)} \times 1000\text{lbs/kip}}{389\text{in/sec}^2 \times \text{FloorArea (in}^2)}$$

Equation 1

This mass will be applied to the ETABS model per unit area for lateral dynamic analysis purposes. For a typical floor with an area of 2421520.9in^2, this mass translates to 1.9x10^6 lb-sec^2 /in^3.

The factor of safety against overturning of the building can now be calculated since the weight of the structure is known. Using the most sever wind tunnel test overturning moment of 1,048,568 ft-kips and a resisting moment of 6,190,260 ft-kips, the factor of safety is determined by:

$$\text{F.S.} = \frac{\text{Resisting Moment}}{\text{Overturning Moment}}$$

Equation 2

This results in a factor of safety of 6.7 and is more than two times greater than the recommended factor of safety is 3.0; therefore overturning is not a stability issue. Calculations are available upon request.

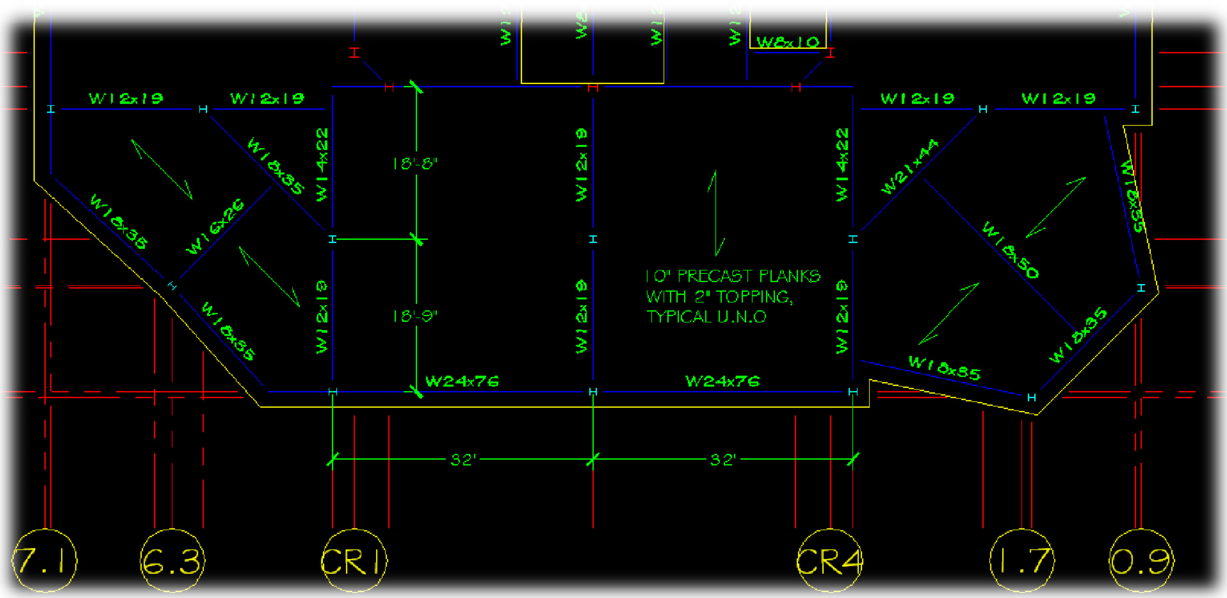


***Figure 23*: Typical Bay Steel Frame and Plank Framing Plan**

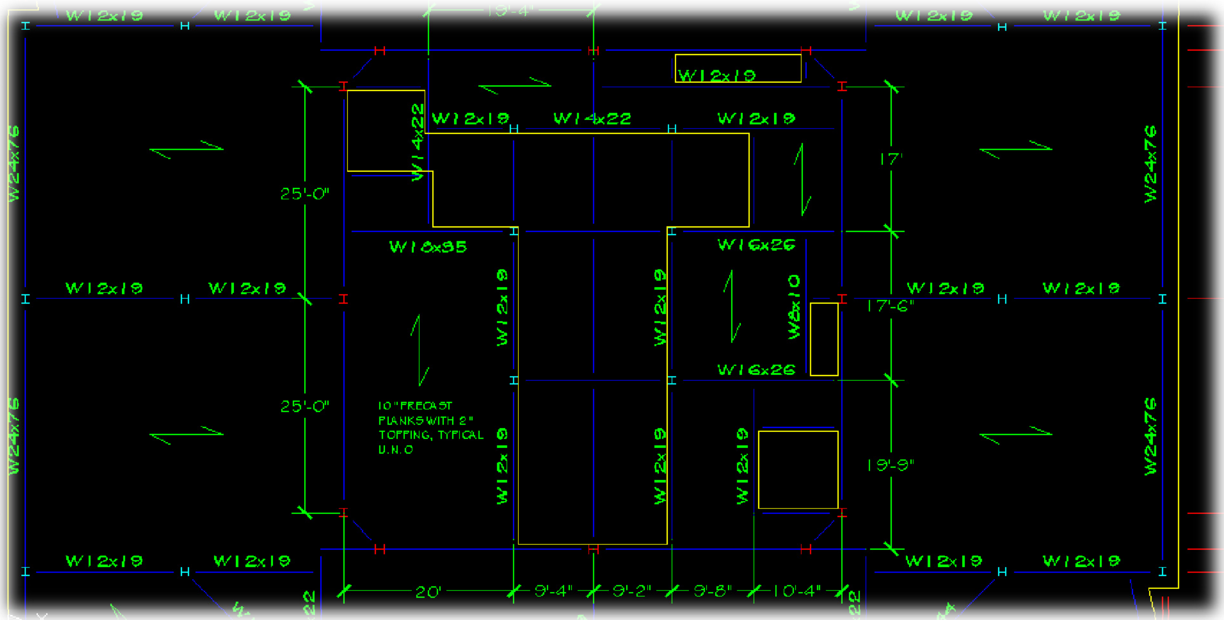


Figure 24: **Typical Core Steel Frame and Plank Framing Plan**

Braced Frame Core Design

Introduction

The proposed lateral force resisting system redesign consist of replacing the core of concrete shear walls with braced frames as seen in Figure 25 and 26, respectively. A steel braced frame was chosen to be evaluated due to the stiffness that can be provided to the building in such a small amount of space. Braced frames are often preferred over moment frames because moment frames offer construction challenges in terms of field connections; which translates to higher cost.

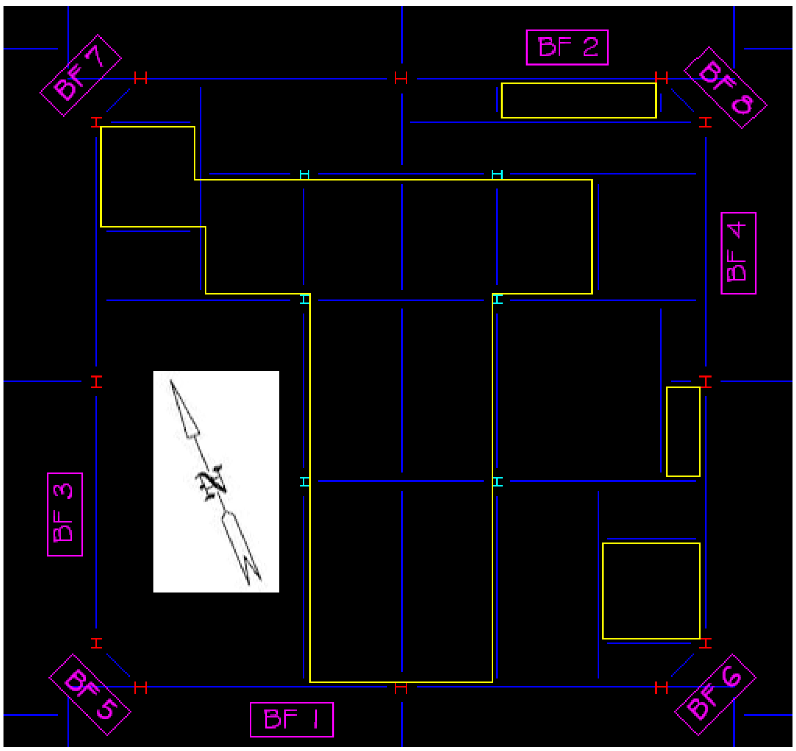


Figure 25: **Plan Layout of the Braced Frame Core**

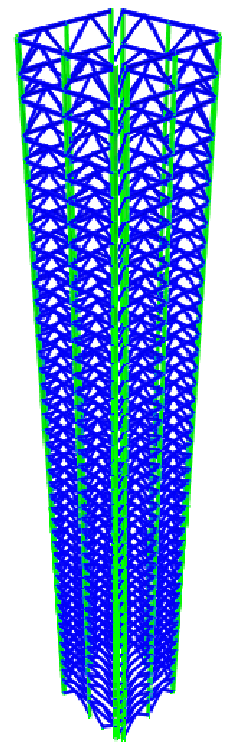


Figure 26: **ETABS Isometric of Braced Frame Core**

Initial member sizes of the braced frames were determined using classical, simplified methods. These initial sizes were input into an ETABS model for further design and optimization. Design groups were chosen at every 8 floors (a total of 5 design groups) for simplification. Results of the analysis and optimization will meet the requirements of code and the recommended drift limitation of H/400. Braced frame connections shall be detailed and designed in a simplified manner to illustrate feasibility. The punching shear of the mat foundation will be evaluated to assure that an increase in mat thickness will not be required; or conversely to see if a decrease in thickness is feasible. Finally, a parametric acceleration check will be performed following the procedure presented in *Serviceability Limit States under Wind Load,* by Lawrence G. Griffis. Acceleration is often an issue with tall, slender, core-only steel structures.

This is a serviceability issue and is related to the motion perception of the building occupants at the upper levels of the tower.

Before any design was conducted, the layout of the elevator and service core was changed to accommodate the braced frame core. Openings were moved and areas were redesigned accordingly as to provide as many concentrically braced frames as possible. Concentrically braced frames are preferred over eccentrically braced frames because a concentrically braced frame provides greater stiffness to the overall structure. Eccentrically braced frames were avoided as much as possible, but were still required at the elevator lobbies of the core to accommodate the opening. For a more detailed core layout analysis, see the architectural breadth of this report.

Methodology

A braced frame is an extremely efficient system because the horizontal shear forces resulting from lateral loads are resisted by the axial capacities of the braces and columns of the system. The system effectively acts as a vertical truss, where little or no moment exists in the columns, beams, or braces. Since forces are resisted mostly by axial forces, a highly efficient system results because the complete cross section of steel section resists the forces, compared to just the deformations caused by bending.

Before a design procedure can be set forth, it is important to understand the behavior of such a braced frame system. After conducting independent research while speaking with various design professionals, it was found that the exterior columns of the braced frame convert the bending forces of the system into axial tension and compression, while the braces convert the shear forces of the system into axial tension and compression. This type of behavior is analogous to a wide flange beam, where the columns of the braced frame act as the flange and the braces as the web. The interior columns act as "zipper columns" and resist little axial forces caused by lateral loads. Zipper columns act more as intermediate supports for girders and brace. This behavior is illustrated in Figure 27.

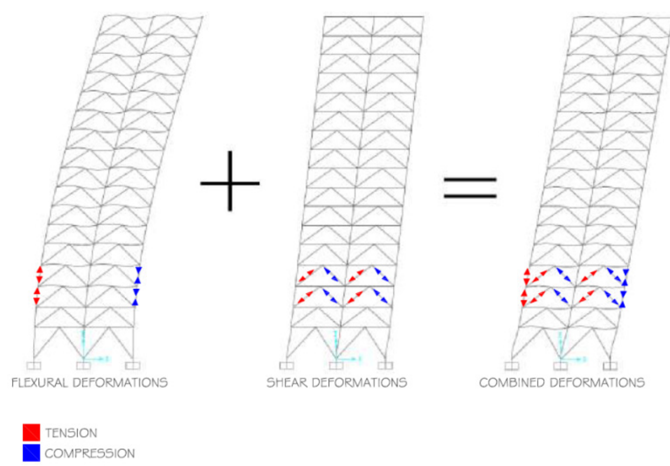


***Figure 27*: Braced Frame Behavior**

Columns in the braced frame of tall buildings accumulate large axial forces from both lateral and gravity loads. These forces result in large axial deformations in the columns. In the braced frame of a tall building, a large percentage of the building drift results from the deformations in the columns, known as "chord drift". A smaller percentage of the building drift results from the shear deformations of the braces, known as "shear racking". Because columns play a pivotal role in the control of drift, large columns are often necessary to control the accumulating shear and gravity forces of the building. This will result in a large column size that is often in excess of the strength requirement.

Design Goals and Assumptions

The overall design goal of this redesign is to effectively replace the concrete shear wall core with a core of braced frames. Other goals are as follows:

Design Goals

- Obtain initial column sizes based upon the simplified moment area method.
- Obtain and compare initial sizes of moment area method with the virtual work method provided in AISC Design Guide 5 – Design of Low and Medium Rise Buildings.
- Setup ETABS model with initial frame layouts and member designs.
- Input wind tunnel test and ASCE 7-05 seismic design loads into ETABS model.
- Run ETABS model and iterate design groups until strength and drift criteria has been satisfied.
- Provide an optimal braced frame design for use in further investigation.
- Spot and hand check critical columns, braces, and girders.
- Design and detail the typical braced frame connections.
- Design the most critical braced frame column base plate.

In order to expedite the design process, a few assumptions were made. These assumptions are as follows:

Design Assumptions

- To obtain initial trial sizes, forces were distributed evenly among frames.
- Wind loads determined according to ASCE 7-05 MWFRS were neglected and only the loads of the wind tunnel test were used.
- Columns, braces, and girders are designed by groups, 8 floors in each group for a total of 5 design groups.
- P-delta effects were considered in the drift and strength design.
- Rigid diaphragm action results from the precast planks with 2” concrete topping. However, semi-rigid diaphragm action was used in order to impose axial forces on the girders of the braced frame.
- Concentric inverted “V” Chevron braces will be utilized whenever possible, as they provide greater stiffness over eccentric braces.
- Lumped mass was applied to each diaphragm over the entire area of the diaphragm. These masses were found using the RAM Steel output.

Design Process

To gage the initial member sizes of the braced frames, two classical methods of analysis were utilized. Moment area method and the virtual work method presented in AISC Design Guide 5 were used to obtain initial column, brace, and girder sizes. Both methods neglect the impacts of gravity loads.

Moment area method

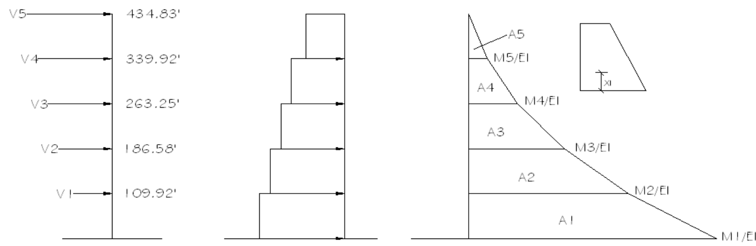


***Figure 28*: Load, Shear and Moment Relationship of Moment Area Method**

Moment area method assumes that all of the deformations of the braced frame are due to flexure and the cross section of the end columns resist the tension and compression forces caused by bending. The flexure forces result from the overturning moments caused by the wind tunnel loads, where the most extreme loads were taken. It is important to note that both the effects of torsion and gravity are neglected by moment area method. Also, it is assumed that each brace contributes equally to the resistance of the lateral loads. Detailed calculations can be found in Appendix C.

The structure was split into five groups, 8 stories to each group. The wind forces were summed up for each group and were said to act at the top story of each design group. From the winds loads, a shear and moment relationship can be developed as shown in Figure 28. Dividing the moments by the unknown EI, the areas of each piece of the M/EI diagram can be found by

$$A_i = \left((M_i + M_{i+1}) \times h_i\right) \div (2EI_{oi}) \qquad \textit{Equation 1}$$

Where E = 29000ksi for steel and I is the end column moment of inertia found by

$$I_{oi} = \Sigma(A_{ci} d_i^2) \qquad \textit{Equation 2}$$

Where d is the center line to center line distance between the end columns and A_{ci} is the gross area of the end columns. With the target deflection set to H/400 in both the E-W and N-S direction, this value can be substituted into Equation 6, leaving only the required moment of inertia for each design group as the unknown. By substituting the distances squared and rearranging Equation 4, the areas of the columns of each design group can be found. These required areas are summarized in Figure 29 below.

$$\bar{X}_i = \frac{h_i}{3}\left(\frac{M_i + 2M_{i+1}}{M_i + M_{i+1}}\right) \qquad \textit{Equation 5}$$

$$\Delta_{ci} = A_i(h_i - \bar{X}_i) + \sum_{j=1}^{i=1} A_j (H_i - \bar{X}_j) \qquad \textit{Equation 6}$$

Overturning Moment			Required Column Area		
M5	1542667.1	in-kips	Acol5	**22.439**	in^2
M4	3585800	in-kips	Acol4	**68.5828**	in^2
M3	5985908.3	in-kips	Acol3	**143.528**	in^2
M2	8762778.8	in-kips	Acol2	**252.781**	in^2
M1	12955479	in-kips	Acol1	**424.176**	in^2

***Figure 29*: Moment Area Method Column Area Summary**

Because the area of a W14x730, the largest W-shape column available in today's steel market, is 215in^2, built-up or composite column sections are required. After speaking with Malcolm Bland, principal at The Harman Group, it was found that built-up sections are typically preferred over composite column sections because of construction management issues, including sequencing and constructability of connections. The design sections of these built-up columns will be discussed later in this section of the report.

Classical Virtual Work Method (as presented in AISC Design Guide 5)

As moment area method is a great tool to obtain initial braced frame column sizes, a method is needed to find initial sizes of braces and girders. The method chosen is the classical virtual work method presented in AISC Design Guide 5. This is an optimization method utilized for "inverted V" or "chevron" braced frames. Final member sizes are obtained by multiplying required areas by a correction factor that accounts for drift. This method can be found complete in Appendix C.

Many assumptions had to be made in order to use this method. The geometry of all bays in the braced frames had to be assumed to be concentric inverted "V", when in reality some eccentric braces exist. Because of this assumption, these calculations will approximate a drift that is much smaller than the actual drift. As with moment area method, all braced frames were assumed to contribute equally to lateral force resistance.

The procedure to find optimal member areas involves first finding member forces due to the external wind forces; second finding member forces due to virtually applied forces at the point deflection is to be optimized; third calculating areas due to strain with lambda = 1.0; fourth computing the deflection by virtual loads with lambda = 1.0; and finally applying a correction factor which is the ratio of the target deflection of H/400 to the calculated deflection. The results of this method are summarized below in Figure 30. The column sizes of classical virtual work method are compared to that of the moment area method. The member areas required are fairly similar to each other; classical virtual work shows the requirement of a larger column area.

	Classic Virtual Work			Moment Area Method	
	A_{col}	A_{brace}	A_{girder}	Ovt Mom	A_{col}
Group 5	76.226206	9.32948	11.7558	1542667.1	22.4390097
Group 4	178.98679	11.9457	15.0525	3585800	68.5828473
Group 3	288.64802	13.5319	17.0512	5985908.3	143.527923
Group 2	380.54798	14.3852	18.1264	8762778.8	252.781058
Group 1	498.74328	14.8786	24.1676	12955479	424.176461

***Figure 30*: Classical Virtual Work Summary with Comparison to Moment Area Method**

ETABS Frame Analysis

ETABS was chosen for the lateral analysis software of choice for this study due to its proven use in the design of the world's tallest and most complex structures. The floor plans and story heights of the Trump Taj Mahal Hotel tower were entered into the model. 2 models were created; a model for drift and a model for strength. The strength model will be discussed later in this report. The drift model assumes rigid diaphragm action of the precast concrete plank floor system. The mass of each floor was lumped per unit area of the diaphragm; this mass was obtained from the RAM Steel gravity model output. The wind loads from the wind tunnel test were input into the model; all 20 of the cases were considered. For drift design, a 25% reduction was applied to these wind loads as a way of converting a 50 year wind speed (strength) to a 10 year wind speed (serviceability). A minimum 25% reduction was recommended by AISC Design Guide 3 and ASCE 7-05 Commentary on Wind Loads (Chapter 6). Tabulated seismic loads per ASEC 7-05 Equivalent Lateral Force Procedure were also imposed on the structure in both the north/south and east/west directions; a ±5% accidental torsion was applied to the structure. For clarity, the following table list all load cases input into ETABS with a brief description of each.

Dead	Self Weight and Superimposed Dead Loads
Live	Live Load per ASCE 7-05 Requirements
Wind1 - 20	Wind Tunnel Test Wind Load Case, 20 Cases Total – Drift Model has 25% Reduction Applied per AISC Design Guide 3.
EQX	Seismic Forces Acting East/West
EQXE1	Seismic Forces Acting East/West with +5% Accidental Eccentricity
EQXE2	Seismic Forces Acting East/West with -5% Accidental Eccentricity
EQX	Seismic Forces Acting North/South
EQXE1	Seismic Forces Acting North/South with +5% Accidental Eccentricity
EQXE2	Seismic Forces Acting North/South with -5% Accidental Eccentricity

Table 4: ETABS Load Case Identification

The braced frame cores were constrained geometrically to allow space for the required openings of the redesigned service core. Although it is preferred to have all concentric braced frames, eccentric braced frames were required in Braced Frame 1 (E-W direction) in order to accommodate the openings into the elevator lobby. The elevations of the 8 braced frames are shown in Figure 31 below (See Figure 25 for plan layout of braced frames). 5 design groups were created for the columns, braces and girders; each design group encompassing 8 stories of the braced frames. Concentric and eccentric braced frames were put into 2 different design groups because of the differing behavior of each.

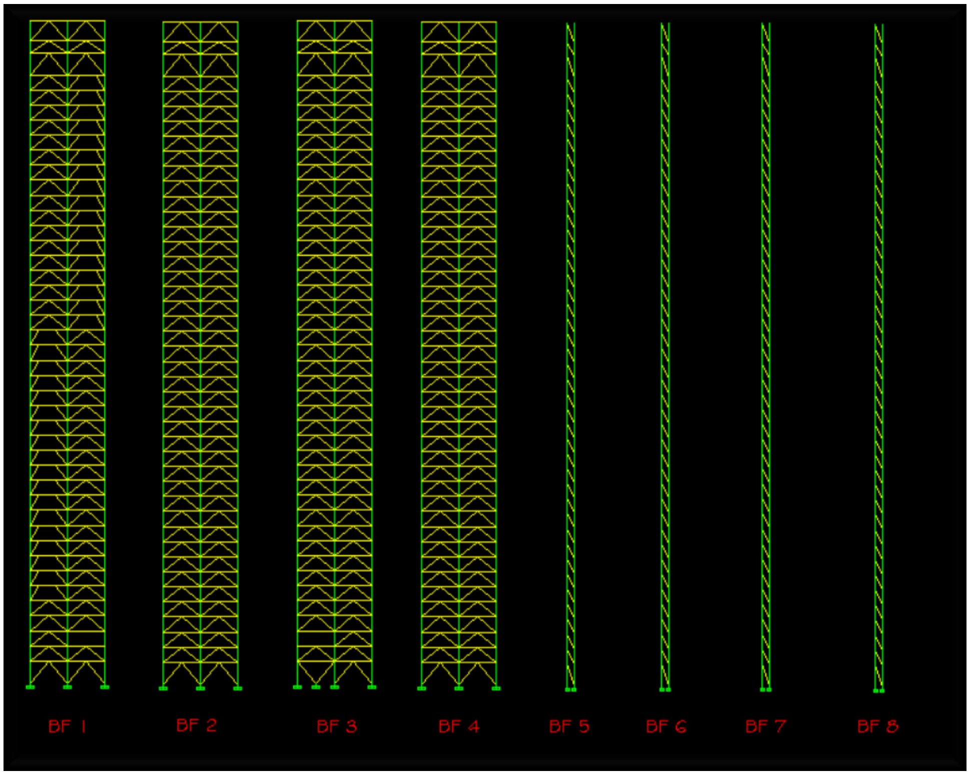


***Figure 31*: Braced Frame Elevations**

Initial member sizes determined by classical virtual work method and moment area method were input into the model. The model was run with P-delta effects considered. Iterations were preformed on the member sizes of each of the 5 design groups until the drift limitation of H/400 was met and member optimization was accomplished.

After completing the drift optimization of the frames, a strength model was created. This model differs from the drift model in that semi-rigid diaphragms were assumed in order to impose axial forces on the girders of the braced frames. "Dummy" null areas acting as tributary areas were also setup up around the braced frames to distribute floor dead and live loads onto the braced frame members (See Figure 32). The full wind tunnel test wind loads were used for strength design.

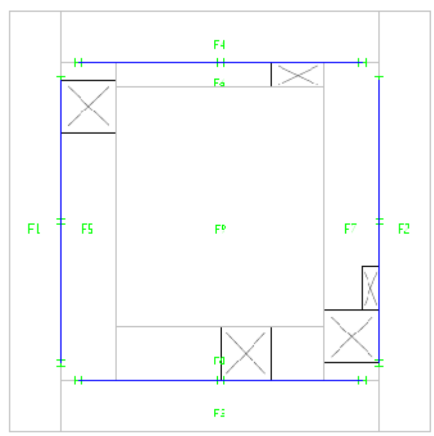


***Figure 32*: "Dummy" Null Tributary Areas**

For LRFD, the load combinations of ASCE 7-05 Chapter 2 Strength Design were used to obtain the ultimate design loads of the structure. The load combinations are as follows:

1. 1.2D + 1.6L + 0.5(L_r or S or R)
2. 1.2D + 1.6(L_r or S or R) + (L or 0.80W)
3. 1.2D ± 1.6W + L + 0.5((L_r or S or R)
4. 1.2D ± 1.0E + L + 0.2S
5. 0.90D ± 1.6W
6. 0.90D ± 1.0E

*Note: ± indicates the possibility of uplift resulting from lateral forces

Overall, ultimate member forces were compared and designed to meet equation H1-1a (Equation 5) or H1-1b (Equation 6), members under combined forces, as specified in Chapter H of AISC Manual of Steel Construction 13th Edition. As shown below, the interaction equation must not exceed 1.0.

$$For\ \frac{P_r}{P_c} \leq 0.2$$

$$\frac{P_r}{P_c} + \frac{8}{9}\left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cx}}\right) \leq 1.0 \qquad \textit{H1-1a (Equation 3)}$$

$$For\ \frac{P_r}{P_c} > 0.2$$

$$\frac{P_r}{2P_c} + \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cx}}\right) \leq 1.0 \qquad \textit{H1-1b (Equation 4)}$$

Iterations were performed until the interaction equation of all members did not exceed 1.0. Braced Frame elevations complete with interaction ratios can be seen in Figure 33. Please note that all red members are extremely close to 1.0, but do not exceed it. Any increases in member sizes due to strength requirements were updated in the drift model; the drift model was re-run with these updated member sizes. A schedule of the final member sizes of each braced frame can be found in Figure 34. The section properties of built-up column sections can be found in Figure 35.

Spot checks of columns, braces, and girders were performed to verify the design outputs of ETABS. These spot checks were performed by superimposing the gravity loads obtained from RAM Steel on the columns and girders. These loads were than input into a spreadsheet with the member's design section in order to determine conformance with Equation 7 and Equation 8. Brace designs were spot checked on the basis of limiting slenderness ratios to KL/r ≤ 300 for tension and KL/r ≤ 200 for compression. Calculations and spot checks are available upon request.

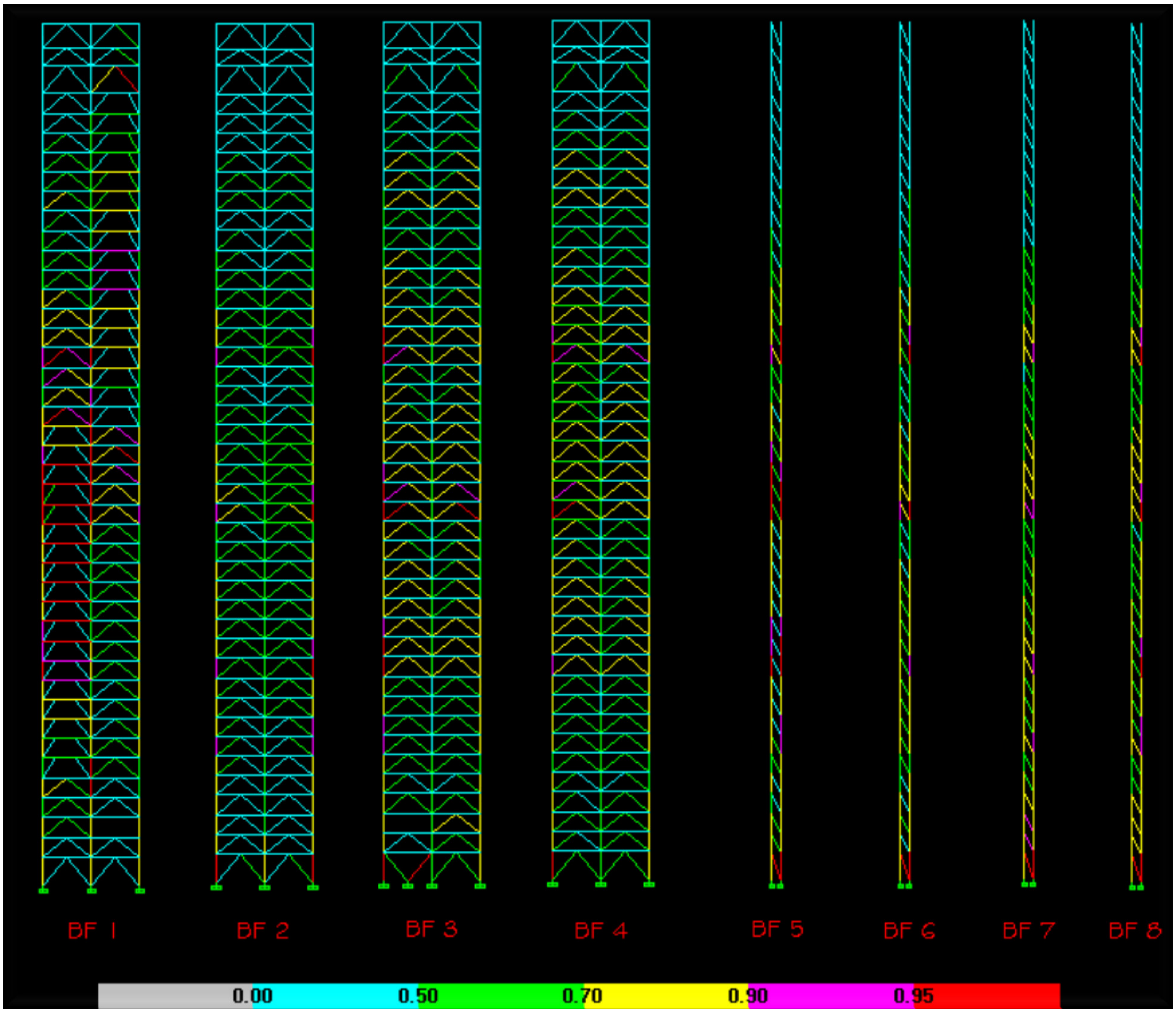


Figure 33: **Braced Frame Strength Design – Interaction Equations**

Having both the strength and drift models finalized, output can now be processed and used for comparison purposes. For the purpose of this study, it is important to compare the performance of the braced frame core to that of the concrete shear wall core. Please note that all of the results used for the concrete shear wall core are taken from the analyses and investigations completed in Technical Report Number 3 (Reichwein, December 2007). Figure 36 and Figure 37 compare the center of rigidity and inherent eccentricity of both the concrete shear wall and braced frame core. It is important to note that the braced frame core was designed in such a way to minimize the inherent torsion of the structure. This involved an architectural redesign of the service core which was not considered for the concrete shear wall core. By comparison, the concrete shear wall core exhibits much more inherent eccentricity as compared to the braced frame core.

Braced Frame Schedule

Concentrically Braced Frames (BF 1,2,3,4)			
Levels	**Column**	**Brace**	**Girder**
1 - 4	Builtup 3	W12x210	W14x132
5 - 8	Builtup 2	W12x170	W14x132
9 - 16	Builtup 1	W12x136	W14x109
17 - 24	W14x550	W12x106	W16x89
25 - 32	W14x311	W12x87	W16x77
33 - Roof	W14x257	W12x53	W16x77

Eccentrically Braced Frames (BF 1 Only)			
Levels	**Column**	**Brace**	**Girder**
3 - 4	Builtup 3	W12x210	W14x145
5 - 8	Builtup 2	W12x170	W14x145
9 - 16	Builtup 1	W12x136	W14x145
17 - 24	W14x550	W12x106	W14x120
25 - 32	W14x311	W12x87	W16x77
33 - 38	W14x257	W12x53	W16x77

BF 5,6,7,8	
Levels	**Brace**
1 - 16	2L8x8x1
16 - Roof	2L6x6x1

***Figure 34*: Braced Frame Column, Brace, and Girder Schedule**

Built-up Column Section Properties

Section	Wt (plf)	A (in^2)	I_{33} (in^4)	I_{22} (in^4)	S_{33} (in^3)	S_{22} (in^3)	z_{33} (in^3)	z_{22} (in^3)	r_{33} (in)	r_{22} (in)
Builtup 1	908.54	267	22048	5465	1694	611	2292	986	9	4.5
Builtup 2	1112.71	327	33964	6550	2235	732	3137	1208	10.2	4.5
Builtup 3	1429.17	420	42840	12125	2856	1212	3960	1875	10.1	5.3

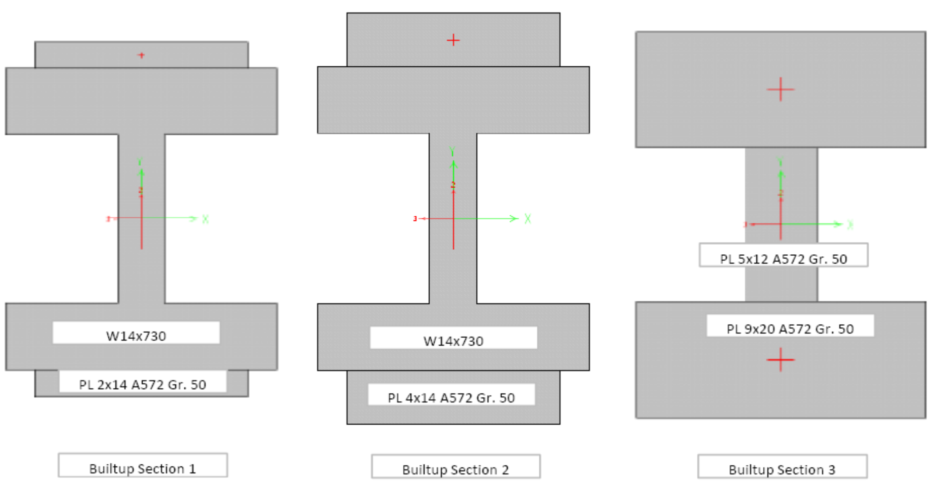
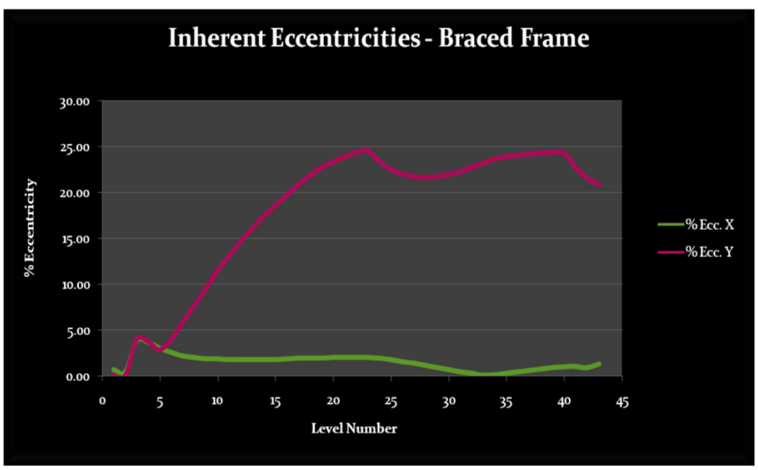


Figure 35: Built-up Column Section Properties

Braced Frame Core						
Story	XCM	YCM	XCR	YCR	%eX	%eY
STORY40	804.44	797.22	793.50	963.39	1.36	20.84
STORY39.1	800.88	801.03	793.63	973.66	0.91	21.55
STORY39	802.08	799.81	793.72	980.76	1.04	22.62
STORY38	802.06	799.86	793.95	994.36	1.01	24.32
STORY37	802.05	799.89	794.70	994.76	0.92	24.36
STORY36	802.05	799.89	795.67	994.26	0.80	24.30
STORY35	802.05	799.89	796.79	993.39	0.66	24.19
STORY34	802.05	799.89	798.05	992.22	0.50	24.04
STORY33	802.05	799.89	799.44	990.86	0.32	23.88
STORY32	802.03	799.92	800.96	989.25	0.13	23.67
STORY31	802.02	799.94	802.60	985.28	0.07	23.17
STORY30	802.02	799.94	804.29	981.57	0.28	22.71
STORY29	802.02	799.94	806.01	978.29	0.50	22.29
STORY28	802.02	799.94	807.76	975.59	0.72	21.96
STORY27	802.02	799.94	809.53	973.71	0.94	21.72
STORY26	802.02	799.94	811.31	972.93	1.16	21.62
STORY25	802.02	799.94	813.07	973.62	1.38	21.71
STORY24	802.00	799.97	814.77	976.18	1.59	22.03
STORY23	801.98	800.00	816.23	980.11	1.78	22.51
STORY22	801.98	800.00	817.46	987.10	1.93	23.39
STORY21	802.03	800.00	818.38	996.23	2.04	24.53
STORY20	802.11	800.00	818.41	994.86	2.03	24.36
STORY19	802.11	800.00	818.33	991.47	2.02	23.93
STORY18	802.11	800.00	818.23	987.14	2.01	23.39
STORY17	802.11	800.00	818.09	981.80	1.99	22.73
STORY16	802.10	800.02	817.89	975.29	1.97	21.91
STORY15	802.10	800.05	817.51	966.69	1.92	20.83
STORY14	802.10	800.05	817.15	958.09	1.88	19.75
STORY13	802.10	800.05	816.84	948.98	1.84	18.61
STORY12	802.10	800.05	816.60	939.22	1.81	17.39
STORY11	802.10	800.05	816.44	928.75	1.79	16.09
STORY10	802.10	800.05	816.41	917.46	1.78	14.68
STORY9	802.10	800.05	816.58	905.25	1.81	13.15
STORY8	802.09	800.08	816.98	891.91	1.86	11.48
STORY7	802.10	800.12	817.45	877.00	1.91	9.61
STORY6	802.10	800.12	818.35	862.16	2.03	7.76
STORY5	802.10	800.12	819.91	847.16	2.22	5.88
STORY4	802.09	800.12	822.48	832.10	2.54	4.00
STORY3	802.04	800.02	826.32	822.87	3.03	2.86
STORY2.1-1	801.97	799.92	831.67	829.88	3.70	3.75
STORY2.1	802.32	800.80	833.39	832.81	3.87	4.00
STORY2	802.33	800.80	805.99	800.17	0.46	0.08
STORY1	801.96	799.92	807.46	800.83	0.69	0.11

Shear Wall Core						
Story	XCM	YCM	XCR	YCR	%eX	%eY
STORY40	347.56	347.65	522.75	638.71	50.41	83.72
STORY39	347.26	347.46	523.96	641.33	50.88	84.58
STORY38	346.40	346.00	526.12	638.43	51.88	84.52
STORY37	346.39	346.00	527.80	635.43	52.37	83.65
STORY36	346.39	346.00	529.67	631.50	52.91	82.52
STORY35	346.39	346.00	531.75	626.77	53.51	81.15
STORY34	346.39	346.00	534.06	621.37	54.18	79.59
STORY33	346.39	346.00	536.64	615.40	54.92	77.86
STORY32	346.39	346.00	539.53	608.99	55.76	76.01
STORY31	346.39	346.00	542.76	602.27	56.69	74.07
STORY30	346.39	346.00	546.37	595.37	57.73	72.07
STORY29	346.39	346.00	550.41	588.47	58.90	70.08
STORY28	346.39	346.00	554.92	581.76	60.20	68.14
STORY27	346.39	346.00	559.96	575.47	61.65	66.32
STORY26	346.39	346.00	565.55	569.82	63.27	64.69
STORY25	346.39	346.00	571.76	565.09	65.06	63.32
STORY24	346.39	346.00	578.62	561.53	67.04	62.29
STORY23	346.39	346.00	586.20	559.38	69.23	61.67
STORY22	346.39	346.00	594.63	559.14	71.67	61.60
STORY21	346.36	346.73	603.38	560.44	74.21	61.63
STORY20	347.57	346.45	620.08	556.95	78.41	60.76
STORY19	346.62	346.28	624.70	557.91	80.23	61.11
STORY18	346.62	346.28	626.21	558.42	80.66	61.26
STORY17	346.62	346.28	625.21	558.57	80.37	61.30
STORY16	346.62	346.28	622.11	558.46	79.48	61.27
STORY15	346.62	346.28	617.19	558.12	78.06	61.18
STORY14	346.62	346.28	610.66	557.53	76.18	61.00
STORY13	346.62	346.28	602.61	556.61	73.85	60.74
STORY12	346.62	346.28	593.08	555.31	71.11	60.36
STORY11	346.62	346.28	582.31	553.90	68.00	59.96
STORY10	346.62	346.28	569.35	551.74	64.26	59.33
STORY9	346.62	346.28	554.79	548.39	60.06	58.36
STORY8	346.62	346.28	538.75	543.99	55.43	57.09
STORY7	346.62	346.28	521.13	538.31	50.35	55.45
STORY6	346.62	346.28	501.80	530.96	44.77	53.33
STORY5	346.62	346.28	480.51	521.39	38.63	50.57
STORY4	346.69	346.61	456.70	513.20	31.73	48.06
STORY3	333.30	340.56	432.89	529.02	29.88	55.34
STORY2	346.85	346.01	318.26	360.11	8.24	4.07
STORY1	350.99	344.85	321.25	290.54	8.47	15.75

***Figure 36*: Center of Mass, Center of Rigidity, and Inherent Eccentricity of Both the Shear Wall and Braced Frame Core**



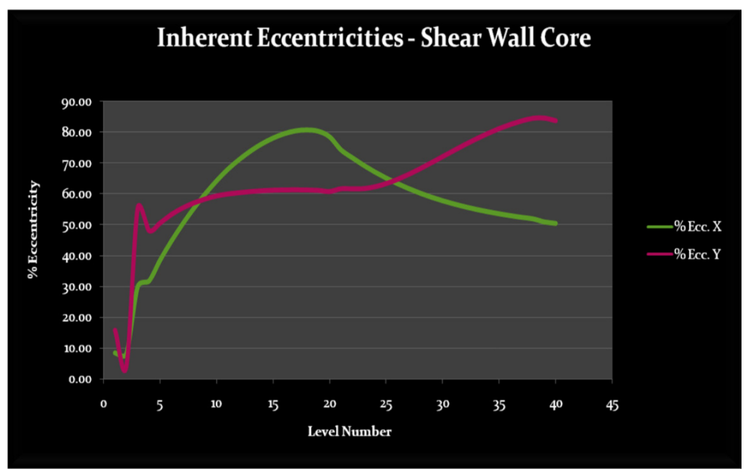


***Figure 37*: Inherent Eccentricity Comparison of Both Structural Systems**

The seismic story drift of the braced frame core under the most severe seismic load case was well under the allowable story height of $0.20 \times h_x$. Results of the seismic story drift are illustrated in Figure 38 and Figure 38 below. The seismic drift of all load cases can be found in Appendix D.

Wind drift governed the design of most members of the braced frame core. A drift limitation of H/400 was used as recommended by AISC Design Guide 3 and ASCE 7-05. A comparison of the drift resulting from the most severe wind tunnel test load case of both the concrete shear wall core and the braced frame core is shown below in Figure 39. Figure 40 is a graphic of the comparison of the drift of both systems versus H/400 and H/500, respectively. As can be seen by both of these figures, the drift of the concrete shear wall core falls below H/500 for all levels, whereas the drift of the braced frame core barely meets the limitation of H/400. As P-delta effects were considered, Figure 41 illustrates the most severe wind case drift for the braced frame core with and without P-delta effects. P-delta effects had only contributed to a slight increase in overall building drift. All results of the braced frame core drift for all wind tunnel test load cases can be found in Appendix D.

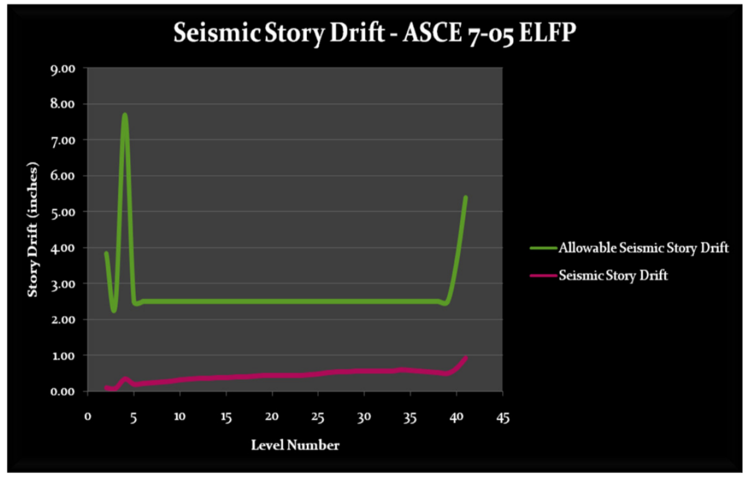


Figure 37: **Seismic Story Drift Versus Allowable**

Building Drift Under Most Severe Seismic Case (Cd = 3.3)						
Braced Frame Core (EQXE2)						
Level	Height (ft)	Total Drift (in)	Amplified Drift (in)	H/?	Amplified Story Drift (in)	ASCE 7-05 Allowable Story Drift (in)
41	460.00	5.30	17.49	315.64	0.93	5.38
40	437.58	5.02	16.56	317.08	0.64	3.60
39	422.58	4.82	15.92	318.51	0.50	2.50
38	412.17	4.67	15.42	320.78	0.53	2.50
37	401.75	4.51	14.89	323.75	0.55	2.50
36	391.33	4.35	14.34	327.41	0.57	2.50
35	380.92	4.17	13.78	331.81	0.58	2.50
34	370.50	4.00	13.19	337.00	0.59	2.50
33	360.08	3.82	12.60	342.94	0.56	2.50
32	349.67	3.65	12.04	348.65	0.57	2.50
31	339.25	3.48	11.47	354.95	0.57	2.50
30	328.83	3.30	10.90	361.94	0.56	2.50
29	318.42	3.13	10.34	369.62	0.56	2.50
28	308.00	2.96	9.78	377.96	0.55	2.50
27	297.58	2.80	9.23	386.91	0.54	2.50
26	287.17	2.63	8.69	396.37	0.52	2.50
25	276.75	2.48	8.18	406.05	0.48	2.50
24	266.33	2.33	7.70	415.07	0.46	2.50
23	255.92	2.19	7.24	424.01	0.44	2.50
22	245.50	2.06	6.81	432.80	0.43	2.50
21	235.08	1.93	6.38	442.47	0.44	2.50
20	224.67	1.80	5.94	453.92	0.44	2.50
19	214.25	1.67	5.50	467.31	0.44	2.50
18	203.83	1.54	5.07	482.81	0.43	2.50
17	193.42	1.41	4.64	500.45	0.41	2.50
16	183.00	1.28	4.23	518.95	0.40	2.50
15	172.58	1.16	3.84	539.85	0.39	2.50
14	162.17	1.05	3.45	564.09	0.38	2.50
13	151.75	0.93	3.07	592.40	0.36	2.50
12	141.33	0.82	2.71	625.69	0.35	2.50
11	130.92	0.72	2.36	665.26	0.33	2.50
10	120.50	0.61	2.03	712.84	0.31	2.50
9	110.08	0.52	1.72	769.96	0.28	2.50
8	99.67	0.43	1.44	833.35	0.26	2.50
7	89.25	0.36	1.17	911.64	0.24	2.50
6	78.83	0.28	0.93	1012.24	0.22	2.50
5	68.42	0.22	0.72	1147.02	0.19	2.50
4	58.00	0.16	0.53	1323.14	0.35	7.68
3	26.00	0.05	0.18	1747.61	0.08	2.40
2	16.00	0.03	0.10	1945.88	0.10	3.84

Figure 38: **Seismic Story Drift**

Building Drift Comparison Under Most Severe Wind Tunnel Case (P-Delta Effects and 25% Reduction)										
	Shear Wall Core (Case 12)				Braced Frame Core (Case 9)				Drift Ratios	
Level	Height (ft)	Total Drift (in)	H/?	Story Drift (in)	Height (ft)	Total Drift (in)	H/?	Story Drift (in)	H/400 (in)	H/500 (in)
41	434.83	7.77	671.98	0.34	460.00	12.87	428.98	0.81	13.80	11.04
40	407.00	7.43	657.69	0.24	437.58	12.06	435.45	0.56	13.13	10.50
39	397.42	7.18	663.75	0.16	422.58	11.50	441.12	0.40	12.68	10.14
38	387.83	7.02	662.75	0.17	412.17	11.10	445.56	0.40	12.37	9.89
37	378.25	6.85	662.18	0.17	401.75	10.70	450.65	0.41	12.05	9.64
36	368.67	6.68	662.09	0.18	391.33	10.29	456.49	0.42	11.74	9.39
35	359.08	6.50	662.44	0.18	380.92	9.87	463.13	0.42	11.43	9.14
34	349.50	6.32	663.27	0.19	370.50	9.45	470.66	0.43	11.12	8.89
33	339.92	6.14	664.57	0.19	360.08	9.02	479.05	0.40	10.80	8.64
32	330.33	5.95	666.32	0.19	349.67	8.62	486.85	0.40	10.49	8.39
31	320.75	5.76	668.52	0.19	339.25	8.22	495.36	0.40	10.18	8.14
30	311.17	5.56	671.16	0.20	328.83	7.82	504.71	0.40	9.86	7.89
29	301.58	5.37	674.22	0.20	318.42	7.42	514.93	0.39	9.55	7.64
28	292.00	5.17	677.64	0.20	308.00	7.03	526.07	0.39	9.24	7.39
27	282.42	4.97	681.36	0.20	297.58	6.64	538.18	0.38	8.93	7.14
26	272.83	4.78	685.28	0.19	287.17	6.25	551.30	0.38	8.62	6.89
25	263.25	4.58	689.24	0.19	276.75	5.87	565.36	0.36	8.30	6.64
24	253.67	4.39	693.00	0.19	266.33	5.52	579.18	0.35	7.99	6.39
23	244.08	4.21	696.27	0.18	255.92	5.17	594.20	0.34	7.68	6.14
22	234.50	4.03	698.25	0.15	245.50	4.82	610.58	0.34	7.37	5.89
21	224.92	3.88	695.40	0.19	235.08	4.49	628.40	0.33	7.05	5.64
20	215.33	3.70	699.23	0.20	224.67	4.16	647.75	0.32	6.74	5.39
19	205.75	3.50	706.13	0.21	214.25	3.84	668.75	0.31	6.43	5.14
18	196.17	3.29	715.81	0.21	203.83	3.54	691.55	0.30	6.11	4.89
17	186.58	3.07	728.41	0.22	193.42	3.24	715.96	0.27	5.80	4.64
16	177.00	2.85	744.14	0.22	183.00	2.97	739.82	0.27	5.49	4.39
15	167.42	2.63	763.24	0.22	172.58	2.70	766.16	0.26	5.18	4.14
14	157.83	2.41	786.09	0.22	162.17	2.45	795.55	0.25	4.87	3.89
13	148.25	2.19	813.22	0.22	151.75	2.20	828.52	0.24	4.55	3.64
12	138.67	1.97	845.18	0.21	141.33	1.96	865.66	0.23	4.24	3.39
11	129.08	1.76	882.07	0.21	130.92	1.73	907.68	0.22	3.93	3.14
10	119.50	1.55	925.88	0.20	120.50	1.51	955.65	0.20	3.62	2.89
9	109.92	1.35	978.49	0.19	110.08	1.31	1009.55	0.18	3.30	2.64
8	100.33	1.16	1042.33	0.18	99.67	1.13	1060.76	0.17	2.99	2.39
7	90.75	0.97	1120.83	0.17	89.25	0.96	1117.49	0.16	2.68	2.14
6	81.17	0.80	1218.57	0.16	78.83	0.80	1181.90	0.15	2.36	1.89
5	71.58	0.64	1342.19	0.14	68.42	0.65	1255.17	0.14	2.05	1.64
4	62.00	0.50	1490.68	0.41	58.00	0.52	1341.04	0.33	1.74	1.39
3	26.00	0.09	3545.45	0.05	26.00	0.19	1666.67	0.08	0.78	0.62
2	16.00	0.04	5026.18	0.04	16.00	0.11	1789.38	0.11	0.48	0.38

***Figure 39*: Building Drift of Both Systems Resulting from the Most Severe Wind Tunnel Load Case**

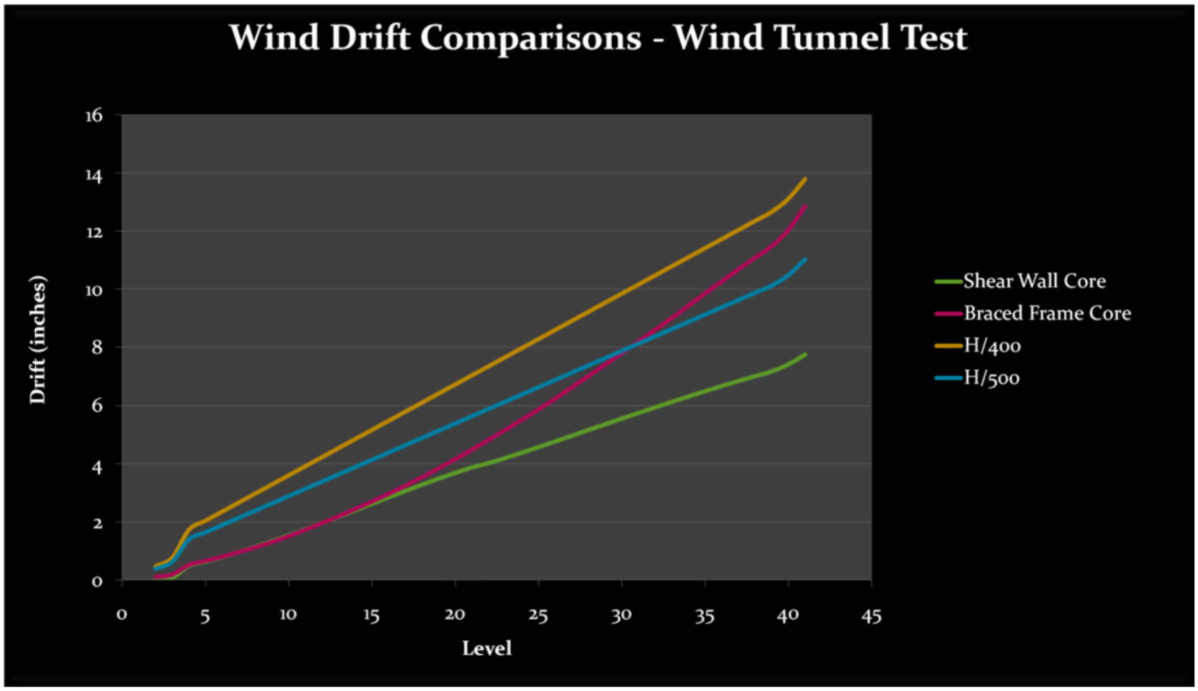


Figure 40: **Wind Drift Comparison of Both Systems versus H/400 and H/500**

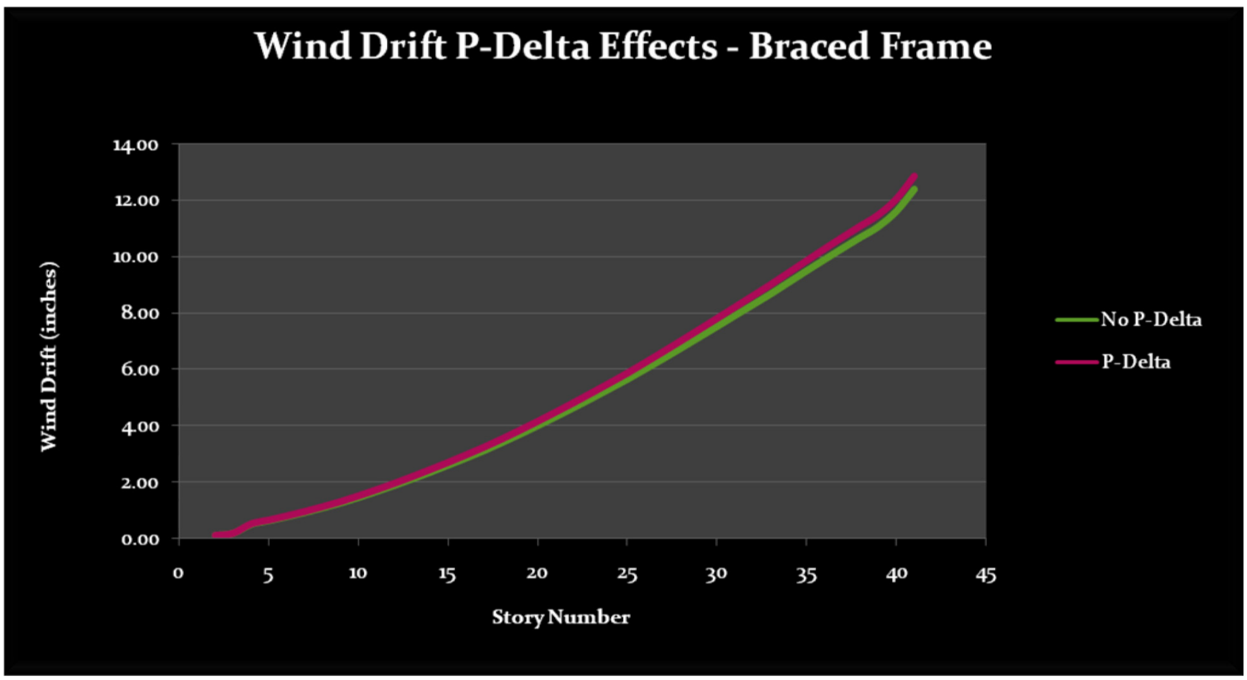


Figure 41: **P-Delta Effects on the Braced Frame Core**

Braced Frame Connection Design and Detailing

An important aspect of the investigation of converting a concrete structure to a steel structure is the effect on the floor to floor height. While detailing the braced frame connections it was found that a minimum 10" increase, 30'-0" total building height increase is required to accommodate the braced frame connections without impeding core openings. However, a simple gusset plate that acts as at the interface of the brace and girder would require an even larger increase in floor to floor height as to not interfere with openings. With the working points taken at the centerline intersections of all members of the braced frame, a special "V" shaped connection is utilized at the brace to girder interface. This "V" shaped connection is comprised of two halves of an ordinary gusset plate shop welded to the bottom flange of the girder; two field bolted plates on each side of the brace act as the connecting element between the brace and gusset plate. A simpler connection is utilized at the brace to column interface. A gusset plate that uses "claw angles" as the connecting element between the gusset plate and brace is utilized at the brace to column interface; the gusset plates are to be shop welded to the column and field bolted to the girder. The entire braced frame connection detail can be seen in Figure 42.

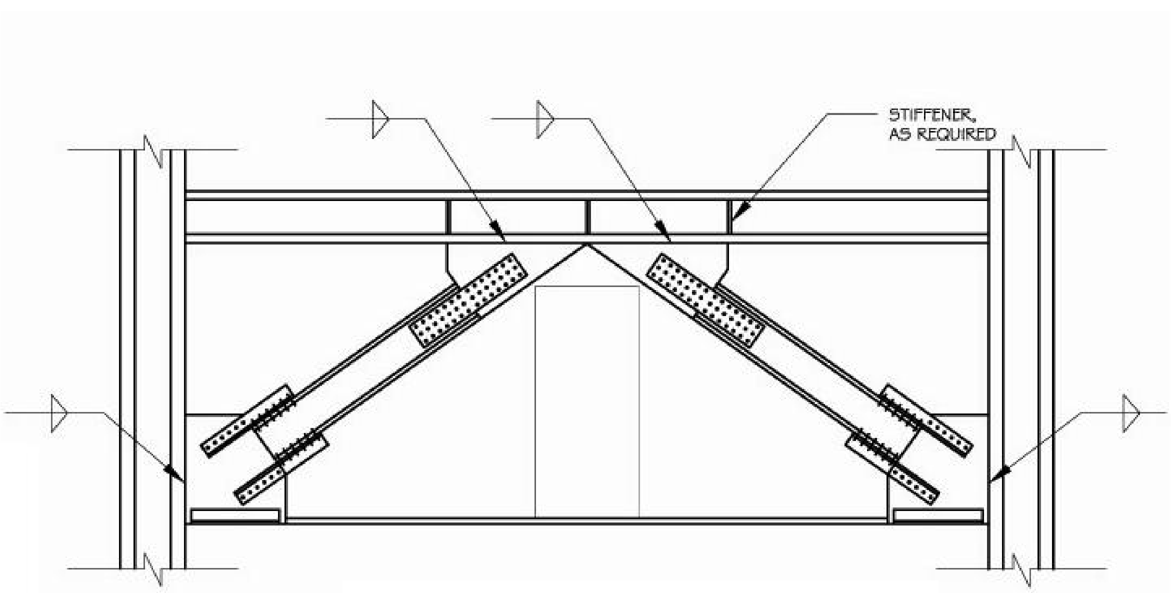


***Figure 42*: Typical Braced Frame Detail**

The design of the braced frame connection was conducted for 5 different axial loads; 1000kip, 800kip, 600kip, 400kip, and 200kip axial forces were considered. It was found that the brace to girder connection was controlled mainly by block shear of the brace W-Shape. Because block shear controls for a 1000kip axial load acting on the largest W14 brace used for the entire braced frame core, higher axial forces will require web reinforcement (such as a welded doubler plate) to accommodate block shear. The girders may also require stiffeners at the brace to girder connection to accommodate flange crippling due to concentrated point loads.

Based on load path analysis, the following limit states were considered for the braced frame connection:

- Brace Limit States
  - Tension Yielding
  - Tension Rupture
  - Block Shear
- Bolt Limit States
  - Bolt Shear
  - Bolt Bearing
    - Brace
    - Plate
    - Gusset Plate
  - Bolt Tearout
    - Brace
    - Plate
    - Gusset Plate
- Gusset Plate Limit states
  - Tension Yielding
  - Tension Rupture
  - Block Shear
  - Compression Buckling
- Weld Limit States
  - Base Metal
  - Weld Rupture

A summary of the connection design is shown below in Table 5 and Table 6 for brace to girder connections and brace to column connections, respectively. The detailed calculations can be found in Appendix E.

Factored Load	Number Rows of Bolts	Bolts Per Row	Plate Thickness, Each (in)	Brace to Gusset Plate Width, each (in)	Gusset Plate Thickness	Weld Size per 1/16"/Weld Length (in)
801kips to 1000kips	4	7	2.25	9	3	8/38
601kips to 800kips	3	7	2	9	2.5	8/30
401kips to 600kips	2	8	1.25	9	1.5	8/22
201kips to 400kips	2	6	0.75	9	1.5	5/24
Up to 200kips	2	5	0.5	9	0.5	5/12

Table 5: Summary of Brace to Girder Connections
Note: Plate Fy=36ksi, Bolt Diameter = ¾", Fillet Welds

Factored Load	Number Rows of Bolts per Angle	Number of Bolts per Row	Angle Size	Gusset Plate Thickness (inches)
801kips to 1000kips	1	5	L5x5x7/8	1.5
601kips to 800kips	1	4	L5x5x3/4	1.25
401kips to 600kips	1	3	L5x5x3/4	1
201kips to 400kips	1	4	L4x4x7/16	0.625
Up to 200kips	1	3	L3x3x5/16	0.5

Table 6: Summary of Brace to Column Connections
Note: Plate Fy=36ksi, Bolt Diameter = ¾"

Comparatively, the brace to column connection is much more efficient in terms of weight of material used. The limit states of block shear, tension rupture, and tension yielding is often alleviated by claw angles because the thicker flange of the W-Shape is utilized as resistance.

Base Plate Design and Mat Foundation Punching Shear Check

Using the most severe axial load and moment combination of the braced frame core, a base plate was designed to accommodate all of the columns of the braced frame core. As the bases were assumed to be fixed because of the rigidity provided by the mat foundation, the base plates had both a large moment and large axial force acting on them. The base plate was designed in accordance with the LRFD procedure of AISC Design Guide 1 – Base Plate and Anchor Rod Design. RAM Base Plate was utilized to verify the design. The specifications of the base plate are as follows:

Plate Thickness…………………………………..……………………………………………..10-1/2"
Plate Length……………………………………………………………………………………………65"
Plate Width……………………………………………………………………………………………….55"
Number of 2-3/4" A449 Grade 120 Anchor Bolts………………………………………………………..32

The overall specification would be an A36 PL 65x55x10.50 with (32) 2-3/4" A449 Grade 120 Anchor Bolts. This is an extremely large plate, comparable to the base plates used at the World Trade Center twin towers. Calculations and details are available upon request.

With a known base plate size, the punching shear of the mat foundation can be checked to verify that a thicker mat will not be required. For punching shear of a rectangular base plate with an aspect ratio of less than 1.5:1.0:

$$V_u \leq \phi V_C = 0.75 \times 4 \times \sqrt{f_c'} \times b_o \times d \qquad \textit{Equation 5}$$

With V_u equal to 15,910kips, it was found that a 110" thick mat would be required to resist punching shear. The mat foundation provided at the core is 9'0" ≈110", therefore it will be concluded that the current mat foundation will satisfy the demands of the braced frame core. Calculations are available upon request.

Tall Building Dynamics

Often, the design of the lateral force resisting systems is governed by serviceability requirements such as drift. However, satisfying drift alone does not guarantee adequate acceleration performance under wind loads, especially wind loads in hurricane prone regions along the Atlantic Ocean coastline. Because steel structural frames are extremely light compared to concrete frames, acceleration issues in the form of human perception are often an issue to consider in the preliminary design. However, the determination of such accelerations can only be truly obtained through wind tunnel studies.

Given the nature of this study, a wind tunnel test is out of the question. However, *Serviceability Limit States Under Wind Loading,* by Lawrence G. Griffis, provides an approximate calculation procedure which may be used in preliminary investigations to determine whether or not building accelerations may be an issue under 10 year recurrent wind forces. According to Griffis, the RMS building acceleration can be determined and compared to the following human response spectrum:

Table 5.
Traditional Motion Perception (Acceleration) Guidelines (Note 1)
10-year Mean Recurrence Interval

Occupancy Type	Peak Acceleration (Milli-g)	Root-mean-square (RMS) Acceleration (Milli-g)		
		$1 \le T < 4$ $0.25 < f \le 1.0$ $(g_p \approx 4.0)$	$4 \le T < 10$ $0.1 < f \le 0.25$ $(g_p \approx 3.75)$	$T \ge 10$ $f \le 0.1$ $(g_p \approx 3.5)$
Commercial	15–27 Target 21	3.75–6.75 Target 5.25	4.00–7.20 Target 5.60	4.29–7.71 Target 6.00
Residential	10–20 Target 15	2.50–5.00 Target 3.75	2.67–5.33 Target 4.00	2.86–5.71 Target 4.29

Notation:
T = period (seconds)
f = frequency (hertz)
g_p = peak factor

NOTE:
1. RMS and peak accelerations listed in this table are the traditional "unofficial" standard applied in U.S. practice based on the author's experience.

Figure 43: Motion Perception (Acceleration) Response Parameters

To determine the along-wind, across-wind, torsional, and resultant RMS accelerations of a steel structure, the following equations were used:

$$A_D(Z) = C_D(Z)\frac{U_H^{2.74}}{K_D^{0.37} \times \zeta^{0.5} \times M_D^{0.3}} \qquad \textit{Equation 6}$$

$$A_L(Z) = C_L(Z)\frac{U_H^{3.54}}{K_L^{0.77} \times \zeta^{0.5} \times M_L^{0.23}} \qquad \textit{Equation 7}$$

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{1.88}}{K_\theta^{-0.06}\times\zeta^{0.5}\times M_\theta^{1.06}}\frac{N_\theta B}{U_H} \leq 0.25$$ *Equation 8*

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{1.88}}{K_\theta^{-0.06}\times\zeta^{0.5}\times M_\theta^{1.06}},\frac{N_\theta B}{U_H} \leq 0.25$$ *Equation 9*

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{2.76}}{K_\theta^{0.38}\times\zeta^{0.5}\times M_\theta^{0.62}},\frac{N_\theta B}{U_H} > 0.25$$ *Equation 10*

$$C_D(Z) = 0.0116\times B^{0.26}\times Z$$ *Equation 11*

$$C_L(Z) = 0.0263\times B^{-0.54}\times Z$$ *Equation 12*

$$C_\theta(Z) = 0.00341\times B^{2.12}\times Z,\frac{N_\theta B}{U_H} \leq 0.25$$ *Equation 13*

$$C_\theta(Z) = 0.00510\times B^{1.24}\times Z,\frac{N_\theta B}{U_H} > 0.25$$ *Equation 14*

$$A_R = (A_D^2 + A_L^2 + (B/\sqrt{2}\times A_\theta)^2)^{0.5}$$ *Equation 15*

$$K = (2\pi N)^2 \times M$$ *Equation 16*

Where:

$A_D(Z)$, $A_L(Z)$, $A_\theta(Z)$ = along-wind, across-wind, and torsional RMS accelerations at height Z, respectively (meters/sec^2, radians/sec^2)
A_R = resultant RMS acceleration at the corner of the building
U_H = mean hourly 10 year wind speed at the top of the building (meters/sec)
H = building height (meters)
B = plan dimension of square building (meters)
M = generalized mass of the building (kilograms)
N = frequency (hertz) – obtained from ETABS modal analysis
K = generalized stiffness (Newton/meters) = $(2\pi N)^2 \times M$
ζ = damping ratio - taken as 2% as recommended by ASCE Committee on Tall Buildings

The building frequencies of the braced frame core were determined using ETABS modal analysis and are compared to the concrete shear wall core in the following figure:

Direction	Shear Wall Core		Braced Frame Core	
	Period	Frequency	Period	Frequency
X	3.13	0.32	3.78	0.26
Y	2.75	0.36	4.28	0.23
Rz	1.77	0.56	2.9	0.34

Figure 44: ETABS Modal Analysis – Shear Wall Core and Braced Frame Core

After completing the parametric study of RMS building accelerations, it was found that the resultant RMS acceleration of the steel braced frame core structure is approximately 9.4 milli-g's, which exceeds the target value of 4.8 milli-g's for a residential occupancy by a factor of almost 2. The resultant RMS acceleration of the concrete shear wall core and filigree flat plate system is approximately 4.4 milli-g's, which meets the target acceleration limit of 4.5 milli-g's. This indicates that the braced frame core may not perform adequately under wind loads at upper levels, as occupants may perceive movements caused by excessive accelerations. However, final conclusions can only be made based on a wind tunnel study. Calculations of the parametric RMS acceleration study can be found in Appendix F.

Structural Depth Conclusions

The results of the structural redesign conclude that a steel gravity and lateral structural system can be provided as a viable alternative to the cast-in-place concrete structural system of the Trump Taj Mahal Hotel based on strength and drift requirements. It was found that only a 10" increase in floor to floor height, resulting in approximately 30' additional overall, would be required in order to accommodate the steel framed system. Additional costs incurred will be discussed in both the architectural and construction management breadth studies.

An effective non-composite steel frame with a precast concrete plank floor system was designed to replace the filigree flat plate system. The layout of the steel and precast plank system was designed in such a way as to not interrupt the architectural and mechanical layout of a typical hotel room level. However, in order to conceal the steel framing, soffits will be required around the perimeter W-shape girders of the hotel rooms and also around the brace beams that run in between some of the guest rooms. This will have minor architectural implications that will be discussed later on in the architectural breadth study.

A core of braced frames was designed to replace the concrete shear wall core. These braced frames were laid out around the redesigned elevator/service core as to provide adequate space for openings. To accommodate these openings, it was found that a 10" increase in floor to floor height would be required. The braced frames met the strength requirements and recommended drift requirement of H/400. Built-up column sections were provided in lieu of composite W-shape columns encased in concrete due to constructability issues and ease of schedule (it is important to remember that scheduling and cost takes first priority in this study).

However, drift and strength are not the only determining factors of conceptual design of a high rise structural system. After performing a parametric study of the RMS accelerations of the tower under wind loading, it was found that the resultant acceleration of the building exceeds the allowable as determined based on occupant perception. The magnitude of the hurricane force wind velocities of Atlantic City, New Jersey, at a 10 year reoccurrence level produce building accelerations that may be considered annoying by building occupants on the upper levels of the tower. Supplementary damping devices in the form of tuned mass dampers or tuned liquid column dampers may be required to control the building response to wind loads. If required, a tuned mass damper will add substantial cost, in the realm of $2 to $3 million, to the cost of the building.

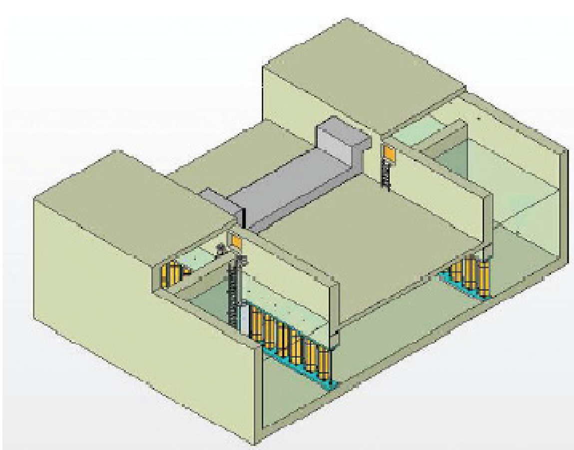


Figure 46: Tuned Liquid Column Damper Provided by Motioneering

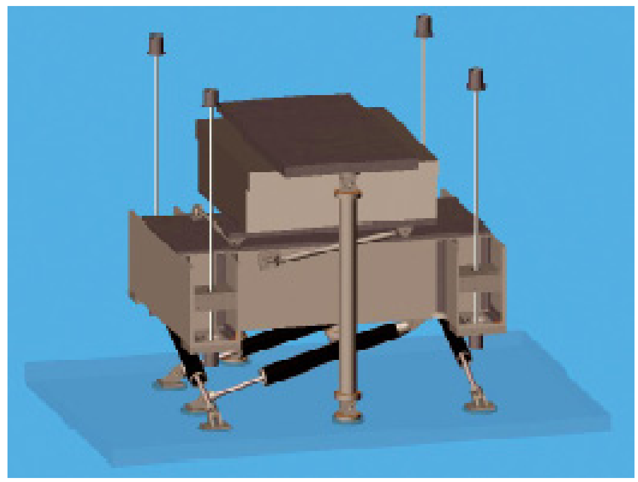


Figure 45: Tuned Mass Damper, Linked Provided by Motioneering

Without the use of a wind tunnel study to adequately determine the actual dynamic properties of the braced frame core and steel structural system, the information presented on the structural redesign indicates acceptable performance on the basis of strength and drift criteria. However, drift and strength are not the only factors of in the design of high-rise structures, as accelerations must be addressed to ensure that human comfort of the building is not an issue. When designing a slender high-rise structure, numerous factors that involve complex analysis of wind forces acting on the structure need to be performed in order to determine the correct structural system for the building type.

Architectural Breadth Study

Introduction

The redesign of a concrete structural system to a steel structural system presents the opportunity of analyzing numerous impacts on other building systems. An analysis on the impact of the architecture of the building was chosen to be studied. Four major design impacts will be discussed including the redesign of the elevator/service core at the center of the tower, the architectural impact of concealing the beams and girders of the steel frame, the architectural impacts on both the interior and exterior of the tower due to the 10" floor to floor height increase, and fireproofing requirements for steel members and partitions.

Elevator/Service Core Redesign

In order to obtain efficient braced frame geometry where inverted "V" bracing configurations could be utilized, openings in the core had to be relocated. Relocating the openings in the core was not an easy task, as the layout of the entire core would also need to be redesigned. It was found that by rotating the elevators 45 degrees a more flexible core layout could be obtained to accommodate the braced frame core. Spaces were then redesigned to accommodate all services and lobbies. Below are two figures that compare the existing core to the redesigned core for a typical hotel level. Revised floor plans for levels 3, 6 thru 22, and 25 thru 39 can be found in Appendix G.

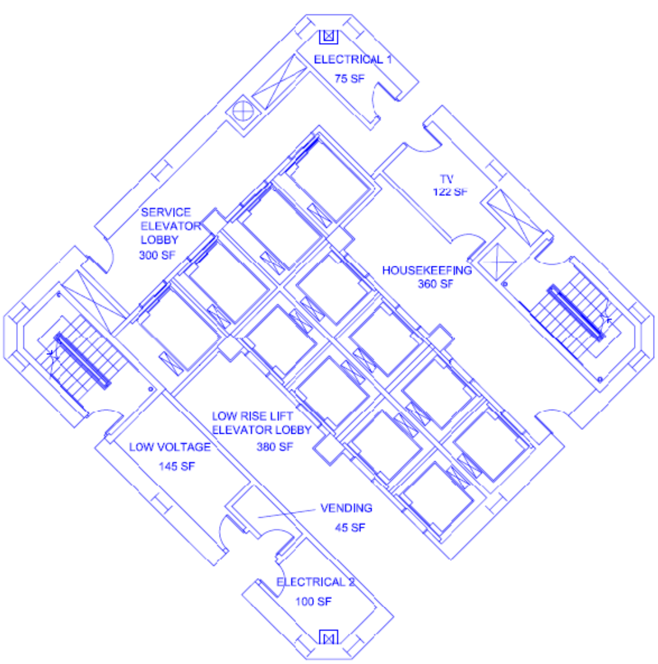


Figure 47: Redesigned Elevator/Elevator Core

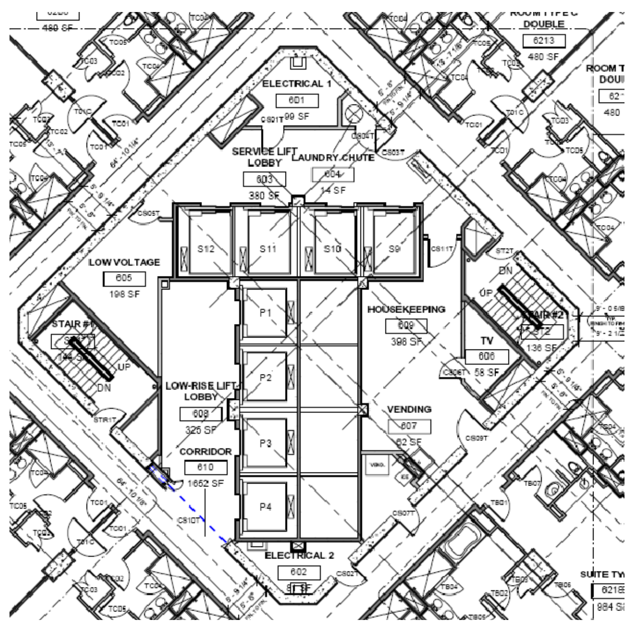


Figure 48: Existing Elevator/Service Core

Concealing the Steel Frame

Concealing the steel frame in such away to minimize the increase in floor to floor height required the steel girders and beams to be enclosed in gypsum panel soffits. These soffits will be visible throughout the guest rooms of the hotel tower and will hinder the visible area of the perimeter windows of all guest rooms. Figure 49 and Figure 50 are two renderings which directly compare the interior space of a typical guest room with the current filigree flat plate and steel frame with precast plank systems, respectively. Concealing the steel frame in the hallways also had an impact on the space. As shown with Figure 52, a gypsum board drop ceiling was utilized at the corners of the hallways to conceal the steel beams that frame into the core. This can be compared to the hallway rendering of the filigree flat plate floor system, shown in Figure 52.

Figure 49: Interior Rendering of a Typical Guest Room – Filigree Flat Plate Floor System

Figure 50: Interior Rendering of a Typical Guest Room – Steel Frame with Precast Plank Floor System

Figure 51: Interior Rendering of Hotel Hallway – Filigree Flat Plate Floor System

Figure 52: Interior Rendering of Hotel Hallway – Steel Frame with Precast Plank Floor System

Architectural Impacts on the Tower Façade

The façade of the Trump Taj Mahal Hotel tower is impacted by the structural system redesigned in three ways. First, the floor to floor height increase makes the curtain wall glass panels appear to be more vertical in nature as compared to the original elevation of the tower. Second, the steel spandrel beams that line the perimeter of the tower are required to be enclosed by a gypsum board soffit which may or may not be visible from the outside of the tower. Because the glass panels specified by the architect are fairly reflective, this should not be an issue. Finally, the spandrel curtain wall panels that conceal the slab of the floor system will be increase 2", as the slab of the filigree floor system was 10" versus the 12" slab thickness of the precast planks with topping slab. Figure 53 and Figure 54 compare the curtain wall façade prior to and after the structural redesign, respectively. The 10" floor to floor height increase is hardly noticeable and the reflective property of the curtain wall glass conceals the spandrel beam soffits.

Resulting from the 10" floor to floor height increase, the overall height of the tower is increased by approximately 30 feet. This adds substantial costs to some of the architectural elements of the tower, especially to the elevator and curtain wall system. These additional costs will be further discussed in more detail in the construction management breadth study.

Figure 53: Exterior of the Current Façade

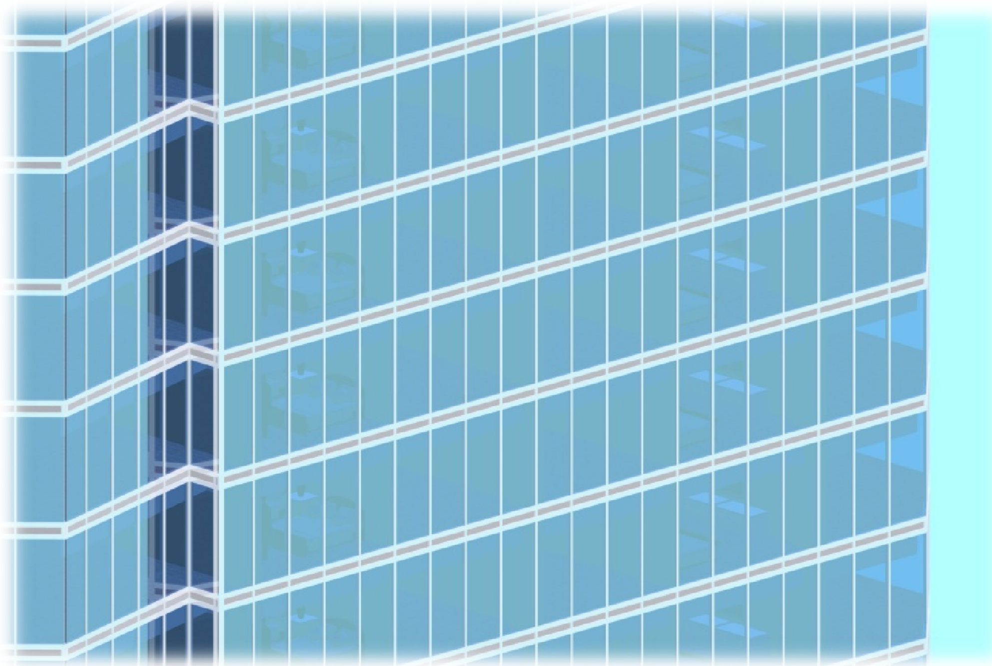


Figure 54: Exterior of the Façade Following to Structural Redesign

Steel Fireproofing and Fire Rated Partitions

Unlike its concrete counterpart, which has inherent fireproofing qualities, structural steel members of hotels and multi-family residential buildings are required to be provided with a 2 hour fire rated protection, as required by IBC 2003 for construction type 1A. As soffits were utilized to conceal the steel beams and columns, they will also be utilized as fireproofing where applicable.

The Underwriter's Laboratory ANSI/UL 263 Design No. N501 gypsum board assembly was chosen to provide the minimum required 2 hour fire protection of the steel beams, minimum size being a W8x24. The Underwriter's Laboratory ANSI/UL 263 Design No. X521 (for columns larger than W14x258) and Design No. X518 (for columns smaller than W14x258) gypsum board assemblies were chosen to provide the minimum required 2 hour fire protection of the steel columns**.** The additional costs incurred of the gypsum board soffits have been estimated using R.S. Means 2008 Cost Data; this data is shown in Table 7. Details and specifications of Design No. N501, X518, and X521are found in Appendix G.

Due to the absence of the concrete wall after structural redesign, a 2 hour minimum fire rated partition is required to conceal the elevator/service core. The partition can also serve as a thermal envelope for the steel braced frame core, providing a minimum of a 2 hour fire rated protection. Chose because it only requires a minimum 5" thickness, the Underwriter's Laboratory ANSI/UL 263 Design No. U411 was utilized as an alternative to the concrete wall. This partition must be provided on both sides of the braced frame core in order to complete the thermal envelope of the steel braced frame core. The additional costs incurred by takeoff of this partition have been estimated using R.S. Means 2008 Cost Data. Details and specifications of Design No. U411 are found in Appendix G.

Fire resistant drop ceilings shall be provided in the elevator/service core to provide a minimum 2 hour fire rated resistance. The Underwriter's Laboratory ANSI/UL 263 Design No. D502 gypsum board drop ceiling will be provided in the elevator/service core to conceal and fireproof the underlying steel structure. The additional costs incurred by takeoff of this drop ceiling have been estimated using R.S. Means 2008 Cost Data. Details and specifications of Design No. D502 are found in Appendix G.

Application	UL Assembly Designation	Cost/SF
Beam Soffit and Fireproofing – 2 hr Minimum	ANSI/UL 263 Design No. N501	$5.47
Column Fireproofing (up to W14x258) – 2hr Minimum	ANSI/UL 263 Design No. X518	$5.71
Column Fireproofing (larger than W14x258) – 2hr Minimum	ANSI/UL 263 Design No. X521	$5.71
Braced Frame Fireproof Envelope and Elevator/Service Core Fire Rated Partition - 2hr Minimum	ANSI/UL 263 Design No. U411	$5.16
Fire Resistant Drop Ceiling – 2hr Minimum	ANSI/UL 263 Design No. D502	$3.36

Table 7: Summary of Fire Rated Partition and Steel Fireproofing Assemblies

Architectural Breadth Study Conclusions

The structural redesign of the Trump Taj Mahal Hotel impacted the architectural aspects of the tower in several ways. The elevator/service core at the center of the tower required a redesign in order to provide enough flexibility to design an effective braced frame core. The architectural redesign of the core involved rotating the elevators 45 degrees, relocating openings through the core, and relocating rooms. The redesign of the core has only little impact on the functionality and can be considered a viable alteration to accommodate the structural redesign.

The filigree flat plate system is comprised only of a slab, where little or none of the structure was required to be concealed. The steel frame with precast plank floor system is much deeper than that of the filigree flat plate and requires that the steel beams and columns be concealed by gypsum panel soffits. Along the perimeter of the tower, the spandrel beams must be enclosed by a soffit. Also, the beams that run down the column lines in between 2 adjacent hotel rooms must be enclosed by soffits as well. These soffits are not too much of a concern; however they do have considerable drawbacks. The window area is blocked by the perimeter soffit and the soffit that encases the beams between the guest rooms protrudes into the space. Ultimately, the owner will have ball-in-court to decide the acceptability of these changes.

Additional costs that reflect on the overall building costs are incurred due to steel fireproofing requirements and the addition of fire rated partitions due to the loss of the concrete walls. These additional costs are substantial and must be evaluated in order to perform a cost comparison between the concrete and steel structural systems. Additional costs will be further discussed in more detail in the construction management breadth study.

Construction Management Breadth Study

There is a substantial difference between the construction sequence and management of a steel structure and concrete structure. Such differences include cost, scheduling, sequencing, and site conditions. Site conditions will be evaluated based on existing conditions and altercations that may be necessary in order to accommodate the construction of a steel and precast plank frame. Scheduling and cost of the proposed steel and precast plank redesign will be evaluated based on information obtained from various interviews conducted with construction management professionals and data obtained from construction references, such as R.S. Means 2008. The schedule and cost of the proposed redesign will be directly compared to the actual schedule and estimate to the concrete frame. Constructability issues will be compared between both systems and conclusions will be made.

Site Conditions

Existing Site Conditions

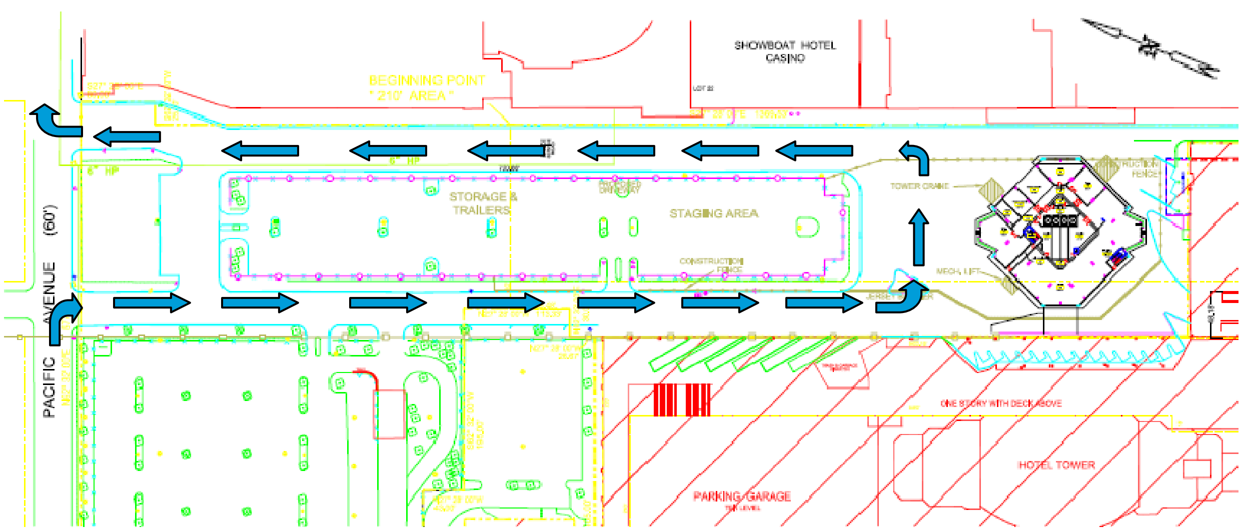


Figure 55: Existing Site Conditions and Delivery Flow

The site of the new Trump Taj Mahal Hotel is located on the 1000 block of the boardwalk Atlantic City, New Jersey, in between the existing Trump Taj Mahal Hotel and Casino and the Harrah's Showboat Hotel and Casino. The site was used as a parking lot prior to construction of the new Trump Taj Mahal Hotel.

The site is relatively unconfined, with ample space for storage and staging of construction materials. The site is easily accessible from Pacific Avenue, as delivery trucks can easily cycle through the site. One tower crane is located on the north side of the tower, as this is the closest side to the staging area. The longest lifting radius for the project is 180 feet; the swinging radius is impaired by the Showboat Hotel and Casino to the north. The tower crane must be tied to the building frame to erect the upper levels of the tower, as its maximum height will be greater than 250 feet. A mechanical lift is located on the west side of the tower and is utilized for material delivery and as temporary vertical transportation until the elevators are operational.

Proposed Site Conditions

Although a steel structural system often requires much more staging and storage space compared to a concrete system, the 25,000 square foot staging area should provide ample storage space to accommodate the steel frame erection. The delivery route will not need to be addressed, as the same storage area will be utilized. However, the tower crane needs to be investigated because heavy steel built-up column sections and pre-cast concrete planks will need to be erected.

Up to this point, column splicing was to occur at every 4 levels. However, an investigation of the tower crane's lifting capacity limits the column splicing of all built-up sections of the braced frame core to 2 levels, or a maximum member length of 24'-0", 30'-0", and 35'-0" for built-up section 3, 2, and 1 respectively. It is important to note that the lifting radius for these members is taken as 120' (36.6meters). As a result of these findings, built-up sections 3 and 2 will be spliced every 2 levels and built-up section 1 will be spliced every 3 levels. Tower crane specifications for Terex Comedil CTL 630 can be found in Appendix H.

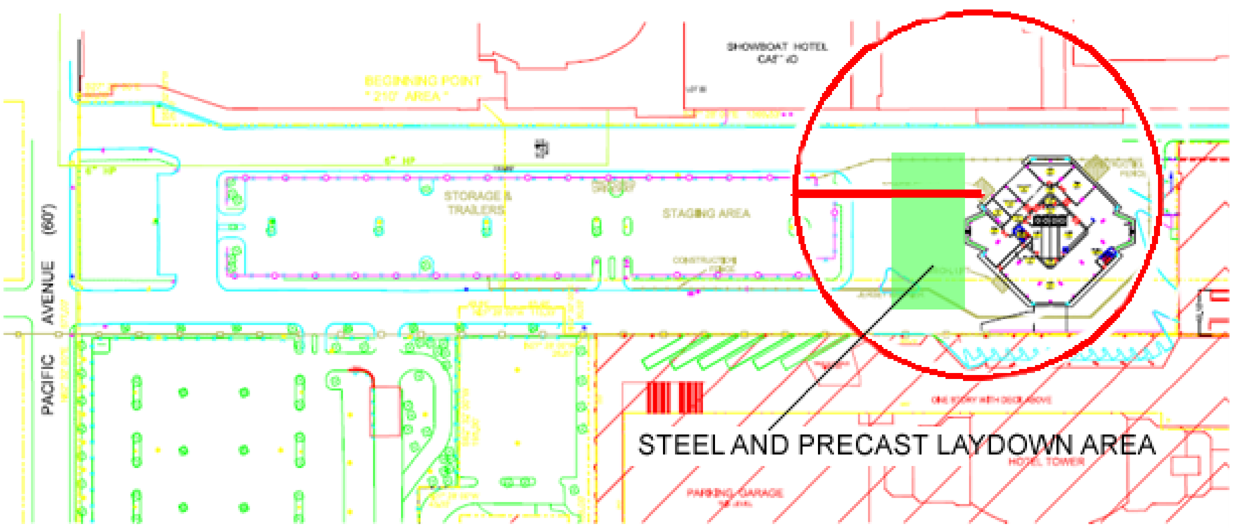


Figure 56: Steel and Precast Plank Lay Down Area with Tower Crane Radius

Schedule Analysis

Existing Schedule

According to the schedule provided by Bovis Lend Lease, the erection of the superstructure started in October of 2006 and was completed in January 2008. This equates to a total erection time of 64 weeks and an 8 day cycle per typical floor. Design and detailing of the concrete (foundation and superstructure) and excavation with on-site deep utilities started in April 2006. The lead time required for the structural concrete was 3 months, or 13 weeks. Foundations started in July of 2006 with completion in October 2006. A summary of the schedule is shown below in Figure 57.

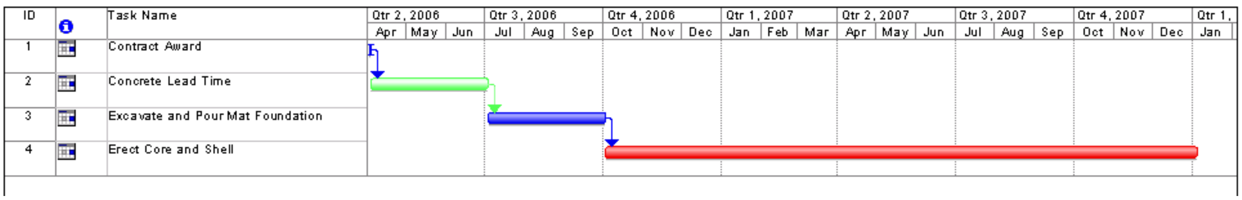


Figure 57: Summary of Concrete Shear Wall and Filigree Floor System Schedule

Proposed Schedule

The scope of this project merited interviews of various construction professionals in order to obtain viable data to estimate the schedule of the redesigned steel structural system. The following data was used to determine the schedule of the steel structural system:

Structural Steel and Precast Plank Lead Time……………………………………………8 months
Steel Erection………………………………………………………….…………..…40 Pieces per day
Precast Concrete Planks………………………………………………………….…..3600 SF per day
Tower Crane Jumps…………………………………………………..……….…….3 Add'l weeks
Plumbing and Bolting of Steel……………………………………………………..……3 Add'l weeks

The structural steel requires much more lead time (8 months) compared to that of concrete (3 months). The lead time pushes the start of the mat foundation to September 2006 and the completion to December 2006. This means that the steel erection will not commence until December 2006.

The erection of the steel will start in December 2006 and complete in December 2007. This equates to a total erection time of 52 weeks and a 6 ½ day cycle time per typical floor. A summary of the structural steel schedule can be seen below in Figure 58.

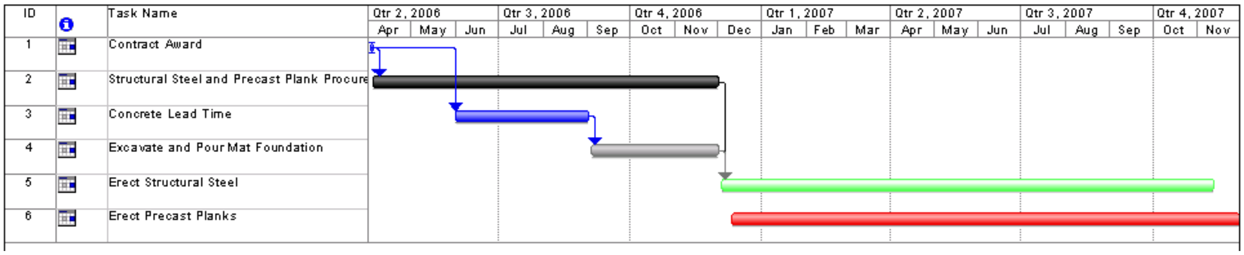


Figure 58: Summary of Steel Shear Wall Core and Precast Plank Floor System Schedule

Cost Analysis

Concrete and Filigree Structural System Cost

The structural cost breakdown, as obtained from Bovis Lend Lease, of the concrete and filigree structural system is as follows:

Foundations Cost…………………………………………………………………...$3.3 mil
Superstructure Cost………………………………………………………………..$41.5 mil
Misc. Structural Steel…………………………………………………………….. $3.5 mil
Metal Stairs…………………………………………………………………………$1.4 mil

TOTAL………...………………………………………………………………….**$49.7mil**

Steel Structural System Cost with Additional Cost

By interviewing various construction professionals and also utilizing R.S. Means 2008, the following data was compiled for use in determining the cost estimate of the steel structural system (15% overhead and profit is included):

Structural Steel………………………………..……………………………………$3,800.00/ton

Beam Connection Allowance………………………………………..7.00%
Column Splice Allowance…………………………………….....10.00%
Brace Connection Allowance…………………………...….…….20.00%

10" Precast Concrete Planks……………………..………………………………….$15.00/SF
3000 psi 2 inch Topping Slab………………………………………...………………..$3.75/SF
Shear Studs……………………………………………………………………...……$5.75/EA

A 10% premium was added to the cost of built-up column sections and atypical precast concrete planks.

By speaking with the lead estimator on the Trump Taj Mahal Hotel project, John Adams of Bovis Lend Lease, the following data was compiled for use in determining the additional cost of the structural steel system (15% overhead and profit is included):

Sotawall Hybrid Curtain Wall……..…………………………………………………..$85.00/SF
Otis Elevator……………………………………………………………………...$260,000.00
Mechanical Piping………………………………………………………………..$500,000.00
Sanitary System…………………………………………………………………..$250,000.00
Domestic Water…………………………………………………………………..$250,000.00
Bathroom Exhaust………………………………………………………………..$250,000.00
Busduct……………………………………………………………………….…$50,000.00

Additional costs of beam and column soffits, fireproofing, and fire-rated partitions reflect those costs recorded in Table 7 of the architectural breadth studies. Again, these costs were obtained using R.S. Means 2008.

A summary of the costs of the steel and precast plank structural system is as follows:

Foundations Cost…………………………………………………………………...$3.3 mil
Superstructure Cost…………………………………………………………....…..$34.1 mil
Additional Cost……………………………………………………………………..$5.9 mil
Misc. Structural Steel………………………………………………………….... $3.5 mil
Metal Stairs……………………………………………………………………………$1.4 mil

TOTAL………...…………………………………………………………………….$**48.2mil**

All detailed cost calculations including takeoff can be found in Appendix H.

Construction Management Studies Conclusions

The following table compares both the cost (including additional costs) and schedule of the steel and concrete structural systems:

	Steel and Precast Plank System	Concrete/Filigree System
Total Structural Schedule (Weeks)	**88**	**92**
Superstructure Schedule (Weeks)	52	65
Cycle Time per Typical Floor	6 ½ days	8 days
Cost of Construction (Total)	**$48.2million**	**$49.7million**
Cost of Construction/SF	$65.50/SF	$67.50/SF

Table 8: Cost and Schedule Comparison

As it can be seen by Table 8, the cost and schedule of both systems is very similar. The steel structural system is $1.5 million lower than the concrete/filigree system. The steel structural system will also top out 4 weeks earlier than the concrete/filigree system; requiring approximately 13 less weeks for superstructure erection (cost savings are also reflected by this). However, this does not include any additional cost and schedule time reflected by the requirement of a tuned mass damper. The impact of such additional items was also not taken into consideration in the total schedule. This will be discussed further in the final conclusions and recommendations part of this report.

Structural steel and precast concrete systems require much more area for staging and storage, however the 25,000 square feet of provided space on-site should suffice. A tower crane will able to lift the large built-up steel column sections without the use of a supplemental mobile crane. Steel columns of precast plank systems are fabricated in larger lengths (more than 40 feet lengths) and are erected prior to the planks. This means that the tower crane operator will have to be careful to avoid hitting an erected steel column with a precast concrete plank. A tower crane with a luffing boom will help alleviate this issue.

On-site quality control of a cast-in-place concrete system is always a concern of the structural engineer of record and the construction manager. For this particular project, The Harman Group has provided an on-site field inspector. As precast planks are fabricated in a controlled environment, a higher quality product is obtained. This may eliminate the need for the on-site presence of a field inspector.

Final Conclusions and Recommendations

Limiting the drift of a tall building does not guarantee satisfactory motion perception performance due the accelerations caused by wind. The high wind velocities of the Atlantic Ocean shore line cause high along-wind, across-wind, and torsional accelerations on the upper levels of the Trump Taj Mahal Hotel. These accelerations are much higher on the lighter and more flexible steel braced frame core as compared to the rigid and heavy concrete shear wall core.

Because of its behavior to the high velocity wind of Atlantic City, the steel braced frame core designed in this study may require supplementary mass and damping in the form of a liquid-tuned column damper or a tuned mass damper. These devices can add substantial costs to the project; in the realm of $2 to $3 million. However, only parametric RMS acceleration calculations were performed in this study to determine the dynamic response of the steel braced frame core. In order to absolutely verify that a tuned mass damper will be required, complex wind tunnel studies must be performed.

Other costs are incurred when converting a concrete system to a steel system. Because of the 10 inch floor to floor height increase, additional costs were incurred due to increased runs of elevators, MEP equipment, and curtain wall glass and framing; as well as steel fireproofing and the addition of fire-rated partitions. The wind tunnel loads used in this report were determined for a tower that was 30 feet lower than the redesigned steel tower. This will impact the wind loads in such a way as to increase the magnitude, and thus, the strength and drift requirements. This could result in a more costly braced frame core. However for the purposes of this study, the increase was neglected (the height increase is only 6%).

The overall cost of the redesigned steel structure is in the realm of $1 to $2 million more than the concrete shear wall and filigree system if a tuned mass damper is required. Even if the steel structural frame and precast floor is completed approximately 1 month prior to the concrete frame, the additional time required to install the tuned mass damper and all required additional architectural and MEP components (curtain wall, partitions, fireproofing, soffits, etc.) will negate some of the time saved during erection. This indicates that the redesigned steel structure may top out at approximately the same time as the concrete system and may cost more overall as well.

The final conclusion and recommendation is to keep the existing concrete shear wall core and filigree flat plate system. A braced frame core was found to limit the drift of the building within an acceptable range; however the dynamic behavior may prove to cause building occupants to experience motion perception in the form of accelerations. The filigree flat plate system accommodates the architecture of a hotel tower without any negative ramifications. It is concluded that a project of this size requires years of professional design experience to fully understand the behavior and design considerations. However, results of this study do shed light on advanced high-rise design topics which can be used for further study.

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Appendix A

Load Calculations

Project Trump Taj Mahal
Engineer Stephen Reichwein
Date 4/8/2008

Seismic Loads Per ASCE 7-05 Equivalent Lateral Force Procedure

Input	
Occupancy Category	I
Importance Factor	1.00
Soil Site Class	D
Seismic Design Category	B
F_a	1.600
F_v	2.400
S_s	0.191
S_1	0.061
S_{DS}	0.204
S_{D1}	0.0976
R	3.3
Ω	2.5
C_d	3.3
T_s	0.319
h_n	434.830
x	0.750
C_t	0.020
T_a	1.904
T_L	6.0
Cu	1.7
T (ETABS)	4.3
Ta x Cu	3.2
C_s	0.0100
k	2.0
Base Shear (V_b)	**718.5** kips

Use Minimum

$T_a = C_t \times h_n^x$

$T \le T_L$ min
$C_s = S_{D1} / (T (R / I))$ 0.0093
$C_s = S_{DS} / (R / I)$ 0.0628

$T > T_L$ min
$C_s = S_{D1} \times T_L / (T^2 (R / I))$
$C_s = S_{DS} / (R / I)$

$C_{smin} = .01$

Max Deflection 0.020 x hsx

Level	Weight of Level (kips)	Elevation Height (feet)	$w_x h_x^k$	$(w_x h_x^k / \sum w_x h_x^k) x V_b$ Shear Per Floor (kips)	Overturning Moment
Sign	500	496.00	123008000	17.00	8430.67
Roof	1400	460.00	296240000	40.93	18829.93
40	2100	437.58	402105652	55.56	24313.51
39	1750	422.58	312508685.8	43.18	18248.25
38	1750	412.17	297292862.8	41.08	16931.86
37	1750	401.75	282455359.4	39.03	15680.24
36	1750	391.33	267997654.6	37.03	14491.87
35	1750	380.92	253921081.6	35.09	13365.22
34	1750	370.50	240222937.5	33.19	12298.43
33	1750	360.08	226904592.1	31.35	11289.97
32	1750	349.67	213967269.1	29.57	10338.30
31	1750	339.25	201408484.4	27.83	9441.58
30	1750	328.83	189229498.3	26.15	8598.27
29	1750	318.42	177431425.3	24.52	7806.81
28	1750	308.00	166012000	22.94	7065.41
27	1750	297.58	154972373.3	21.41	6372.49
26	1750	287.17	144313550.3	19.94	5726.49
25	1750	276.75	134033484.4	18.52	5125.64
24	1750	266.33	124133217.1	17.15	4568.36
23	1750	255.92	114613644.1	15.84	4053.06
22	1750	245.50	105472937.5	14.57	3577.99
21	1750	235.08	96712029.56	13.36	3141.58
20	1750	224.67	88331706.56	12.21	2742.22
19	1750	214.25	80330359.38	11.10	2378.20
18	1750	203.83	72708810.81	10.05	2047.90
17	1750	193.42	65467737.81	9.05	1749.72
16	1750	183.00	58605750	8.10	1481.97
15	1750	172.58	52123560.81	7.20	1243.02
14	1750	162.17	46021737.81	6.36	1031.27
13	1750	151.75	40299109.38	5.57	845.03
12	1750	141.33	34956279.56	4.83	682.68
11	1750	130.92	29993706.56	4.14	542.59
10	1750	120.50	25410437.5	3.51	423.10
9	1750	110.08	21206967.06	2.93	322.59
8	1750	99.67	17383644.06	2.40	239.41
7	1750	89.25	13939734.38	1.93	171.91
6	1750	78.83	10875623.31	1.50	118.47
5	1750	68.42	8191550.306	1.13	77.44
4	2000	58.00	6728000	0.93	53.92
3	2400	26.00	1622400	0.22	5.83
2	2200	16.00	563200	0.08	1.25
∑	**71850**		**5199717054**	**718.5**	**245854.47**

Project Trump Taj Mahal - AE 481W
Engineer Stephen Reichwein
Date 4/8/2008

Wind Pressure Per ASCE 7-05 **MWFRS Procedure 2**

Basic Wind Speed	114.00	mph
Importantance Factor	1.00	
Occupancy Category	II	
Exposure Category	C	
Directionality Factor (K_d)	0.85	
Gust Factor (G) N/S	1.01	
Gust Factor (G) E/W	1.05	
$C_{p,windward}$	0.80	
$C_{p,leeward}$	0.50	
K_{zt}	1.00	
z_g	900	ft
α	9.5	
Base Shear N/S	3725	kips
Base Shear E/W	3865	kips

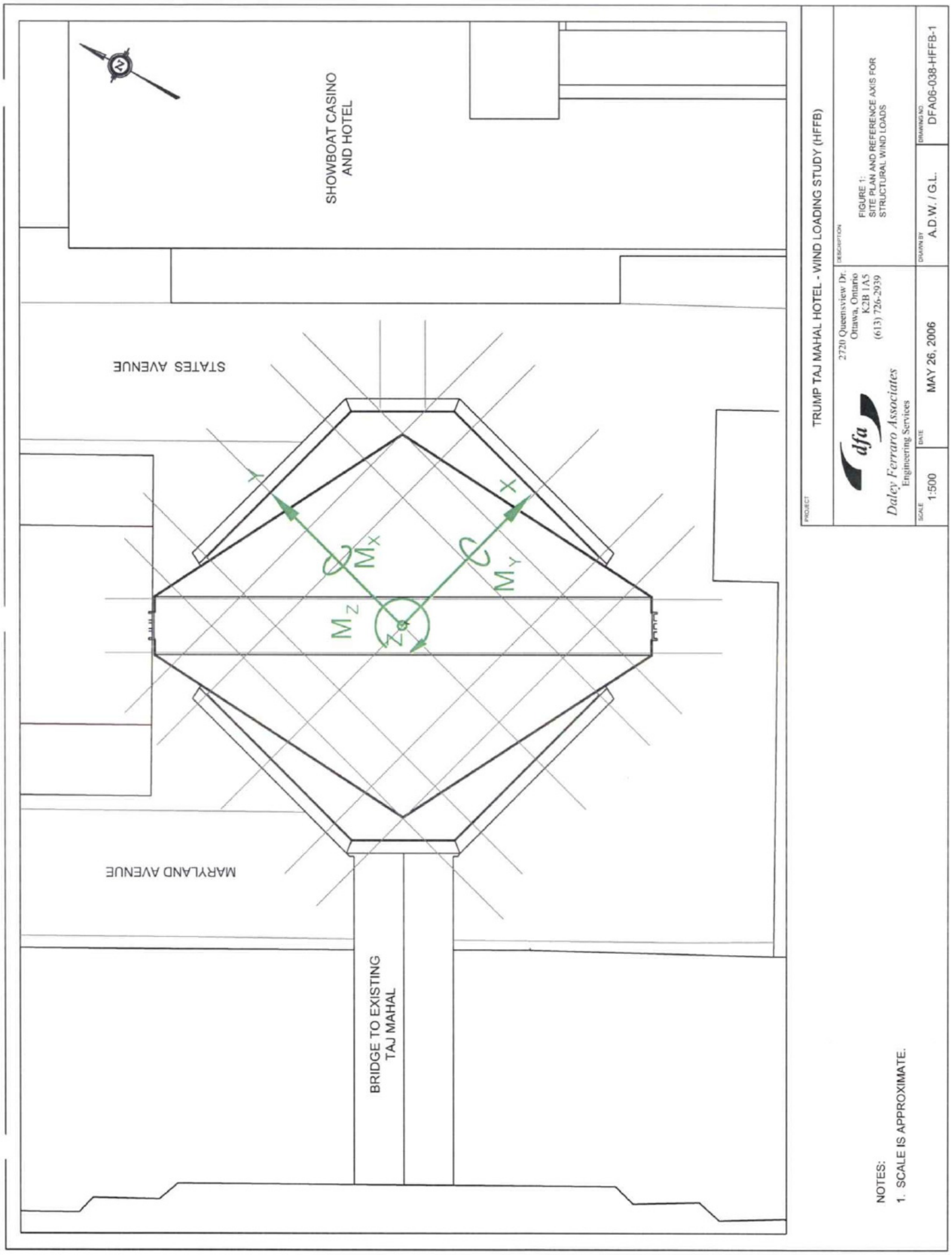
$K_z = 2.01(z/z_g)^{2/\alpha}$

$P = 0.00256 \times K_d \times G \times V^2 \times I \times (K_z C_{p,w} + K_h C_{p,l})$

Level	Height (ft)	K_z	K_h	Windward Pressure	Leeward Pressure	Tributary Height	Perimeter N/S (ft)	Perimeter E/W (ft)	Floor Load N/S (kips)	Floor Load E/W (kips)	Ovt Mom N/S	Ovt Mom E/W
1	0.00	0.00	1.75	0	25	0.00	141.25	141.25				
2	16.00	0.86	1.75	20	25	21.00	141.25	141.25	133	138	2121.26	2201.07
3	26.00	0.95	1.75	22	25	21.00	141.25	141.25	139	144	5731.50	5947.14
4	58.00	1.13	1.75	26	25	21.21	141.25	141.25	152	158	14561.39	15109.25
5	68.42	1.17	1.75	27	25	10.42	141.25	141.25	76	79	19768.92	20512.70
6	78.83	1.20	1.75	28	25	10.42	141.25	141.25	77	80	25863.04	26836.11
7	89.25	1.24	1.75	28	25	10.42	141.25	141.25	78	81	32858.39	34094.65
8	99.67	1.26	1.75	29	25	10.42	141.25	141.25	79	82	40767.20	42301.02
9	110.08	1.29	1.75	30	25	10.42	141.25	141.25	80	83	49601.52	51467.72
10	120.50	1.32	1.75	30	25	10.42	141.25	141.25	81	84	59372.84	61606.67
11	130.92	1.34	1.75	31	25	10.42	141.25	141.25	82	85	70090.37	72727.43
12	141.33	1.36	1.75	31	25	10.42	141.25	141.25	83	86	81764.02	84840.29
13	151.75	1.38	1.75	32	25	10.42	141.25	141.25	83	86	94403.44	97955.25
14	162.17	1.40	1.75	32	25	10.42	141.25	141.25	84	87	108015.89	112079.85
15	172.58	1.42	1.75	32	25	10.42	141.25	141.25	85	88	122609.92	127222.97
16	183.00	1.44	1.75	33	25	10.42	141.25	141.25	85	88	138194.02	143393.40
17	193.42	1.45	1.75	33	25	10.42	141.25	141.25	86	89	154774.01	160597.19
18	203.83	1.47	1.75	34	25	10.42	141.25	141.25	86	90	172357.52	178842.26
19	214.25	1.49	1.75	34	25	10.42	141.25	141.25	87	90	190952.25	198136.59
20	224.67	1.50	1.75	34	25	10.42	141.25	141.25	87	91	210562.87	218485.04
21	235.08	1.52	1.75	35	25	10.42	141.25	141.25	88	91	231196.38	239894.86
22	245.50	1.53	1.75	35	25	10.42	141.25	141.25	88	92	252859.92	262373.46
23	255.92	1.54	1.75	35	25	10.42	141.25	141.25	89	92	275557.19	285924.69
24	266.33	1.56	1.75	36	25	10.42	141.25	141.25	89	92	299294.75	310555.35
25	276.75	1.57	1.75	36	25	10.42	141.25	141.25	90	93	324079.31	336272.39
26	287.17	1.58	1.75	36	25	10.42	141.25	141.25	90	93	349913.76	363078.83
27	297.58	1.59	1.75	36	25	10.42	141.25	141.25	90	94	376804.30	390981.10
28	308.00	1.60	1.75	37	25	10.42	141.25	141.25	91	94	404757.36	419985.85
29	318.42	1.62	1.75	37	25	10.42	141.25	141.25	91	95	433775.09	450095.34
30	328.83	1.63	1.75	37	25	10.42	141.25	141.25	92	95	463863.45	481315.74
31	339.25	1.64	1.75	37	25	10.42	141.25	141.25	92	95	495028.64	513653.48
32	349.67	1.65	1.75	38	25	10.42	141.25	141.25	92	96	527272.14	547110.10
33	360.08	1.66	1.75	38	25	10.42	141.25	141.25	93	96	560599.74	581691.61
34	370.50	1.67	1.75	38	25	10.42	141.25	141.25	93	96	595017.46	617404.25
35	380.92	1.68	1.75	38	25	10.42	141.25	141.25	93	97	630526.19	654248.95
36	391.33	1.69	1.75	39	25	10.42	141.25	141.25	94	97	667131.56	692231.56
37	401.75	1.70	1.75	39	25	10.42	141.25	141.25	94	97	704839.51	731358.23
38	412.17	1.71	1.75	39	25	10.42	141.25	141.25	94	98	743650.33	771629.26
39	422.58	1.71	1.75	39	25	12.71	141.25	141.25	115	120	792351.32	822162.56
40	437.58	1.73	1.75	39	25	18.71	116.25	116.25	140	146	853727.65	885848.09
Roof	460.00	1.75	1.75	40	25	11.21	116.25	116.25	85	88	892632.82	926217.02
								Σ	3725	3865		

Table 4: Load Combinations In Orthogonal Directions

Load Case	Y-Axis (%)	X-Axis (%)	Z-Axis (%)
1	+100	+50	+50
2	+100	+50	-50
3	+100	-50	+50
4	+100	-50	-50
5	-100	+50	+50
6	-100	+50	-50
7	-100	-50	-50
8	-100	-50	-50
9	+65	+100	+60
10	+65	+100	-60
11	-65	+100	+60
12	-65	+100	-60
13	+65	-100	+60
14	+65	-100	-60
15	-65	-100	+60
16	-65	-100	-60
17	+65	+50	+60
18	+65	-50	+60
19	-65	+50	-60
20	-65	-50	-60


SHOWBOAT CASINO AND HOTEL
STATES AVENUE
MARYLAND AVENUE
BRIDGE TO EXISTING TAJ MAHAL
NOTES:
1. SCALE IS APPROXIMATE.
TRUMP TAJ MAHAL HOTEL - WIND LOADING STUDY (HFFB)
Daley Ferraro Associates
Engineering Services
2720 Queensview Dr.
Ottawa, Ontario
K2B 1A5
(613) 726-2939
FIGURE 1:
SITE PLAN AND REFERENCE AXIS FOR STRUCTURAL WIND LOADS
1:500
MAY 26, 2006
A.D.W. / G.L.
DFA06-038-HFFB-1

Level	Height	Load Case 1			Load Case 2			Load Case 3		
		Fx	Fy	Mz	Fx	Fy	Mz	Fx	Fy	Mz
Roof	460.00	139.00	95.70	10260.00	139.00	95.70	-10260.00	139.00	-95.70	10260.00
40	437.58	169.30	116.65	15960.00	169.30	116.65	-15960.00	169.30	-116.65	15960.00
39	422.58	103.20	71.05	9960.00	103.20	71.05	-9960.00	103.20	-71.05	9960.00
38	412.17	96.30	66.35	9480.00	96.30	66.35	-9480.00	96.30	-66.35	9480.00
37	401.75	100.20	69.00	10020.00	100.20	69.00	-10020.00	100.20	-69.00	10020.00
36	391.33	97.60	67.25	9780.00	97.60	67.25	-9780.00	97.60	-67.25	9780.00
35	380.92	95.10	65.50	9540.00	95.10	65.50	-9540.00	95.10	-65.50	9540.00
34	370.50	92.50	63.75	9240.00	92.50	63.75	-9240.00	92.50	-63.75	9240.00
33	360.08	90.00	62.00	9000.00	90.00	62.00	-9000.00	90.00	-62.00	9000.00
32	349.67	87.40	60.25	8760.00	87.40	60.25	-8760.00	87.40	-60.25	8760.00
31	339.25	84.90	58.45	8520.00	84.90	58.45	-8520.00	84.90	-58.45	8520.00
30	328.83	82.30	56.70	8220.00	82.30	56.70	-8220.00	82.30	-56.70	8220.00
29	318.42	79.90	55.05	7980.00	79.90	55.05	-7980.00	79.90	-55.05	7980.00
28	308.00	77.40	53.30	7740.00	77.40	53.30	-7740.00	77.40	-53.30	7740.00
27	297.58	74.80	51.55	7500.00	74.80	51.55	-7500.00	74.80	-51.55	7500.00
26	287.17	72.30	49.80	7260.00	72.30	49.80	-7260.00	72.30	-49.80	7260.00
25	276.75	69.70	48.00	6960.00	69.70	48.00	-6960.00	69.70	-48.00	6960.00
24	266.33	65.80	45.30	6720.00	65.80	45.30	-6720.00	65.80	-45.30	6720.00
23	255.92	63.30	43.60	6480.00	63.30	43.60	-6480.00	63.30	-43.60	6480.00
22	245.50	60.80	41.85	6180.00	60.80	41.85	-6180.00	60.80	-41.85	6180.00
21	235.08	58.30	40.15	5940.00	58.30	40.15	-5940.00	58.30	-40.15	5940.00
20	224.67	55.80	38.45	5700.00	55.80	38.45	-5700.00	55.80	-38.45	5700.00
19	214.25	53.30	36.70	5460.00	53.30	36.70	-5460.00	53.30	-36.70	5460.00
18	203.83	50.90	35.05	5220.00	50.90	35.05	-5220.00	50.90	-35.05	5220.00
17	193.42	48.40	33.35	4920.00	48.40	33.35	-4920.00	48.40	-33.35	4920.00
16	183.00	45.90	31.65	4680.00	45.90	31.65	-4680.00	45.90	-31.65	4680.00
15	172.58	43.40	29.90	4440.00	43.40	29.90	-4440.00	43.40	-29.90	4440.00
14	162.17	40.90	28.20	4200.00	40.90	28.20	-4200.00	40.90	-28.20	4200.00
13	151.75	38.40	26.50	3900.00	38.40	26.50	-3900.00	38.40	-26.50	3900.00
12	141.33	35.90	24.75	3660.00	35.90	24.75	-3660.00	35.90	-24.75	3660.00
11	130.92	33.40	23.05	3420.00	33.40	23.05	-3420.00	33.40	-23.05	3420.00
10	120.50	31.00	21.30	3180.00	31.00	21.30	-3180.00	31.00	-21.30	3180.00
9	110.08	28.50	19.60	2880.00	28.50	19.60	-2880.00	28.50	-19.60	2880.00
8	99.67	26.00	17.90	2640.00	26.00	17.90	-2640.00	26.00	-17.90	2640.00
7	89.25	23.60	16.25	2400.00	23.60	16.25	-2400.00	23.60	-16.25	2400.00
6	78.83	21.10	14.55	2160.00	21.10	14.55	-2160.00	21.10	-14.55	2160.00
5	68.42	18.60	12.80	1920.00	18.60	12.80	-1920.00	18.60	-12.80	1920.00
4	58.00	29.80	20.55	2340.00	29.80	20.55	-2340.00	29.80	-20.55	2340.00
3	26.00	9.20	6.30	900.00	9.20	6.30	-900.00	9.20	-6.30	900.00
2	16.00	6.40	4.40	600.00	6.40	4.40	-600.00	6.40	-4.40	600.00

Level	Height	Load Case 4			Load Case 5			Load Case 6		
		Fx	Fy	Mz	Fx	Fy	Mz	Fx	Fy	Mz
Roof	460.00	139.00	-95.70	-10260.00	-139.00	95.70	10260.00	-139.00	95.70	-10260.00
40	437.58	169.30	-116.65	-15960.00	-169.30	116.65	15960.00	-169.30	116.65	-15960.00
39	422.58	103.20	-71.05	-9960.00	-103.20	71.05	9960.00	-103.20	71.05	-9960.00
38	412.17	96.30	-66.35	-9480.00	-96.30	66.35	9480.00	-96.30	66.35	-9480.00
37	401.75	100.20	-69.00	-10020.00	-100.20	69.00	10020.00	-100.20	69.00	-10020.00
36	391.33	97.60	-67.25	-9780.00	-97.60	67.25	9780.00	-97.60	67.25	-9780.00
35	380.92	95.10	-65.50	-9540.00	-95.10	65.50	9540.00	-95.10	65.50	-9540.00
34	370.50	92.50	-63.75	-9240.00	-92.50	63.75	9240.00	-92.50	63.75	-9240.00
33	360.08	90.00	-62.00	-9000.00	-90.00	62.00	9000.00	-90.00	62.00	-9000.00
32	349.67	87.40	-60.25	-8760.00	-87.40	60.25	8760.00	-87.40	60.25	-8760.00
31	339.25	84.90	-58.45	-8520.00	-84.90	58.45	8520.00	-84.90	58.45	-8520.00
30	328.83	82.30	-56.70	-8220.00	-82.30	56.70	8220.00	-82.30	56.70	-8220.00
29	318.42	79.90	-55.05	-7980.00	-79.90	55.05	7980.00	-79.90	55.05	-7980.00
28	308.00	77.40	-53.30	-7740.00	-77.40	53.30	7740.00	-77.40	53.30	-7740.00
27	297.58	74.80	-51.55	-7500.00	-74.80	51.55	7500.00	-74.80	51.55	-7500.00
26	287.17	72.30	-49.80	-7260.00	-72.30	49.80	7260.00	-72.30	49.80	-7260.00
25	276.75	69.70	-48.00	-6960.00	-69.70	48.00	6960.00	-69.70	48.00	-6960.00
24	266.33	65.80	-45.30	-6720.00	-65.80	45.30	6720.00	-65.80	45.30	-6720.00
23	255.92	63.30	-43.60	-6480.00	-63.30	43.60	6480.00	-63.30	43.60	-6480.00
22	245.50	60.80	-41.85	-6180.00	-60.80	41.85	6180.00	-60.80	41.85	-6180.00
21	235.08	58.30	-40.15	-5940.00	-58.30	40.15	5940.00	-58.30	40.15	-5940.00
20	224.67	55.80	-38.45	-5700.00	-55.80	38.45	5700.00	-55.80	38.45	-5700.00
19	214.25	53.30	-36.70	-5460.00	-53.30	36.70	5460.00	-53.30	36.70	-5460.00
18	203.83	50.90	-35.05	-5220.00	-50.90	35.05	5220.00	-50.90	35.05	-5220.00
17	193.42	48.40	-33.35	-4920.00	-48.40	33.35	4920.00	-48.40	33.35	-4920.00
16	183.00	45.90	-31.65	-4680.00	-45.90	31.65	4680.00	-45.90	31.65	-4680.00
15	172.58	43.40	-29.90	-4440.00	-43.40	29.90	4440.00	-43.40	29.90	-4440.00
14	162.17	40.90	-28.20	-4200.00	-40.90	28.20	4200.00	-40.90	28.20	-4200.00
13	151.75	38.40	-26.50	-3900.00	-38.40	26.50	3900.00	-38.40	26.50	-3900.00
12	141.33	35.90	-24.75	-3660.00	-35.90	24.75	3660.00	-35.90	24.75	-3660.00
11	130.92	33.40	-23.05	-3420.00	-33.40	23.05	3420.00	-33.40	23.05	-3420.00
10	120.50	31.00	-21.30	-3180.00	-31.00	21.30	3180.00	-31.00	21.30	-3180.00
9	110.08	28.50	-19.60	-2880.00	-28.50	19.60	2880.00	-28.50	19.60	-2880.00
8	99.67	26.00	-17.90	-2640.00	-26.00	17.90	2640.00	-26.00	17.90	-2640.00
7	89.25	23.60	-16.25	-2400.00	-23.60	16.25	2400.00	-23.60	16.25	-2400.00
6	78.83	21.10	-14.55	-2160.00	-21.10	14.55	2160.00	-21.10	14.55	-2160.00
5	68.42	18.60	-12.80	-1920.00	-18.60	12.80	1920.00	-18.60	12.80	-1920.00
4	58.00	29.80	-20.55	-2340.00	-29.80	20.55	2340.00	-29.80	20.55	-2340.00
3	26.00	9.20	-6.30	-900.00	-9.20	6.30	900.00	-9.20	6.30	-900.00
2	16.00	6.40	-4.40	-600.00	-6.40	4.40	600.00	-6.40	4.40	-600.00

Level	Height	Load Case 7			Load Case 8			Load Case 9		
		Fx	Fy	Mz	Fx	Fy	Mz	Fx	Fy	Mz
Roof	460.00	-139.00	-95.70	10260.00	-139.00	-95.70	-10260.00	90.35	191.40	12312.00
40	437.58	-169.30	-116.65	15960.00	-169.30	-116.65	-15960.00	110.05	233.30	19152.00
39	422.58	-103.20	-71.05	9960.00	-103.20	-71.05	-9960.00	67.08	142.10	11952.00
38	412.17	-96.30	-66.35	9480.00	-96.30	-66.35	-9480.00	62.60	132.70	11376.00
37	401.75	-100.20	-69.00	10020.00	-100.20	-69.00	-10020.00	65.13	138.00	12024.00
36	391.33	-97.60	-67.25	9780.00	-97.60	-67.25	-9780.00	63.44	134.50	11736.00
35	380.92	-95.10	-65.50	9540.00	-95.10	-65.50	-9540.00	61.82	131.00	11448.00
34	370.50	-92.50	-63.75	9240.00	-92.50	-63.75	-9240.00	60.13	127.50	11088.00
33	360.08	-90.00	-62.00	9000.00	-90.00	-62.00	-9000.00	58.50	124.00	10800.00
32	349.67	-87.40	-60.25	8760.00	-87.40	-60.25	-8760.00	56.81	120.50	10512.00
31	339.25	-84.90	-58.45	8520.00	-84.90	-58.45	-8520.00	55.19	116.90	10224.00
30	328.83	-82.30	-56.70	8220.00	-82.30	-56.70	-8220.00	53.50	113.40	9864.00
29	318.42	-79.90	-55.05	7980.00	-79.90	-55.05	-7980.00	51.94	110.10	9576.00
28	308.00	-77.40	-53.30	7740.00	-77.40	-53.30	-7740.00	50.31	106.60	9288.00
27	297.58	-74.80	-51.55	7500.00	-74.80	-51.55	-7500.00	48.62	103.10	9000.00
26	287.17	-72.30	-49.80	7260.00	-72.30	-49.80	-7260.00	47.00	99.60	8712.00
25	276.75	-69.70	-48.00	6960.00	-69.70	-48.00	-6960.00	45.31	96.00	8352.00
24	266.33	-65.80	-45.30	6720.00	-65.80	-45.30	-6720.00	42.77	90.60	8064.00
23	255.92	-63.30	-43.60	6480.00	-63.30	-43.60	-6480.00	41.15	87.20	7776.00
22	245.50	-60.80	-41.85	6180.00	-60.80	-41.85	-6180.00	39.52	83.70	7416.00
21	235.08	-58.30	-40.15	5940.00	-58.30	-40.15	-5940.00	37.90	80.30	7128.00
20	224.67	-55.80	-38.45	5700.00	-55.80	-38.45	-5700.00	36.27	76.90	6840.00
19	214.25	-53.30	-36.70	5460.00	-53.30	-36.70	-5460.00	34.65	73.40	6552.00
18	203.83	-50.90	-35.05	5220.00	-50.90	-35.05	-5220.00	33.09	70.10	6264.00
17	193.42	-48.40	-33.35	4920.00	-48.40	-33.35	-4920.00	31.46	66.70	5904.00
16	183.00	-45.90	-31.65	4680.00	-45.90	-31.65	-4680.00	29.84	63.30	5616.00
15	172.58	-43.40	-29.90	4440.00	-43.40	-29.90	-4440.00	28.21	59.80	5328.00
14	162.17	-40.90	-28.20	4200.00	-40.90	-28.20	-4200.00	26.59	56.40	5040.00
13	151.75	-38.40	-26.50	3900.00	-38.40	-26.50	-3900.00	24.96	53.00	4680.00
12	141.33	-35.90	-24.75	3660.00	-35.90	-24.75	-3660.00	23.34	49.50	4392.00
11	130.92	-33.40	-23.05	3420.00	-33.40	-23.05	-3420.00	21.71	46.10	4104.00
10	120.50	-31.00	-21.30	3180.00	-31.00	-21.30	-3180.00	20.15	42.60	3816.00
9	110.08	-28.50	-19.60	2880.00	-28.50	-19.60	-2880.00	18.53	39.20	3456.00
8	99.67	-26.00	-17.90	2640.00	-26.00	-17.90	-2640.00	16.90	35.80	3168.00
7	89.25	-23.60	-16.25	2400.00	-23.60	-16.25	-2400.00	15.34	32.50	2880.00
6	78.83	-21.10	-14.55	2160.00	-21.10	-14.55	-2160.00	13.72	29.10	2592.00
5	68.42	-18.60	-12.80	1920.00	-18.60	-12.80	-1920.00	12.09	25.60	2304.00
4	58.00	-29.80	-20.55	2340.00	-29.80	-20.55	-2340.00	19.37	41.10	2808.00
3	26.00	-9.20	-6.30	900.00	-9.20	-6.30	-900.00	5.98	12.60	1080.00
2	16.00	-6.40	-4.40	600.00	-6.40	-4.40	-600.00	4.16	8.80	720.00

Level	Height	Load Case 10			Load Case 11			Load Case 12		
		Fx	Fy	Mz	Fx	Fy	Mz	Fx	Fy	Mz
Roof	460.00	90.35	191.40	12312.00	90.35	191.40	12312.00	90.35	191.40	12312.00
40	437.58	110.05	233.30	-19152.00	-110.05	233.30	19152.00	-110.05	233.30	-19152.00
39	422.58	67.08	142.10	-11952.00	-67.08	142.10	11952.00	-67.08	142.10	-11952.00
38	412.17	62.60	132.70	-11376.00	-62.60	132.70	11376.00	-62.60	132.70	-11376.00
37	401.75	65.13	138.00	-12024.00	-65.13	138.00	12024.00	-65.13	138.00	-12024.00
36	391.33	63.44	134.50	-11736.00	-63.44	134.50	11736.00	-63.44	134.50	-11736.00
35	380.92	61.82	131.00	-11448.00	-61.82	131.00	11448.00	-61.82	131.00	-11448.00
34	370.50	60.13	127.50	-11088.00	-60.13	127.50	11088.00	-60.13	127.50	-11088.00
33	360.08	58.50	124.00	-10800.00	-58.50	124.00	10800.00	-58.50	124.00	-10800.00
32	349.67	56.81	120.50	-10512.00	-56.81	120.50	10512.00	-56.81	120.50	-10512.00
31	339.25	55.19	116.90	-10224.00	-55.19	116.90	10224.00	-55.19	116.90	-10224.00
30	328.83	53.50	113.40	-9864.00	-53.50	113.40	9864.00	-53.50	113.40	-9864.00
29	318.42	51.94	110.10	-9576.00	-51.94	110.10	9576.00	-51.94	110.10	-9576.00
28	308.00	50.31	106.60	-9288.00	-50.31	106.60	9288.00	-50.31	106.60	-9288.00
27	297.58	48.62	103.10	-9000.00	-48.62	103.10	9000.00	-48.62	103.10	-9000.00
26	287.17	47.00	99.60	-8712.00	-47.00	99.60	8712.00	-47.00	99.60	-8712.00
25	276.75	45.31	96.00	-8352.00	-45.31	96.00	8352.00	-45.31	96.00	-8352.00
24	266.33	42.77	90.60	-8064.00	-42.77	90.60	8064.00	-42.77	90.60	-8064.00
23	255.92	41.15	87.20	-7776.00	-41.15	87.20	7776.00	-41.15	87.20	-7776.00
22	245.50	39.52	83.70	-7416.00	-39.52	83.70	7416.00	-39.52	83.70	-7416.00
21	235.08	37.90	80.30	-7128.00	-37.90	80.30	7128.00	-37.90	80.30	-7128.00
20	224.67	36.27	76.90	-6840.00	-36.27	76.90	6840.00	-36.27	76.90	-6840.00
19	214.25	34.65	73.40	-6552.00	-34.65	73.40	6552.00	-34.65	73.40	-6552.00
18	203.83	33.09	70.10	-6264.00	-33.09	70.10	6264.00	-33.09	70.10	-6264.00
17	193.42	31.46	66.70	-5904.00	-31.46	66.70	5904.00	-31.46	66.70	-5904.00
16	183.00	29.84	63.30	-5616.00	-29.84	63.30	5616.00	-29.84	63.30	-5616.00
15	172.58	28.21	59.80	-5328.00	-28.21	59.80	5328.00	-28.21	59.80	-5328.00
14	162.17	26.59	56.40	-5040.00	-26.59	56.40	5040.00	-26.59	56.40	-5040.00
13	151.75	24.96	53.00	-4680.00	-24.96	53.00	4680.00	-24.96	53.00	-4680.00
12	141.33	23.34	49.50	-4392.00	-23.34	49.50	4392.00	-23.34	49.50	-4392.00
11	130.92	21.71	46.10	4104.00	21.71	46.10	4104.00	21.71	46.10	4104.00
10	120.50	20.15	42.60	-3816.00	-20.15	42.60	3816.00	-20.15	42.60	-3816.00
9	110.08	18.53	39.20	-3456.00	-18.53	39.20	3456.00	-18.53	39.20	-3456.00
8	99.67	16.90	35.80	-3168.00	-16.90	35.80	3168.00	-16.90	35.80	-3168.00
7	89.25	15.34	32.50	-2880.00	-15.34	32.50	2880.00	-15.34	32.50	-2880.00
6	78.83	13.72	29.10	-2592.00	-13.72	29.10	2592.00	-13.72	29.10	-2592.00
5	68.42	12.09	25.60	-2304.00	-12.09	25.60	2304.00	-12.09	25.60	-2304.00
4	58.00	19.37	41.10	-2808.00	-19.37	41.10	2808.00	-19.37	41.10	-2808.00
3	26.00	5.98	12.60	-1080.00	-5.98	12.60	1080.00	-5.98	12.60	-1080.00
2	16.00	4.16	8.80	-720.00	-4.16	8.80	720.00	-4.16	8.80	-720.00

Level	Height	Load Case 13			Load Case 14			Load Case 15		
		Fx	Fy	Mz	Fx	Fy	Mz	Fx	Fy	Mz
Roof	460.00	90.35	-191.40	12312.00	90.35	-191.40	-12312.00	-90.35	-191.40	12312.00
40	437.58	110.05	-233.30	19152.00	110.05	-233.30	-19152.00	-110.05	-233.30	19152.00
39	422.58	67.08	-142.10	11952.00	67.08	-142.10	-11952.00	-67.08	-142.10	11952.00
38	412.17	62.60	-132.70	11376.00	62.60	-132.70	-11376.00	-62.60	-132.70	11376.00
37	401.75	65.13	-138.00	12024.00	65.13	-138.00	-12024.00	-65.13	-138.00	12024.00
36	391.33	63.44	-134.50	11736.00	63.44	-134.50	-11736.00	-63.44	-134.50	11736.00
35	380.92	61.82	-131.00	11448.00	61.82	-131.00	-11448.00	-61.82	-131.00	11448.00
34	370.50	60.13	-127.50	11088.00	60.13	-127.50	-11088.00	-60.13	-127.50	11088.00
33	360.08	58.50	-124.00	10800.00	58.50	-124.00	-10800.00	-58.50	-124.00	10800.00
32	349.67	56.81	-120.50	10512.00	56.81	-120.50	-10512.00	-56.81	-120.50	10512.00
31	339.25	55.19	-116.90	10224.00	55.19	-116.90	-10224.00	-55.19	-116.90	10224.00
30	328.83	53.50	-113.40	9864.00	53.50	-113.40	-9864.00	-53.50	-113.40	9864.00
29	318.42	51.94	-110.10	9576.00	51.94	-110.10	-9576.00	-51.94	-110.10	9576.00
28	308.00	50.31	-106.60	9288.00	50.31	-106.60	-9288.00	-50.31	-106.60	9288.00
27	297.58	48.62	-103.10	9000.00	48.62	-103.10	-9000.00	-48.62	-103.10	9000.00
26	287.17	47.00	-99.60	8712.00	47.00	-99.60	-8712.00	-47.00	-99.60	8712.00
25	276.75	45.31	-96.00	8352.00	45.31	-96.00	-8352.00	-45.31	-96.00	8352.00
24	266.33	42.77	-90.60	8064.00	42.77	-90.60	-8064.00	-42.77	-90.60	8064.00
23	255.92	41.15	-87.20	7776.00	41.15	-87.20	-7776.00	-41.15	-87.20	7776.00
22	245.50	39.52	-83.70	7416.00	39.52	-83.70	-7416.00	-39.52	-83.70	7416.00
21	235.08	37.90	-80.30	7128.00	37.90	-80.30	-7128.00	-37.90	-80.30	7128.00
20	224.67	36.27	-76.90	6840.00	36.27	-76.90	-6840.00	-36.27	-76.90	6840.00
19	214.25	34.65	-73.40	6552.00	34.65	-73.40	-6552.00	-34.65	-73.40	6552.00
18	203.83	33.09	-70.10	6264.00	33.09	-70.10	-6264.00	-33.09	-70.10	6264.00
17	193.42	31.46	-66.70	5904.00	31.46	-66.70	-5904.00	-31.46	-66.70	5904.00
16	183.00	29.84	-63.30	5616.00	29.84	-63.30	-5616.00	-29.84	-63.30	5616.00
15	172.58	28.21	-59.80	5328.00	28.21	-59.80	-5328.00	-28.21	-59.80	5328.00
14	162.17	26.59	-56.40	5040.00	26.59	-56.40	-5040.00	-26.59	-56.40	5040.00
13	151.75	24.96	-53.00	4680.00	24.96	-53.00	-4680.00	-24.96	-53.00	4680.00
12	141.33	23.34	-49.50	4392.00	23.34	-49.50	-4392.00	-23.34	-49.50	4392.00
11	130.92	21.71	-46.10	4104.00	21.71	-46.10	-4104.00	-21.71	-46.10	4104.00
10	120.50	20.15	-42.60	3816.00	20.15	-42.60	-3816.00	-20.15	-42.60	3816.00
9	110.08	18.53	-39.20	3456.00	18.53	-39.20	-3456.00	-18.53	-39.20	3456.00
8	99.67	16.90	-35.80	3168.00	16.90	-35.80	-3168.00	-16.90	-35.80	3168.00
7	89.25	15.34	-32.50	2880.00	15.34	-32.50	-2880.00	-15.34	-32.50	2880.00
6	78.83	13.72	-29.10	2592.00	13.72	-29.10	-2592.00	-13.72	-29.10	2592.00
5	68.42	12.09	-25.60	2304.00	12.09	-25.60	-2304.00	-12.09	-25.60	2304.00
4	58.00	19.37	-41.10	2808.00	19.37	-41.10	-2808.00	-19.37	-41.10	2808.00
3	26.00	5.98	-12.60	1080.00	5.98	-12.60	-1080.00	-5.98	-12.60	1080.00
2	16.00	4.16	-8.80	720.00	4.16	-8.80	-720.00	-4.16	-8.80	720.00

Level	Height	Load Case 16			Load Case 17			Load Case 18		
		Fx	Fy	Mz	Fx	Fy	Mz	Fx	Fy	Mz
Roof	460.00	-90.35	-191.40	-12312.00	90.35	95.70	12312.00	90.35	-95.70	12312.00
40	437.58	-110.05	-233.30	-19152.00	110.05	116.65	19152.00	110.05	-116.65	19152.00
39	422.58	-67.08	-142.10	-11952.00	67.08	71.05	11952.00	67.08	-71.05	11952.00
38	412.17	-62.60	-132.70	-11376.00	62.60	66.35	11376.00	62.60	-66.35	11376.00
37	401.75	-65.13	-138.00	-12024.00	65.13	69.00	12024.00	65.13	-69.00	12024.00
36	391.33	-63.44	-134.50	-11736.00	63.44	67.25	11736.00	63.44	-67.25	11736.00
35	380.92	-61.82	-131.00	-11448.00	61.82	65.50	11448.00	61.82	-65.50	11448.00
34	370.50	-60.13	-127.50	-11088.00	60.13	63.75	11088.00	60.13	-63.75	11088.00
33	360.08	-58.50	-124.00	-10800.00	58.50	62.00	10800.00	58.50	-62.00	10800.00
32	349.67	-56.81	-120.50	-10512.00	56.81	60.25	10512.00	56.81	-60.25	10512.00
31	339.25	-55.19	-116.90	-10224.00	55.19	58.45	10224.00	55.19	-58.45	10224.00
30	328.83	-53.50	-113.40	-9864.00	53.50	56.70	9864.00	53.50	-56.70	9864.00
29	318.42	-51.94	-110.10	-9576.00	51.94	55.05	9576.00	51.94	-55.05	9576.00
28	308.00	-50.31	-106.60	-9288.00	50.31	53.30	9288.00	50.31	-53.30	9288.00
27	297.58	-48.62	-103.10	-9000.00	48.62	51.55	9000.00	48.62	-51.55	9000.00
26	287.17	-47.00	-99.60	-8712.00	47.00	49.80	8712.00	47.00	-49.80	8712.00
25	276.75	-45.31	-96.00	-8352.00	45.31	48.00	8352.00	45.31	-48.00	8352.00
24	266.33	-42.77	-90.60	-8064.00	42.77	45.30	8064.00	42.77	-45.30	8064.00
23	255.92	-41.15	-87.20	-7776.00	41.15	43.60	7776.00	41.15	-43.60	7776.00
22	245.50	-39.52	-83.70	-7416.00	39.52	41.85	7416.00	39.52	-41.85	7416.00
21	235.08	-37.90	-80.30	-7128.00	37.90	40.15	7128.00	37.90	-40.15	7128.00
20	224.67	-36.27	-76.90	-6840.00	36.27	38.45	6840.00	36.27	-38.45	6840.00
19	214.25	-34.65	-73.40	-6552.00	34.65	36.70	6552.00	34.65	-36.70	6552.00
18	203.83	-33.09	-70.10	-6264.00	33.09	35.05	6264.00	33.09	-35.05	6264.00
17	193.42	-31.46	-66.70	-5904.00	31.46	33.35	5904.00	31.46	-33.35	5904.00
16	183.00	-29.84	-63.30	-5616.00	29.84	31.65	5616.00	29.84	-31.65	5616.00
15	172.58	-28.21	-59.80	-5328.00	28.21	29.90	5328.00	28.21	-29.90	5328.00
14	162.17	-26.59	-56.40	-5040.00	26.59	28.20	5040.00	26.59	-28.20	5040.00
13	151.75	-24.96	-53.00	-4680.00	24.96	26.50	4680.00	24.96	-26.50	4680.00
12	141.33	-23.34	-49.50	-4392.00	23.34	24.75	4392.00	23.34	-24.75	4392.00
11	130.92	-21.71	-46.10	-4104.00	21.71	23.05	4104.00	21.71	-23.05	4104.00
10	120.50	-20.15	-42.60	-3816.00	20.15	21.30	3816.00	20.15	-21.30	3816.00
9	110.08	-18.53	-39.20	-3456.00	18.53	19.60	3456.00	18.53	-19.60	3456.00
8	99.67	-16.90	-35.80	-3168.00	16.90	17.90	3168.00	16.90	-17.90	3168.00
7	89.25	-15.34	-32.50	-2880.00	15.34	16.25	2880.00	15.34	-16.25	2880.00
6	78.83	-13.72	-29.10	-2592.00	13.72	14.55	2592.00	13.72	-14.55	2592.00
5	68.42	-12.09	-25.60	-2304.00	12.09	12.80	2304.00	12.09	-12.80	2304.00
4	58.00	-19.37	-41.10	-2808.00	19.37	20.55	2808.00	19.37	-20.55	2808.00
3	26.00	-5.98	-12.60	-1080.00	5.98	6.30	1080.00	5.98	-6.30	1080.00
2	16.00	-4.16	-8.80	-720.00	4.16	4.40	720.00	4.16	-4.40	720.00

Level	Height	Load Case 19			Load Case 20		
		Fx	Fy	Mz	Fx	Fy	Mz
Roof	460.00	-90.35	95.70	-12312.00	-90.35	-95.70	-12312.00
40	437.58	-110.05	116.65	-19152.00	-110.05	-116.65	-19152.00
39	422.58	-67.08	71.05	-11952.00	-67.08	-71.05	-11952.00
38	412.17	-62.60	66.35	-11376.00	-62.60	-66.35	-11376.00
37	401.75	-65.13	69.00	-12024.00	-65.13	-69.00	-12024.00
36	391.33	-63.44	67.25	-11736.00	-63.44	-67.25	-11736.00
35	380.92	-61.82	65.50	-11448.00	-61.82	-65.50	-11448.00
34	370.50	-60.13	63.75	-11088.00	-60.13	-63.75	-11088.00
33	360.08	-58.50	62.00	-10800.00	-58.50	-62.00	-10800.00
32	349.67	-56.81	60.25	-10512.00	-56.81	-60.25	-10512.00
31	339.25	-55.19	58.45	-10224.00	-55.19	-58.45	-10224.00
30	328.83	-53.50	56.70	-9864.00	-53.50	-56.70	-9864.00
29	318.42	-51.94	55.05	-9576.00	-51.94	-55.05	-9576.00
28	308.00	-50.31	53.30	-9288.00	-50.31	-53.30	-9288.00
27	297.58	-48.62	51.55	-9000.00	-48.62	-51.55	-9000.00
26	287.17	-47.00	49.80	-8712.00	-47.00	-49.80	-8712.00
25	276.75	-45.31	48.00	-8352.00	-45.31	-48.00	-8352.00
24	266.33	-42.77	45.30	-8064.00	-42.77	-45.30	-8064.00
23	255.92	-41.15	43.60	-7776.00	-41.15	-43.60	-7776.00
22	245.50	-39.52	41.85	-7416.00	-39.52	-41.85	-7416.00
21	235.08	-37.90	40.15	-7128.00	-37.90	-40.15	-7128.00
20	224.67	-36.27	38.45	-6840.00	-36.27	-38.45	-6840.00
19	214.25	-34.65	36.70	-6552.00	-34.65	-36.70	-6552.00
18	203.83	-33.09	35.05	-6264.00	-33.09	-35.05	-6264.00
17	193.42	-31.46	33.35	-5904.00	-31.46	-33.35	-5904.00
16	183.00	-29.84	31.65	-5616.00	-29.84	-31.65	-5616.00
15	172.58	-28.21	29.90	-5328.00	-28.21	-29.90	-5328.00
14	162.17	-26.59	28.20	-5040.00	-26.59	-28.20	-5040.00
13	151.75	-24.96	26.50	-4680.00	-24.96	-26.50	-4680.00
12	141.33	-23.34	24.75	-4392.00	-23.34	-24.75	-4392.00
11	130.92	-21.71	23.05	-4104.00	-21.71	-23.05	-4104.00
10	120.50	-20.15	21.30	-3816.00	-20.15	-21.30	-3816.00
9	110.08	-18.53	19.60	-3456.00	-18.53	-19.60	-3456.00
8	99.67	-16.90	17.90	-3168.00	-16.90	-17.90	-3168.00
7	89.25	-15.34	16.25	-2880.00	-15.34	-16.25	-2880.00
6	78.83	-13.72	14.55	-2592.00	-13.72	-14.55	-2592.00
5	68.42	-12.09	12.80	-2304.00	-12.09	-12.80	-2304.00
4	58.00	-19.37	20.55	-2808.00	-19.37	-20.55	-2808.00
3	26.00	-5.98	6.30	-1080.00	-5.98	-6.30	-1080.00
2	16.00	-4.16	4.40	-720.00	-4.16	-4.40	-720.00

Appendix B

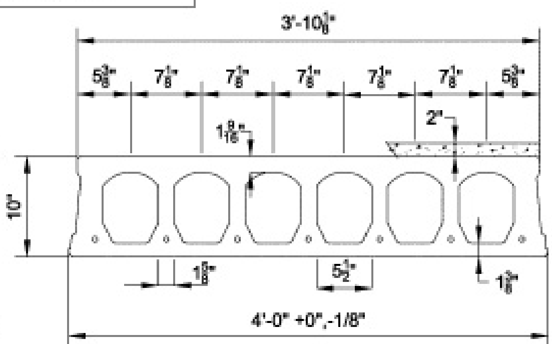
Gravity System Redesign – Precast Plank and Steel Frame

Prestressed Concrete
10"x4'-0" Hollow Core Plank

2 Hour Fire Resistance Rating With 2" Topping

PHYSICAL PROPERTIES
Composite Section

A_c = 327 in.^{2}	Precast S_{bc} = 824 in.^{3}
I_c = 5102 in.^{4}	Topping S_{tc} = 1242 in.^{3}
Y_{bc} = 6.19 in.	Precast S_{tc} = 1340 in.^{3}
Y_{tc} = 3.81 in.	Wt.= 272 PLF
	Wt.= 68.00 PSF



DESIGN DATA

1. Precast Strength @ 28 days = 6000 PSI
2. Precast Strength @ release = 3500 PSI or 4000 PSI.
3. Precast Density = 150 PCF
4. Strand = 1/2"Ø and 0.6"Ø 270K Lo-Relaxation.
5. Strand Height = 1.75 in.
6. Ultimate moment capacity (when fully developed)...
   7-1/2"Ø, 270K = 192.2 k-ft
   7-0.6"Ø, 270K = 256.4 k-ft
7. Maximum bottom tensile stress is $7.5\sqrt{f'c}$ = 580 PSI
8. All superimposed load is treated as live load in the strength analysis of flexure and shear.
9. Flexural strength capacity is based on stress/strain strand relationships.
10. Deflection limits were not considered when determining allowable loads in this table.
11. Topping Strength @ 28 days = 3000 PSI. Topping Weight = 25 PSF.
12. These tables are based upon the topping having a uniform 2" thickness over the entire span. A lesser thickness might occur if camber is not taken into account during design, thus reducing the load capacity.
13. Load values to the left of the solid line are controlled by ultimate shear strength.
14. Load values to the right are controlled by ultimate flexural strength or fire endurance limits.
15. Load values may be different for IBC 2000 & ACI 318-99. Load tables are available upon request.
16. Camber is inherent in all prestressed hollow core slabs and is a function of the amount of eccentric prestressing force needed to carry the superimposed design loads along with a number of other variables. Because prediction of camber is based on empirical formulas it is at best an estimate, with the actual camber usually higher than calculated values.

SAFE SUPERIMPOSED SERVICE LOADS — IBC 2003 & ACI 318-02 (1.2 D + 1.6 L)

Strand Pattern		SPAN (FEET)																		
		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
7 - 1/2"ø	LOAD (PSF)	234	210	189	170	153	137	123	110	98	87	77	68	60	52					
7 - 0.6"ø	LOAD (PSF)			256	244	233	222	202	185	168	154	140	128	116	106	96	87	78	70	63

NITTERHOUSE
CONCRETE PRODUCTS

2655 Molly Pitcher Hwy. South, Box N
Chambersburg, PA 17201-0813
717-267-4505 Fax 717-267-4518

This table is for simple spans and uniform loads. Design data for any of these span-load conditions is available on request. Individual designs may be furnished to satisfy unusual conditions of heavy loads, concentrated loads, cantilevers, flange or stem openings and narrow widths. The allowable loads shown in this table reflect a 2 Hour & 0 Minute fire resistance rating.

05/14/07

10F2.0T

Beam Summary

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS 04/08/08 04:28:46
Building Code: IBC Steel Code: AISC LRFD

STEEL BEAM DESIGN SUMMARY:

Floor Type: ROOF

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	22.49	71.7	0.0	277.1	50.0	W18X35 u	
2	18.97	126.7	0.0	562.5	50.0	W24X55 u	
3	32.71	420.1	0.0	562.5	50.0	W24X55	
4	14.75	21.0	0.0	102.9	50.0	W12X19 u	
5	29.29	2.8	0.0	102.9	50.0	W12X19 u	
6	32.98	337.7	0.0	562.5	50.0	W24X55	
7	26.63	2.4	0.0	102.9	50.0	W12X19 u	
8	22.36	74.9	0.0	277.1	50.0	W18X35 u	
9	15.93	21.0	0.0	102.9	50.0	W12X19 u	
10	22.63	31.9	0.0	277.1	50.0	W18X35 u	
11	15.93	10.8	0.0	102.9	50.0	W12X19 u	
12	22.63	189.7	0.0	562.5	50.0	W24X55 u	
13	18.67	31.0	0.0	102.9	50.0	W12X19 u	
15	18.83	29.0	0.0	102.9	50.0	W12X19 u	
17	32.95	331.4	0.0	562.5	50.0	W24X55	
18	15.42	23.0	0.0	102.9	50.0	W12X19 u	
19	32.52	431.2	0.0	562.5	50.0	W24X55	
56	58.50	2348.6	0.0	2991.7	50.0	W36X182	
27	26.51	2.3	0.0	102.9	50.0	W12X19 u	
28	32.74	414.6	0.0	562.5	50.0	W24X55	
58	29.33	566.4	0.0	737.5	50.0	W24X68	
57	29.17	560.0	0.0	737.5	50.0	W24X68	
33	28.43	3.1	0.0	138.3	50.0	W14X22 u	
35	32.52	364.0	0.0	562.5	50.0	W24X55	
41	26.80	2.4	0.0	102.9	50.0	W12X19 u	
42	18.67	27.7	0.0	102.9	50.0	W12X19 u	
43	22.61	50.5	0.0	102.9	50.0	W12X19	
44	16.07	21.4	0.0	102.9	50.0	W12X19 u	
45	16.07	11.1	0.0	102.9	50.0	W12X19 u	
46	14.75	21.1	0.0	102.9	50.0	W12X19 u	
47	22.51	73.7	0.0	277.1	50.0	W18X35 u	
48	22.63	190.2	0.0	562.5	50.0	W24X55 u	
49	25.44	47.8	0.0	277.1	50.0	W18X35 u	
50	29.32	2.9	0.0	102.9	50.0	W12X19 u	
51	14.75	21.0	0.0	102.9	50.0	W12X19 u	
52	32.98	334.6	0.0	562.5	50.0	W24X55	
53	19.03	127.2	0.0	562.5	50.0	W24X55 u	
54	32.71	417.1	0.0	562.5	50.0	W24X55	
55	22.49	71.9	0.0	277.1	50.0	W18X35 u	

Beam Summary

RAM Steel v11.2 Page 2/12
DataBase: Takeoff Model - PLANKS 04/08/08 04:28:46
Building Code: IBC Steel Code: AISC LRFD

Floor Type: FLR 41 M

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
5	20.00	456.0	0.0	562.5	50.0	W24X55	
6	10.00	17.1	0.0	37.0	50.0	W8X10	
8	10.00	9.2	0.0	37.0	50.0	W8X10	
13	21.25	157.7	0.0	184.2	50.0	W16X26	
14	10.00	61.1	0.0	102.9	50.0	W12X19 u	
18	12.00	0.5	0.0	102.9	50.0	W12X19 u	
19	18.50	435.2	0.0	562.5	50.0	W24X55	
20	18.50	210.1	0.0	277.1	50.0	W18X35	
25	9.25	0.0	0.0	37.0	50.0	W8X10	
50	19.75	1.3	0.0	102.9	50.0	W12X19 u	
28	17.50	1.0	0.0	102.9	50.0	W12X19 u	
29	20.00	295.1	0.0	397.5	50.0	W21X44 u	
31	12.00	0.5	0.0	102.9	50.0	W12X19 u	
32	20.00	318.1	0.0	397.5	50.0	W21X44	
33	9.25	91.8	0.0	277.1	50.0	W18X35 u	
35	20.00	191.2	0.0	225.0	50.0	W16X31	
36	19.75	38.1	0.0	102.9	50.0	W12X19 u	
37	10.33	12.5	0.0	37.0	50.0	W8X10	
38	10.33	17.0	0.0	37.0	50.0	W8X10	
48	17.50	20.9	0.0	102.9	50.0	W12X19 u	
49	4.25	3.9	0.0	37.0	50.0	W8X10	
44	4.25	0.5	0.0	37.0	50.0	W8X10	

Floor Type: FLR 40 M

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	22.49	112.4	0.0	277.1	50.0	W18X35 u	
2	18.97	247.1	0.0	562.5	50.0	W24X55 u	
5	20.35	21.6	0.0	70.8	50.0	W8X18	
4	8.00	0.0	-77.8				
	32.00	6.1	-77.8	225.0	50.0	W16X31	
6	18.75	204.3	0.0	277.1	50.0	W18X35	
7	32.00	35.5	0.0	445.8	50.0	W21X48 u	
8	18.75	779.8	0.0	1016.7	50.0	W27X84	
9	18.75	431.2	0.0	562.5	50.0	W24X55	
12	29.29	2.8	0.0	102.9	50.0	W12X19 u	
15	22.36	123.5	0.0	277.1	50.0	W18X35 u	
16	17.52	13.2	0.0	138.3	50.0	W14X22 u	
17	18.03	158.5	0.0	184.2	50.0	W16X26	
18	22.63	198.3	0.0	277.1	50.0	W18X35	
19	16.00	220.4	0.0	277.1	50.0	W18X35	

Beam Summary

RAM Steel v11.2 Page 3/12
DataBase: Takeoff Model - PLANKS 04/08/08 04:28:46
Building Code: IBC Steel Code: AISC LRFD

Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
20	18.67	438.3	0.0	1016.7	50.0	W27X84 u	
21	16.00	207.4	0.0	277.1	50.0	W18X35	
22	22.63	401.9	0.0	562.5	50.0	W24X55 u	
29	18.75	201.4	0.0	225.0	50.0	W16X31	
24	8.00	0.0	-60.6				
	32.00	21.5	-60.6	155.0	50.0	W12X26	
30	18.67	331.2	0.0	397.5	50.0	W21X44	
32	18.83	337.3	0.0	397.5	50.0	W21X44	
34	18.75	422.4	0.0	562.5	50.0	W24X55	
35	32.00	46.2	0.0	266.7	50.0	W16X36 u	
40	20.00	59.5	0.0	102.9	50.0	W12X19	
41	10.00	9.2	0.0	37.0	50.0	W8X10	
43	10.00	5.9	0.0	37.0	50.0	W8X10	
46	21.25	70.9	0.0	138.3	50.0	W14X22	
47	10.00	1.5	0.0	102.9	50.0	W12X19 u	
51	12.00	0.3	0.0	37.0	50.0	W8X10	
52	18.50	254.0	0.0	326.7	50.0	W18X40	
53	18.50	103.0	0.0	138.3	50.0	W14X22	
54	18.75	776.4	0.0	1016.7	50.0	W27X84 u	
55	32.00	48.6	0.0	326.7	50.0	W18X40 u	
56	18.67	438.9	0.0	1016.7	50.0	W27X84 u	
119	37.25	472.6	0.0	737.5	50.0	W24X68	
120	9.17	0.0	0.0	37.0	50.0	W8X10	
60	12.00	0.3	0.0	37.0	50.0	W8X10	
61	9.25	47.1	0.0	72.5	50.0	W12X14	
123	29.17	22.3	0.0	70.8	50.0	W8X18	
62	18.83	446.1	0.0	1016.7	50.0	W27X84 u	
64	18.75	839.5	0.0	1016.7	50.0	W27X84	
65	32.00	19.2	-62.8	155.0	50.0	W12X26	
	8.00	0.0	-62.8				
66	19.75	6.0	0.0	138.3	50.0	W14X22 u	
67	17.50	4.7	0.0	138.3	50.0	W14X22 u	
68	20.00	153.7	0.0	184.2	50.0	W16X26	
70	12.00	0.3	0.0	37.0	50.0	W8X10	
71	20.00	120.0	0.0	184.2	50.0	W16X26	
73	20.00	39.5	0.0	102.9	50.0	W12X19 u	
124	4.25	2.2	0.0	37.0	50.0	W8X10	
76	19.75	19.3	0.0	52.5	50.0	W10X12	
77	10.33	6.3	0.0	37.0	50.0	W8X10	
78	10.33	8.6	0.0	37.0	50.0	W8X10	
80	12.00	2.0	0.0	37.0	50.0	W8X10	
121	17.50	10.5	0.0	37.0	50.0	W8X10	
122	4.25	2.0	0.0	37.0	50.0	W8X10	
83	4.25	0.2	0.0	37.0	50.0	W8X10	
87	18.83	445.4	0.0	1016.7	50.0	W27X84 u	

Beam Summary

RAM Steel v11.2 Page 4/12
DataBase: Takeoff Model - PLANKS 04/08/08 04:28:46
Building Code: IBC Steel Code: AISC LRFD

Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
88	18.75	435.1	0.0	562.5	50.0	W24X55	
89	22.51	119.8	0.0	277.1	50.0	W18X35 u	
91	18.67	329.1	0.0	562.5	50.0	W24X55 u	
92	22.63	402.2	0.0	562.5	50.0	W24X55 u	
94	16.00	207.4	0.0	277.1	50.0	W18X35	
95	18.83	346.3	0.0	397.5	50.0	W21X44	
96	16.00	225.5	0.0	277.1	50.0	W18X35	
98	18.75	377.0	0.0	445.8	50.0	W21X48	
99	22.63	241.2	0.0	277.1	50.0	W18X35	
103	18.74	190.5	0.0	225.0	50.0	W16X31	
104	29.32	2.9	0.0	102.9	50.0	W12X19 u	
105	18.21	11.3	0.0	277.1	50.0	W18X35 u	
108	18.75	435.9	0.0	562.5	50.0	W24X55	
109	18.75	782.5	0.0	1016.7	50.0	W27X84	
110	18.75	217.3	0.0	277.1	50.0	W18X35	
111	19.62	13.1	0.0	277.1	50.0	W18X35 u	
112	19.03	251.7	0.0	562.5	50.0	W24X55 u	
115	22.49	120.2	0.0	277.1	50.0	W18X35 u	
116	32.00	35.1	0.0	377.9	50.0	W18X46 u	
117	32.00	8.1	-67.0	225.0	50.0	W16X31	
	8.00	0.0	-67.0				

Floor Type: FLR 24 TO 39

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	22.49	66.9	0.0	277.1	50.0	W18X35 u	
2	18.97	137.4	0.0	397.5	50.0	W21X44 u	
4	20.35	13.4	0.0	277.1	50.0	W18X35 u	
3	8.00	0.0	-68.8				
	32.00	423.9	-68.8	833.3	50.0	W24X76	
5	18.75	59.4	0.0	102.9	50.0	W12X19 u	
6	32.00	451.0	0.0	833.3	50.0	W24X76 u	
7	18.75	1.2	0.0	102.9	50.0	W12X19 u	
8	18.75	48.9	0.0	83.8	50.0	W12X16	
9	29.29	7.5	0.0	420.8	50.0	W18X50 u	
10	22.36	68.5	0.0	277.1	50.0	W18X35 u	
11	17.52	9.9	0.0	277.1	50.0	W18X35 u	
12	18.03	149.1	0.0	184.2	50.0	W16X26	
13	22.63	170.4	0.0	277.1	50.0	W18X35 u	
14	16.00	26.1	0.0	102.9	50.0	W12X19 u	
15	18.67	1.2	0.0	102.9	50.0	W12X19 u	
16	16.00	13.4	0.0	102.9	50.0	W12X19 u	
17	22.63	220.2	0.0	397.5	50.0	W21X44 u	
19	18.75	50.9	0.0	102.9	50.0	W12X19 u	
18	8.00	0.0	-61.0				

Beam Summary

RAM Steel v11.2 | Page 5/12
DataBase: Takeoff Model - PLANKS | 04/08/08 04:28:46
Building Code: IBC | Steel Code: AISC LRFD

Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
	32.00	425.7	-61.0	833.3	50.0	W24X76	
20	18.67	41.2	0.0	138.3	50.0	W14X22 u	
22	18.83	36.0	0.0	138.3	50.0	W14X22 u	
24	18.75	48.4	0.0	138.3	50.0	W14X22 u	
25	32.00	451.5	0.0	833.3	50.0	W24X76 u	
29	20.00	220.9	0.0	277.1	50.0	W18X35	
30	10.00	9.2	0.0	37.0	50.0	W8X10	
32	10.00	5.9	0.0	37.0	50.0	W8X10	
33	21.25	70.9	0.0	138.3	50.0	W14X22	
34	10.00	1.5	0.0	102.9	50.0	W12X19 u	
38	12.00	0.3	0.0	37.0	50.0	W8X10	
39	18.50	100.8	0.0	138.3	50.0	W14X22 u	
40	18.50	64.7	0.0	102.9	50.0	W12X19 u	
41	18.75	1.2	0.0	102.9	50.0	W12X19 u	
42	32.00	449.8	0.0	833.3	50.0	W24X76 u	
43	18.67	1.2	0.0	102.9	50.0	W12X19 u	
94	37.25	24.6	0.0	277.1	50.0	W18X35 u	
95	9.17	0.0	0.0	37.0	50.0	W8X10	
47	12.00	0.3	0.0	37.0	50.0	W8X10	
48	9.25	29.6	0.0	37.0	50.0	W8X10	
49	18.83	1.2	0.0	102.9	50.0	W12X19 u	
51	18.75	1.2	0.0	102.9	50.0	W12X19 u	
52	32.00	425.2	-67.6	833.3	50.0	W24X76	
	8.00	0.0	-67.6				
53	19.75	5.8	0.0	102.9	50.0	W12X19 u	
54	17.50	4.6	0.0	102.9	50.0	W12X19 u	
96	20.00	153.7	0.0	184.2	50.0	W16X26	
56	12.00	0.3	0.0	37.0	50.0	W8X10	
57	20.00	120.0	0.0	184.2	50.0	W16X26	
58	9.25	25.1	0.0	37.0	50.0	W8X10	
59	20.00	39.5	0.0	102.9	50.0	W12X19 u	
60	20.00	7.3	0.0	102.9	50.0	W12X19 u	
99	19.75	19.3	0.0	52.5	50.0	W10X12	
62	10.33	6.3	0.0	37.0	50.0	W8X10	
63	10.33	8.6	0.0	37.0	50.0	W8X10	
66	12.00	2.0	0.0	37.0	50.0	W8X10	
97	17.50	10.5	0.0	37.0	50.0	W8X10	
98	4.25	2.0	0.0	37.0	50.0	W8X10	
69	4.25	0.2	0.0	37.0	50.0	W8X10	
73	18.83	1.2	0.0	102.9	50.0	W12X19 u	
74	18.75	49.0	0.0	83.8	50.0	W12X16	
75	22.51	66.7	0.0	277.1	50.0	W18X35 u	
76	18.67	34.2	0.0	138.3	50.0	W14X22 u	
77	22.63	220.3	0.0	397.5	50.0	W21X44 u	
78	16.00	13.4	0.0	102.9	50.0	W12X19 u	

Beam Summary

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Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
79	18.83	42.5	0.0	138.3	50.0	W14X22 u	
80	16.00	26.1	0.0	102.9	50.0	W12X19 u	
81	18.75	53.1	0.0	102.9	50.0	W12X19 u	
82	22.63	180.6	0.0	277.1	50.0	W18X35 u	
83	18.74	161.7	0.0	184.2	50.0	W16X26	
84	29.32	7.5	0.0	420.8	50.0	W18X50 u	
85	18.21	10.7	0.0	277.1	50.0	W18X35 u	
86	18.75	48.9	0.0	83.8	50.0	W12X16	
87	18.75	1.2	0.0	102.9	50.0	W12X19 u	
88	18.75	57.1	0.0	83.8	50.0	W12X16	
89	19.62	12.5	0.0	277.1	50.0	W18X35 u	
90	19.03	138.4	0.0	397.5	50.0	W21X44 u	
91	22.49	66.9	0.0	277.1	50.0	W18X35 u	
92	32.00	452.7	0.0	833.3	50.0	W24X76 u	
93	32.00	424.7	-71.9	833.3	50.0	W24X76	
	8.00	0.0	-71.9				

Floor Type: FLR 4 TO 23

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	22.49	66.9	0.0	277.1	50.0	W18X35 u	
2	18.97	137.4	0.0	397.5	50.0	W21X44 u	
4	20.35	13.4	0.0	277.1	50.0	W18X35 u	
3	8.00	0.0	-68.8				
	32.00	423.9	-68.8	833.3	50.0	W24X76	
5	18.75	59.4	0.0	102.9	50.0	W12X19 u	
6	32.00	451.0	0.0	833.3	50.0	W24X76 u	
7	18.75	1.2	0.0	102.9	50.0	W12X19 u	
8	18.75	49.0	0.0	102.9	50.0	W12X19 u	
9	29.29	7.5	0.0	420.8	50.0	W18X50 u	
10	22.36	68.5	0.0	277.1	50.0	W18X35 u	
11	17.52	9.9	0.0	277.1	50.0	W18X35 u	
12	18.03	149.1	0.0	184.2	50.0	W16X26	
13	22.63	170.4	0.0	277.1	50.0	W18X35 u	
14	16.00	26.1	0.0	102.9	50.0	W12X19 u	
15	18.67	1.2	0.0	102.9	50.0	W12X19 u	
16	16.00	13.4	0.0	102.9	50.0	W12X19 u	
17	22.63	220.2	0.0	397.5	50.0	W21X44 u	
19	18.75	50.9	0.0	102.9	50.0	W12X19 u	
18	8.00	0.0	-61.0				
	32.00	425.7	-61.0	833.3	50.0	W24X76	
20	18.67	41.2	0.0	138.3	50.0	W14X22 u	
22	18.83	36.0	0.0	138.3	50.0	W14X22 u	
24	18.75	48.3	0.0	102.9	50.0	W12X19 u	
25	32.00	451.5	0.0	833.3	50.0	W24X76 u	

Beam Summary

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Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
29	20.00	220.9	0.0	277.1	50.0	W18X35 u	
30	10.00	9.2	0.0	37.0	50.0	W8X10	
32	10.00	5.9	0.0	37.0	50.0	W8X10	
33	21.25	70.9	0.0	138.3	50.0	W14X22	
34	10.00	1.5	0.0	102.9	50.0	W12X19 u	
35	19.75	5.8	0.0	102.9	50.0	W12X19 u	
36	17.50	4.6	0.0	102.9	50.0	W12X19 u	
37	18.50	1.8	0.0	37.0	50.0	W8X10	
38	12.00	0.3	0.0	37.0	50.0	W8X10	
39	18.50	1.6	0.0	37.0	50.0	W8X10	
40	18.50	103.0	0.0	138.3	50.0	W14X22 u	
41	18.75	1.2	0.0	102.9	50.0	W12X19 u	
42	32.00	447.7	0.0	641.7	50.0	W24X62	
43	18.67	1.2	0.0	102.9	50.0	W12X19 u	
44	19.75	0.7	0.0	37.0	50.0	W8X10	
46	17.50	0.5	0.0	37.0	50.0	W8X10	
47	12.00	0.3	0.0	37.0	50.0	W8X10	
48	9.25	47.1	0.0	72.5	50.0	W12X14	
96	29.17	22.3	0.0	70.8	50.0	W8X18	
49	18.83	1.2	0.0	102.9	50.0	W12X19 u	
51	18.75	1.2	0.0	102.9	50.0	W12X19 u	
52	32.00	425.2	-67.6	833.3	50.0	W24X76	
	8.00	0.0	-67.6				
53	19.75	5.8	0.0	102.9	50.0	W12X19 u	
54	17.50	4.6	0.0	102.9	50.0	W12X19 u	
55	20.00	154.1	0.0	184.2	50.0	W16X26	
57	12.00	0.3	0.0	37.0	50.0	W8X10	
58	20.00	120.0	0.0	184.2	50.0	W16X26	
60	20.00	39.5	0.0	102.9	50.0	W12X19 u	
97	4.25	2.2	0.0	37.0	50.0	W8X10	
62	19.75	19.7	0.0	102.9	50.0	W12X19 u	
63	10.33	6.3	0.0	37.0	50.0	W8X10	
64	10.33	8.6	0.0	37.0	50.0	W8X10	
66	12.00	2.0	0.0	37.0	50.0	W8X10	
94	17.50	10.5	0.0	37.0	50.0	W8X10	
95	4.25	2.0	0.0	37.0	50.0	W8X10	
69	4.25	0.2	0.0	37.0	50.0	W8X10	
73	18.83	1.2	0.0	102.9	50.0	W12X19 u	
74	18.75	49.0	0.0	83.8	50.0	W12X16	
75	22.51	66.7	0.0	277.1	50.0	W18X35 u	
76	18.67	34.2	0.0	138.3	50.0	W14X22 u	
77	22.63	220.3	0.0	397.5	50.0	W21X44 u	
78	16.00	13.4	0.0	102.9	50.0	W12X19 u	
79	18.83	42.4	0.0	138.3	50.0	W14X22 u	
80	16.00	25.9	0.0	52.5	50.0	W10X12	

Beam Summary

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Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
81	18.75	53.1	0.0	102.9	50.0	W12X19 u	
82	22.63	180.6	0.0	277.1	50.0	W18X35 u	
83	18.74	161.7	0.0	184.2	50.0	W16X26	
84	29.32	7.5	0.0	420.8	50.0	W18X50 u	
85	18.21	10.7	0.0	277.1	50.0	W18X35 u	
86	18.75	48.9	0.0	83.8	50.0	W12X16	
87	18.75	1.2	0.0	102.9	50.0	W12X19 u	
88	18.75	57.1	0.0	83.8	50.0	W12X16	
89	19.62	12.5	0.0	277.1	50.0	W18X35 u	
90	19.03	138.4	0.0	397.5	50.0	W21X44 u	
91	22.49	66.9	0.0	277.1	50.0	W18X35 u	
92	32.00	452.7	0.0	833.3	50.0	W24X76 u	
93	32.00	424.7	-71.9	833.3	50.0	W24X76	
	8.00	0.0	-71.9				

Floor Type: FLOOR 3.1 3.2

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs

Floor Type: FLR 3

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	22.49	138.8	0.0	277.1	50.0	W18X35 u	
2	18.97	262.8	0.0	326.7	50.0	W18X40	
5	20.35	31.5	0.0	277.1	50.0	W18X35 u	
4	8.00	0.0	-143.9				
	32.00	35.7	-143.9	445.8	50.0	W21X48 u	
6	18.75	334.3	0.0	397.5	50.0	W21X44	
7	32.00	80.3	0.0	445.8	50.0	W21X48 u	
8	18.75	441.0	0.0	562.5	50.0	W24X55	
9	18.75	324.4	0.0	397.5	50.0	W21X44	
12	29.29	2.8	0.0	102.9	50.0	W12X19 u	
15	22.36	141.9	0.0	277.1	50.0	W18X35 u	
16	17.52	23.4	0.0	277.1	50.0	W18X35 u	
17	18.03	281.8	0.0	326.7	50.0	W18X40	
18	22.63	338.5	0.0	397.5	50.0	W21X44	
19	16.00	225.9	0.0	397.5	50.0	W21X44 u	
20	18.67	436.8	0.0	562.5	50.0	W24X55	
21	16.00	207.7	0.0	397.5	50.0	W21X44 u	
22	22.63	401.5	0.0	458.3	50.0	W21X50	
29	18.75	322.5	0.0	397.5	50.0	W21X44	
25	8.00	0.0	-127.4				
	32.00	39.6	-127.4	445.8	50.0	W21X48 u	
30	18.67	338.7	0.0	562.5	50.0	W24X55 u	

Beam Summary

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Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
32	18.83	338.1	0.0	562.5	50.0	W24X55 u	
34	18.75	321.7	0.0	397.5	50.0	W21X44	
35	32.00	80.3	0.0	445.8	50.0	W21X48 u	
40	20.00	93.3	0.0	138.3	50.0	W14X22	
41	10.00	14.6	0.0	37.0	50.0	W8X10	
43	10.00	9.3	0.0	37.0	50.0	W8X10	
46	21.25	111.6	0.0	184.2	50.0	W16X26	
47	10.00	2.2	0.0	102.9	50.0	W12X19 u	
48	19.75	157.6	0.0	184.2	50.0	W16X26	
49	17.50	124.8	0.0	184.2	50.0	W16X26	
50	18.50	1.8	0.0	37.0	50.0	W8X10	
51	12.00	0.3	0.0	37.0	50.0	W8X10	
52	18.50	1.6	0.0	37.0	50.0	W8X10	
53	18.50	156.9	0.0	184.2	50.0	W16X26	
54	18.75	441.0	0.0	562.5	50.0	W24X55	
55	32.00	80.3	0.0	445.8	50.0	W21X48 u	
56	18.67	437.4	0.0	562.5	50.0	W24X55	
57	19.75	0.7	0.0	37.0	50.0	W8X10	
59	17.50	0.5	0.0	37.0	50.0	W8X10	
60	12.00	0.3	0.0	37.0	50.0	W8X10	
61	9.25	87.0	0.0	102.9	50.0	W12X19	
121	29.17	212.6	0.0	277.1	50.0	W18X35	
62	18.83	444.6	0.0	562.5	50.0	W24X55	
64	18.75	441.0	0.0	562.5	50.0	W24X55	
65	32.00	37.2	-140.9	445.8	50.0	W21X48 u	
	8.00	0.0	-140.9				
66	19.75	8.3	0.0	72.5	50.0	W12X14 u	
67	17.50	6.5	0.0	72.5	50.0	W12X14 u	
68	20.00	237.3	0.0	277.1	50.0	W18X35	
70	12.00	0.3	0.0	37.0	50.0	W8X10	
71	20.00	215.9	0.0	277.1	50.0	W18X35	
120	9.67	2.1	0.0	102.9	50.0	W12X19 u	
122	4.25	3.6	0.0	37.0	50.0	W8X10	
75	19.75	30.4	0.0	83.8	50.0	W12X16	
76	10.33	10.0	0.0	37.0	50.0	W8X10	
77	10.33	13.5	0.0	37.0	50.0	W8X10	
119	17.00	32.7	0.0	138.3	50.0	W14X22 u	
123	17.50	16.4	0.0	37.0	50.0	W8X10	
124	4.25	3.1	0.0	37.0	50.0	W8X10	
84	4.25	0.4	0.0	37.0	50.0	W8X10	
88	18.83	443.8	0.0	562.5	50.0	W24X55	
125	18.75	324.5	0.0	397.5	50.0	W21X44	
90	22.51	138.4	0.0	277.1	50.0	W18X35 u	
92	18.67	329.2	0.0	562.5	50.0	W24X55 u	
93	22.63	401.7	0.0	458.3	50.0	W21X50	

Beam Summary

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Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
95	16.00	207.7	0.0	397.5	50.0	W21X44 u	
96	18.83	347.0	0.0	562.5	50.0	W24X55 u	
97	16.00	225.9	0.0	397.5	50.0	W21X44 u	
99	18.75	325.4	0.0	397.5	50.0	W21X44	
100	22.63	359.9	0.0	562.5	50.0	W24X55 u	
104	18.74	304.7	0.0	397.5	50.0	W21X44	
105	29.32	2.9	0.0	102.9	50.0	W12X19 u	
106	18.21	25.2	0.0	277.1	50.0	W18X35 u	
109	18.75	324.4	0.0	397.5	50.0	W21X44	
110	18.75	441.0	0.0	562.5	50.0	W24X55	
111	18.75	331.4	0.0	397.5	50.0	W21X44	
112	19.62	29.3	0.0	277.1	50.0	W18X35 u	
113	19.03	264.5	0.0	326.7	50.0	W18X40	
116	22.49	138.8	0.0	277.1	50.0	W18X35 u	
117	32.00	80.3	0.0	445.8	50.0	W21X48 u	
118	32.00	35.2	-149.8	445.8	50.0	W21X48 u	
	8.00	0.0	-149.8				

Floor Type: FLR 2

Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
	ft	kip-ft	kip-ft	kip-ft	ksi		
1	22.49	133.2	0.0	277.1	50.0	W18X35 u	
2	18.97	258.7	0.0	326.7	50.0	W18X40	
5	20.35	26.1	0.0	277.1	50.0	W18X35 u	
4	8.00	0.0	-133.7				
	32.00	27.7	-133.7	445.8	50.0	W21X48 u	
6	18.75	334.3	0.0	397.5	50.0	W21X44	
7	32.00	66.8	0.0	445.8	50.0	W21X48 u	
8	18.75	441.0	0.0	562.5	50.0	W24X55	
9	18.75	322.0	0.0	397.5	50.0	W21X44	
12	29.29	2.8	0.0	102.9	50.0	W12X19 u	
15	22.36	136.4	0.0	277.1	50.0	W18X35 u	
16	17.52	19.3	0.0	277.1	50.0	W18X35 u	
17	18.03	281.8	0.0	326.7	50.0	W18X40	
18	22.63	338.5	0.0	397.5	50.0	W21X44	
19	16.00	225.9	0.0	397.5	50.0	W21X44 u	
20	18.67	436.8	0.0	562.5	50.0	W24X55	
21	16.00	207.7	0.0	397.5	50.0	W21X44 u	
22	22.63	401.5	0.0	458.3	50.0	W21X50	
29	18.75	322.5	0.0	397.5	50.0	W21X44	
25	8.00	0.0	-118.2				
	32.00	31.2	-118.2	445.8	50.0	W21X48 u	
30	18.67	338.7	0.0	562.5	50.0	W24X55 u	
32	18.83	338.1	0.0	562.5	50.0	W24X55 u	
34	18.75	319.8	0.0	397.5	50.0	W21X44	

Beam Summary

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Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
35	32.00	65.1	0.0	256.3	50.0	W14X38	
40	20.00	93.3	0.0	138.3	50.0	W14X22	
41	10.00	14.6	0.0	37.0	50.0	W8X10	
43	10.00	9.3	0.0	37.0	50.0	W8X10	
46	21.25	111.6	0.0	184.2	50.0	W16X26	
47	10.00	2.2	0.0	102.9	50.0	W12X19 u	
48	19.75	157.6	0.0	184.2	50.0	W16X26	
49	17.50	124.8	0.0	184.2	50.0	W16X26	
50	18.50	1.8	0.0	37.0	50.0	W8X10	
51	12.00	0.3	0.0	37.0	50.0	W8X10	
52	18.50	1.6	0.0	37.0	50.0	W8X10	
53	18.50	156.9	0.0	184.2	50.0	W16X26	
54	18.75	441.0	0.0	562.5	50.0	W24X55	
55	32.00	66.8	0.0	445.8	50.0	W21X48 u	
56	18.67	437.4	0.0	562.5	50.0	W24X55	
57	19.75	0.7	0.0	37.0	50.0	W8X10	
59	17.50	0.5	0.0	37.0	50.0	W8X10	
60	12.00	0.3	0.0	37.0	50.0	W8X10	
61	9.25	87.0	0.0	102.9	50.0	W12X19	
74	29.17	212.6	0.0	277.1	50.0	W18X35 u	
62	18.83	444.6	0.0	562.5	50.0	W24X55	
64	18.75	441.0	0.0	562.5	50.0	W24X55	
65	32.00	27.9	-130.8	326.7	50.0	W18X40	
	8.00	0.0	-130.8				
66	19.75	8.3	0.0	72.5	50.0	W12X14 u	
67	17.50	6.5	0.0	72.5	50.0	W12X14 u	
68	20.00	237.3	0.0	277.1	50.0	W18X35	
70	12.00	0.3	0.0	37.0	50.0	W8X10	
71	20.00	215.9	0.0	277.1	50.0	W18X35 u	
122	9.67	2.1	0.0	102.9	50.0	W12X19 u	
123	4.25	3.6	0.0	37.0	50.0	W8X10	
75	19.75	30.4	0.0	83.8	50.0	W12X16	
76	10.33	10.0	0.0	37.0	50.0	W8X10	
77	10.33	13.5	0.0	37.0	50.0	W8X10	
121	17.00	32.7	0.0	138.3	50.0	W14X22 u	
119	17.50	16.4	0.0	37.0	50.0	W8X10	
120	4.25	3.1	0.0	37.0	50.0	W8X10	
84	4.25	0.4	0.0	37.0	50.0	W8X10	
88	18.83	443.8	0.0	562.5	50.0	W24X55	
89	18.75	322.1	0.0	397.5	50.0	W21X44	
90	22.51	132.8	0.0	277.1	50.0	W18X35 u	
92	18.67	329.2	0.0	562.5	50.0	W24X55 u	
93	22.63	401.7	0.0	458.3	50.0	W21X50	
95	16.00	207.7	0.0	397.5	50.0	W21X44 u	
96	18.83	347.0	0.0	562.5	50.0	W24X55 u	

Beam Summary

RAM Steel v11.2 — Page 12/12
DataBase: Takeoff Model - PLANKS — 04/08/08 04:28:46
Building Code: IBC — Steel Code: AISC LRFD

Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
97	16.00	225.9	0.0	397.5	50.0	W21X44 u	
99	18.75	325.4	0.0	397.5	50.0	W21X44	
100	22.63	359.9	0.0	562.5	50.0	W24X55 u	
104	18.74	304.7	0.0	397.5	50.0	W21X44	
105	29.32	2.9	0.0	102.9	50.0	W12X19 u	
106	18.21	20.7	0.0	225.0	50.0	W16X31 u	
109	18.75	322.0	0.0	397.5	50.0	W21X44	
110	18.75	441.0	0.0	562.5	50.0	W24X55	
111	18.75	331.4	0.0	397.5	50.0	W21X44	
112	19.62	23.1	0.0	70.8	50.0	W8X18	
113	19.03	260.4	0.0	326.7	50.0	W18X40	
116	22.49	133.2	0.0	277.1	50.0	W18X35 u	
117	32.00	65.1	0.0	256.3	50.0	W14X38	
118	32.00	26.6	-138.0	326.7	50.0	W18X40	
	8.00	0.0	-138.0				

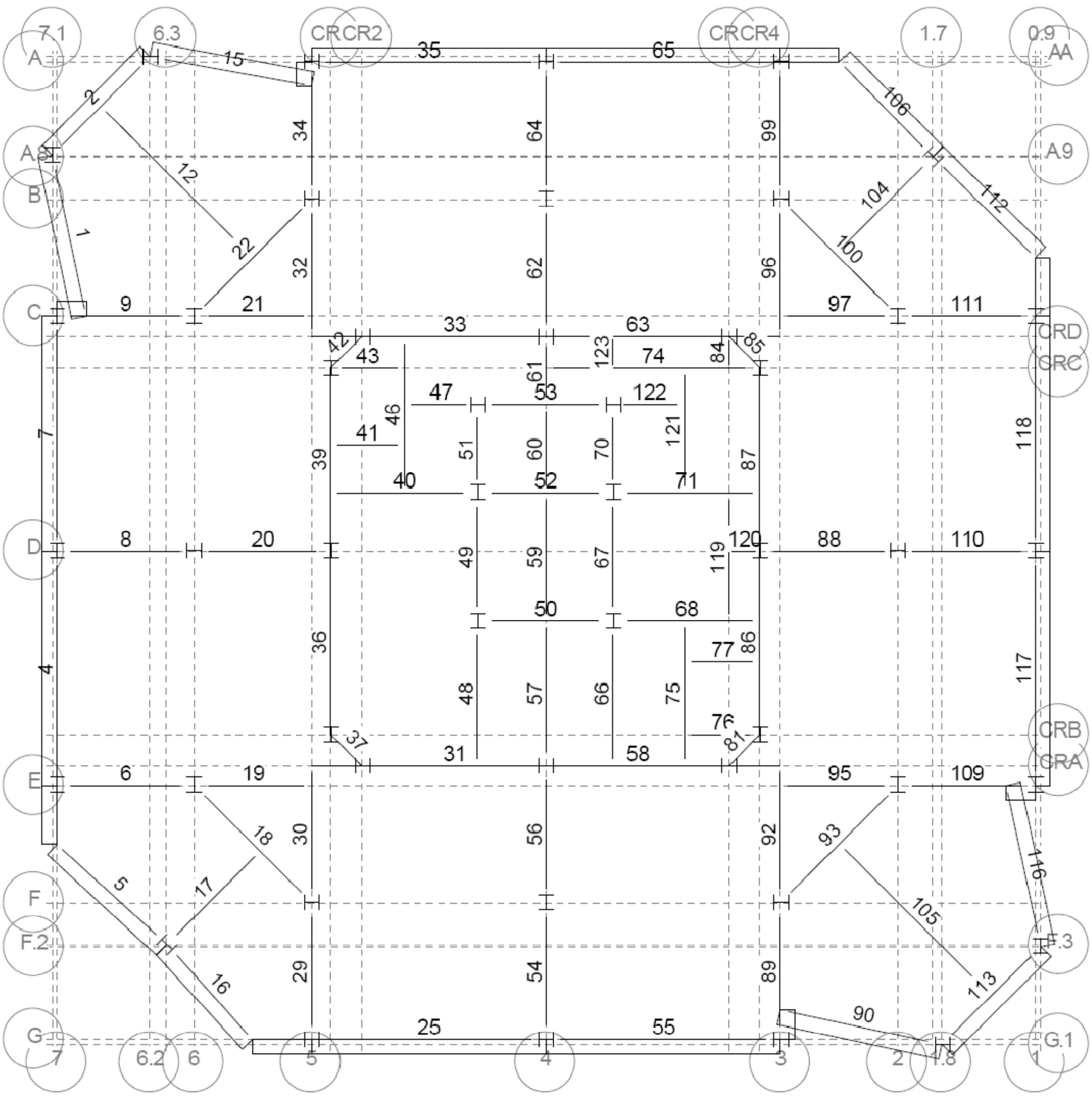
* after Size denotes beam failed stress/capacity criteria.
\# after Size denotes beam failed deflection criteria.
u after Size denotes this size has been assigned by the User.

Floor Map

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS
Building Code: IBC

04/08/08 04:13:45
Steel Code: AISC LRFD

Floor Type: FLR 2

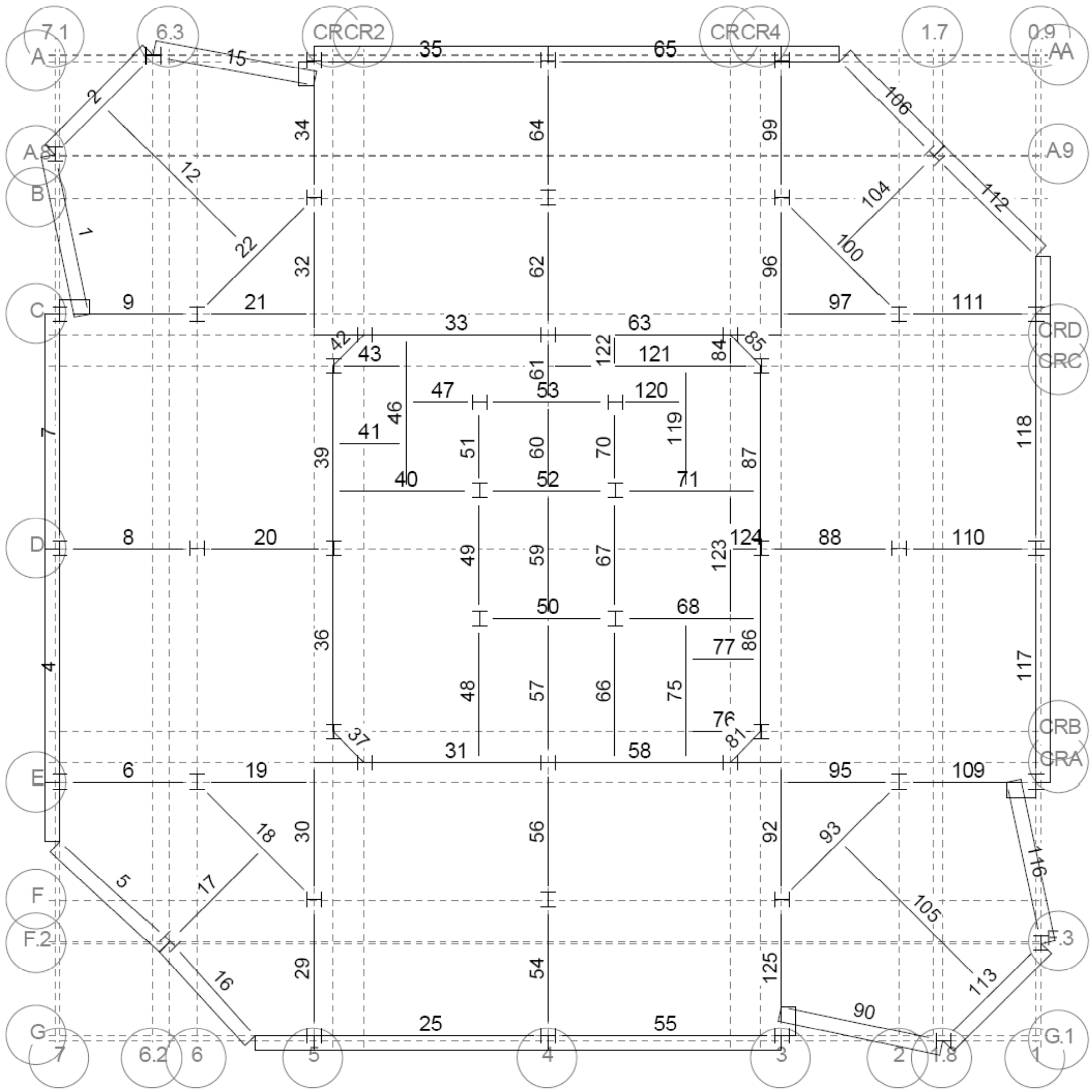


Floor Map

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS
Building Code: IBC

04/08/08 04:13:45
Steel Code: AISC LRFD

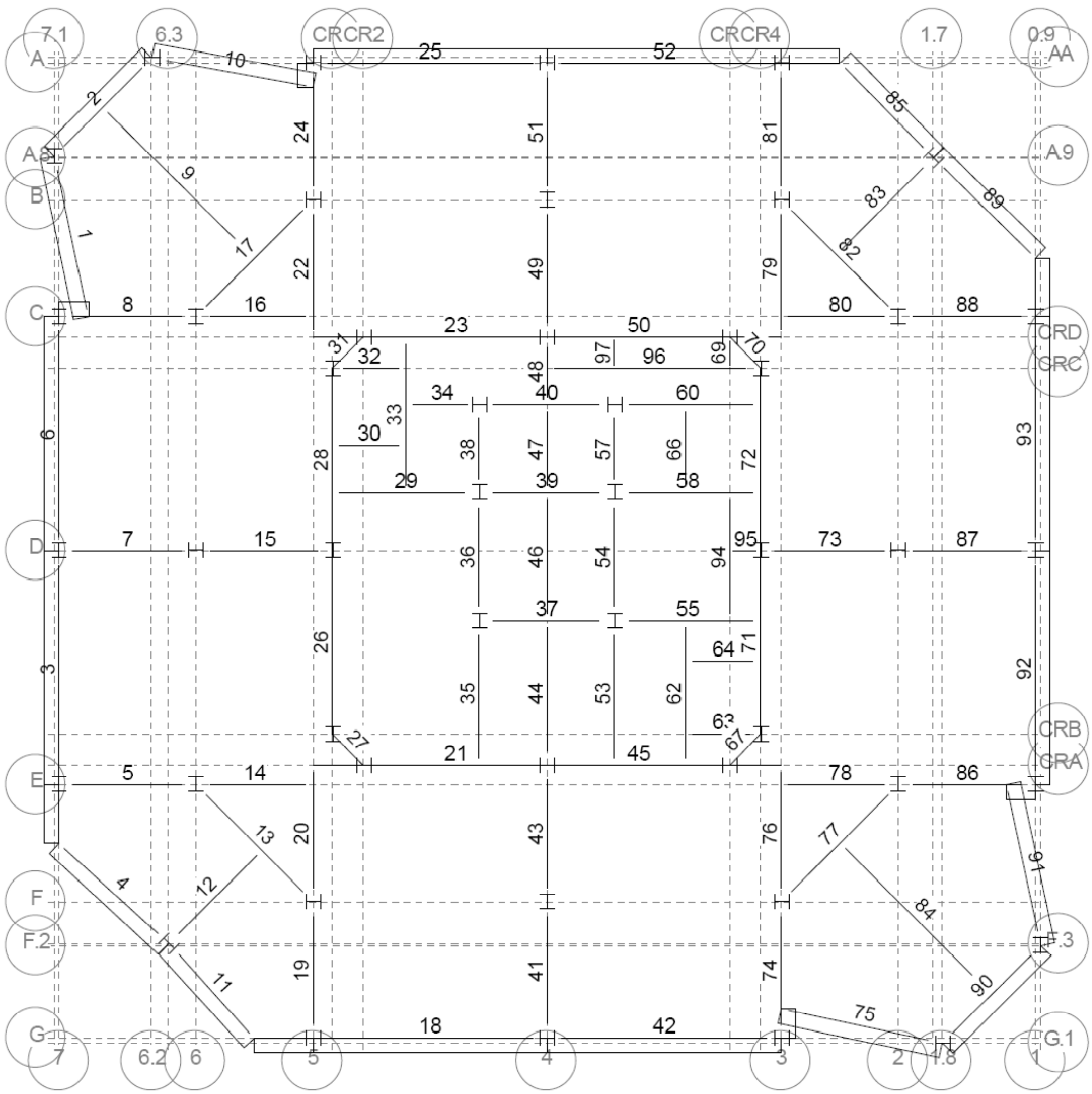
Floor Type: FLR 3



Floor Map

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS 04/08/08 04:13:45
Building Code: IBC Steel Code: AISC LRFD

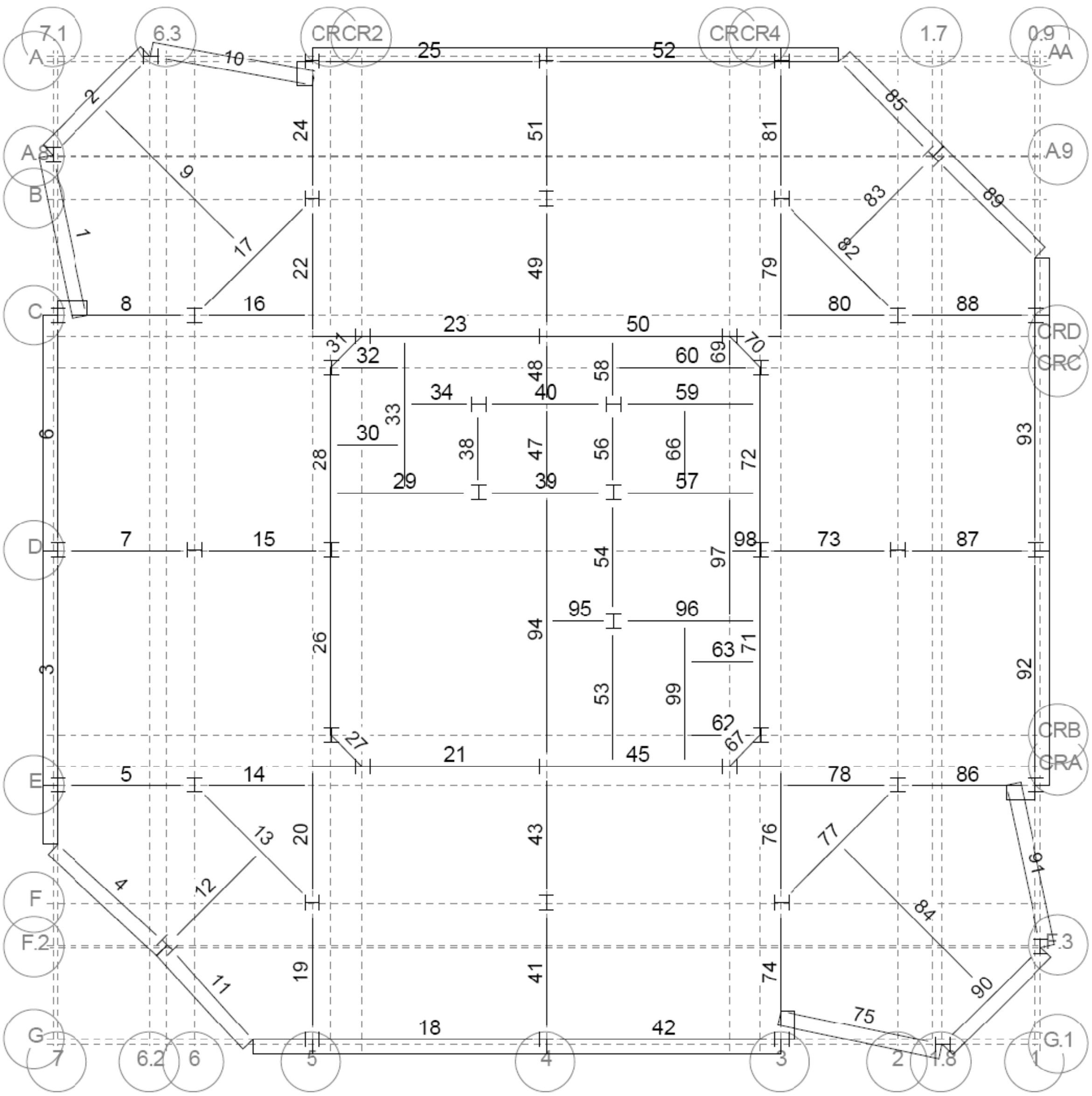
Floor Type: FLR 4 TO 23



Floor Map

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS 04/08/08 04:13:45
Building Code: IBC Steel Code: AISC LRFD

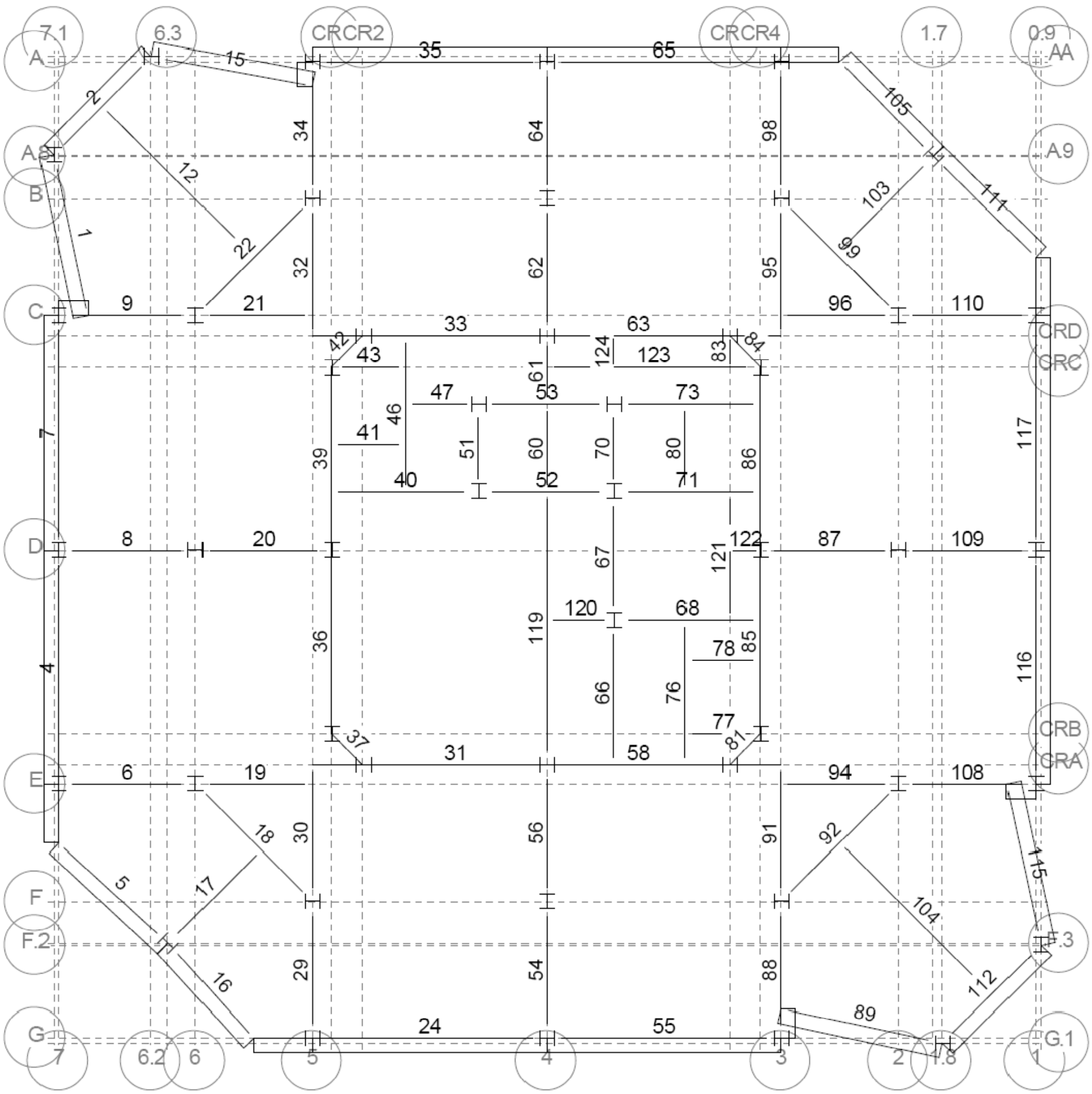
Floor Type: FLR 24 TO 39



Floor Map

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS 04/08/08 04:13:45
Building Code: IBC Steel Code: AISC LRFD

Floor Type: FLR 40 M

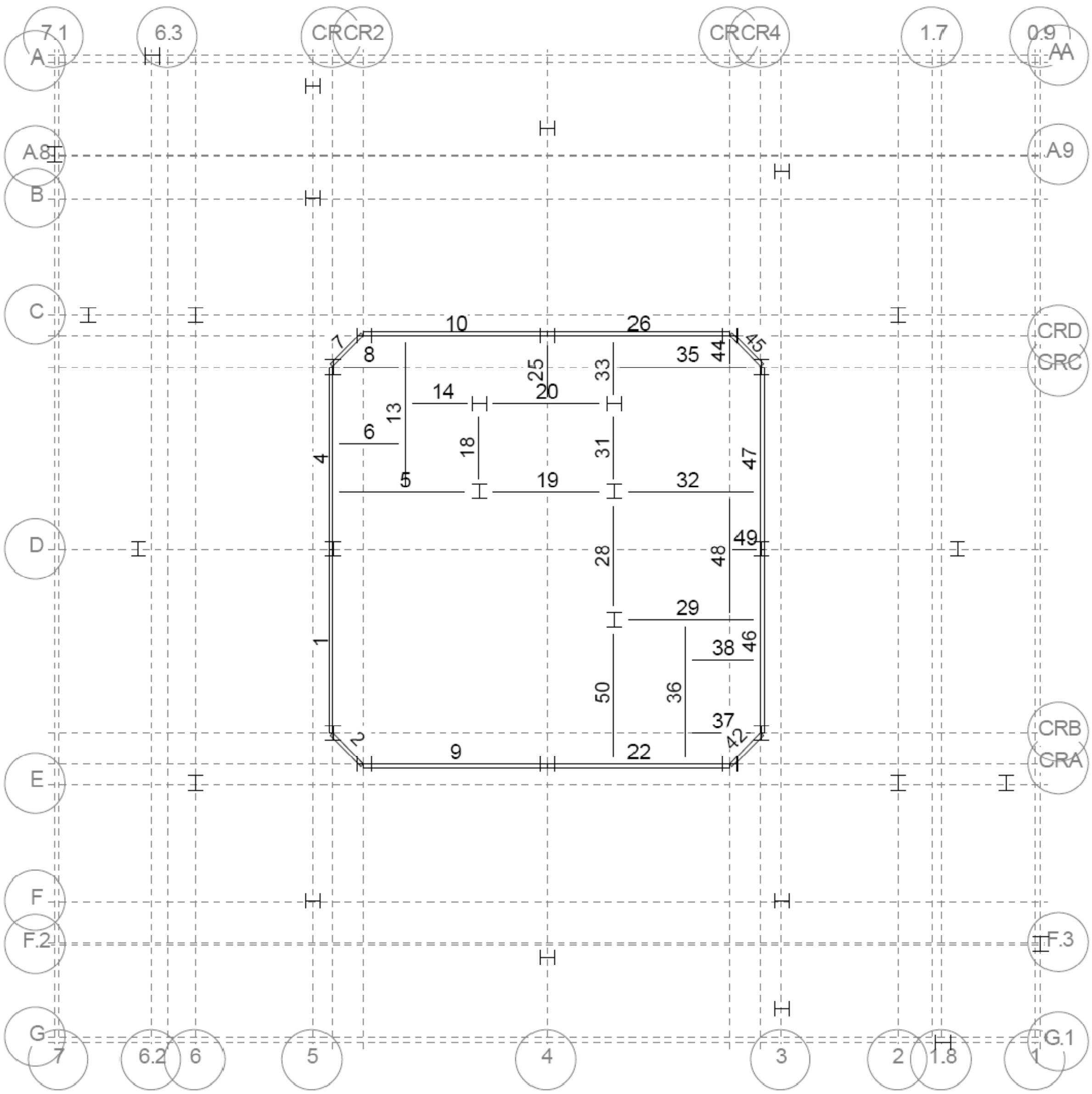


Floor Map

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS
Building Code: IBC

04/08/08 04:13:45
Steel Code: AISC LRFD

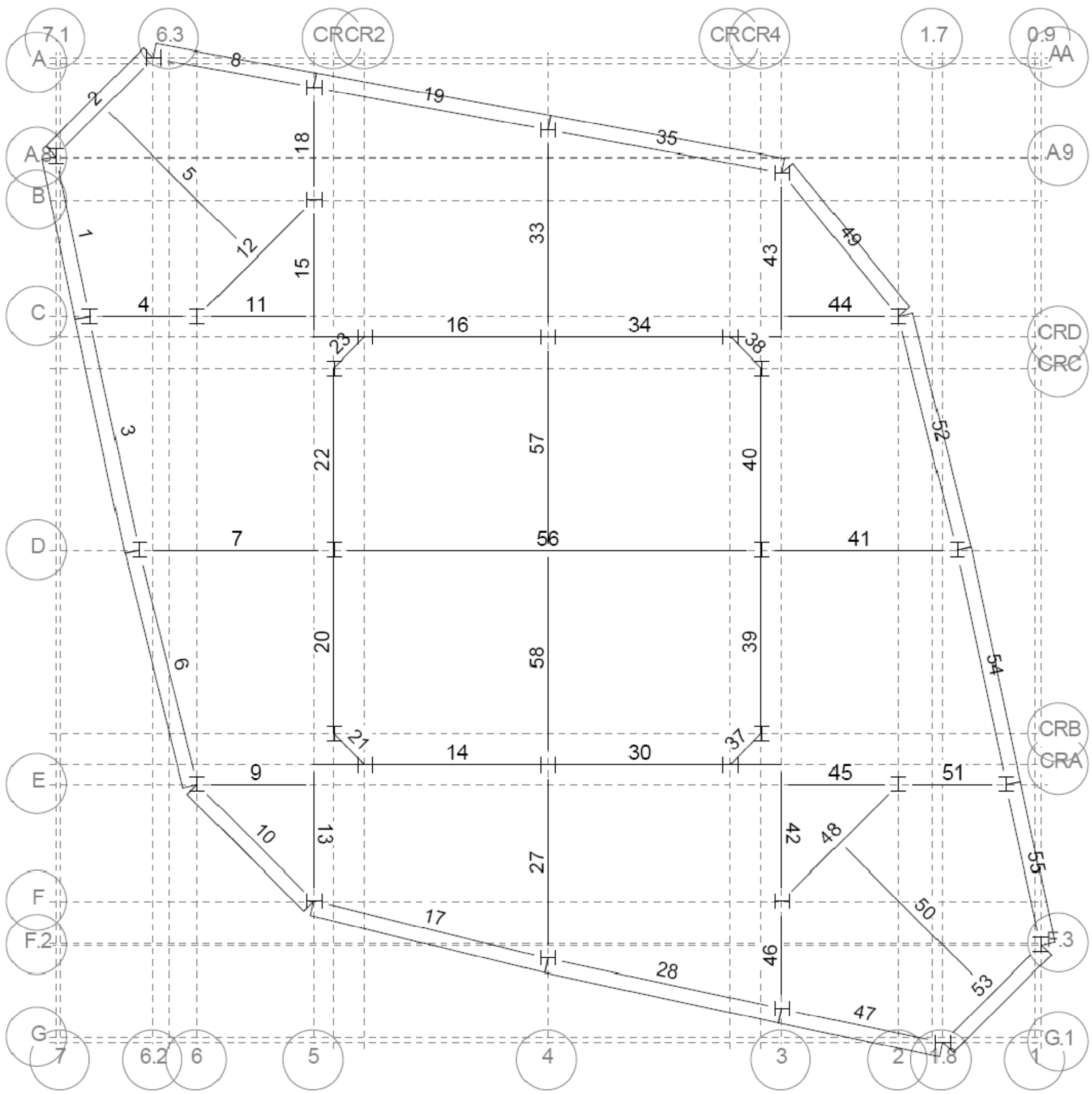
Floor Type: FLR 41 M



Floor Map

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS 04/08/08 04:13:45
Building Code: IBC Steel Code: AISC LRFD

Floor Type: ROOF



Gravity Column Design Summary

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS 04/08/08 04:28:40
Building Code: IBC Steel Code: AISC LRFD

Column Line 7.1 - A.9

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	42.0	1.7	7.2	2	0.42 Eq H1-1a	90.0	50	W14X43
FLOOR 41M	42.5	1.7	7.2	2	0.43 Eq H1-1a	90.0	50	W14X43
FLOOR 40M	105.5	1.1	7.8	3	0.50 Eq H1-1a	90.0	50	W14X43
FLOOR 39	137.9	1.1	4.2	3	0.42 Eq H1-1a	90.0	50	W14X43
FLOOR 38	172.8	1.0	3.5	3	0.50 Eq H1-1a	90.0	50	W14X43
FLOOR 37	208.2	0.9	3.4	3	0.59 Eq H1-1a	90.0	50	W14X43
FLOOR 36	243.9	0.9	3.4	3	0.68 Eq H1-1a	90.0	50	W14X43
FLOOR 35	279.7	0.8	3.4	3	0.77 Eq H1-1a	90.0	50	W14X43
FLOOR 34	315.6	0.8	3.3	3	0.86 Eq H1-1a	90.0	50	W14X43
FLOOR 33	351.4	0.8	3.3	3	0.95 Eq H1-1a	90.0	50	W14X43
FLOOR 32	387.5	0.8	3.8	3	0.65 Eq H1-1a	90.0	50	W14X61
FLOOR 31	423.6	0.8	3.8	3	0.70 Eq H1-1a	90.0	50	W14X61
FLOOR 30	459.6	0.8	3.8	3	0.76 Eq H1-1a	90.0	50	W14X61
FLOOR 29	495.7	0.8	3.8	3	0.82 Eq H1-1a	90.0	50	W14X61
FLOOR 28	532.5	0.8	3.8	3	0.78 Eq H1-1a	90.0	50	W14X68
FLOOR 27	569.8	0.8	3.8	3	0.84 Eq H1-1a	90.0	50	W14X68
FLOOR 26	607.1	0.8	3.8	3	0.89 Eq H1-1a	90.0	50	W14X68
FLOOR 25	644.4	0.8	3.8	3	0.94 Eq H1-1a	90.0	50	W14X68
FLOOR 24	681.8	0.8	3.8	3	0.83 Eq H1-1a	90.0	50	W14X82
FLOOR 23	719.3	0.8	3.8	3	0.87 Eq H1-1a	90.0	50	W14X82
FLOOR 22	756.8	0.8	3.8	3	0.91 Eq H1-1a	90.0	50	W14X82
FLOOR 21	794.2	0.8	3.8	3	0.96 Eq H1-1a	90.0	50	W14X82
FLOOR 20	831.8	0.8	4.9	3	0.82 Eq H1-1a	90.0	50	W14X90
FLOOR 19	869.4	0.8	4.9	3	0.86 Eq H1-1a	90.0	50	W14X90
FLOOR 18	907.0	0.8	4.9	3	0.89 Eq H1-1a	90.0	50	W14X90
FLOOR 17	944.5	0.8	4.9	3	0.93 Eq H1-1a	90.0	50	W14X90
FLOOR 16	982.2	0.8	4.9	3	0.88 Eq H1-1a	90.0	50	W14X99
FLOOR 15	1019.9	0.8	4.9	3	0.91 Eq H1-1a	90.0	50	W14X99
FLOOR 14	1057.6	0.8	4.9	3	0.94 Eq H1-1a	90.0	50	W14X99
FLOOR 13	1095.3	0.8	4.9	3	0.98 Eq H1-1a	90.0	50	W14X99
FLOOR 12	1133.2	0.8	5.0	3	0.83 Eq H1-1a	90.0	50	W14X120
FLOOR 11	1171.2	0.8	5.0	3	0.86 Eq H1-1a	90.0	50	W14X120
FLOOR 10	1209.1	0.8	5.0	3	0.89 Eq H1-1a	90.0	50	W14X120
FLOOR 9	1247.1	0.8	5.0	3	0.91 Eq H1-1a	90.0	50	W14X120
FLOOR 8	1285.2	0.8	5.0	3	0.86 Eq H1-1a	90.0	50	W14X132
FLOOR 7	1323.3	0.8	5.0	3	0.88 Eq H1-1a	90.0	50	W14X132
FLOOR 6	1361.4	0.8	5.0	3	0.91 Eq H1-1a	90.0	50	W14X132
FLOOR 5	1399.5	1.2	7.5	3	0.94 Eq H1-1a	90.0	50	W14X132
FLOOR 4	1438.9	1.8	4.2	3	0.94 Eq H1-1a	90.0	50	W14X233
FLOOR 3.2	1441.9	1.8	4.2	3	0.95 Eq H1-1a	90.0	50	W14X233
FLOOR 3.1	1444.9	1.8	4.2	3	0.95 Eq H1-1a	90.0	50	W14X233
FLOOR 3	1507.0	3.9	12.6	3	0.84 Eq H1-1a	90.0	50	W14X159
FLOOR 2	1568.4	0.3	6.5	1	0.95 Eq H1-1a	90.0	50	W14X159

Gravity Column Design Summary

RAM Steel v11.2 Page 2/37
DataBase: Takeoff Model - PLANKS 04/08/08 04:28:40
Building Code: IBC Steel Code: AISC LRFD

Column Line 7 - E

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	63.5	0.0	0.0	1	0.23 Eq H1-1a	90.0	50	W14X43
FLOOR 39	140.7	0.0	0.0	1	0.36 Eq H1-1a	90.0	50	W14X43
FLOOR 38	219.5	0.0	0.0	1	0.56 Eq H1-1a	90.0	50	W14X43
FLOOR 37	297.4	0.0	0.0	1	0.76 Eq H1-1a	90.0	50	W14X43
FLOOR 36	375.0	0.0	0.0	1	0.60 Eq H1-1a	90.0	50	W14X61
FLOOR 35	452.2	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W14X61
FLOOR 34	529.2	0.0	0.0	1	0.84 Eq H1-1a	90.0	50	W14X61
FLOOR 33	607.0	0.0	0.0	1	0.97 Eq H1-1a	90.0	50	W14X61
FLOOR 32	686.1	0.0	0.0	1	0.66 Eq H1-1a	90.0	50	W14X90
FLOOR 31	765.3	0.0	0.0	1	0.74 Eq H1-1a	90.0	50	W14X90
FLOOR 30	844.5	0.0	0.0	1	0.82 Eq H1-1a	90.0	50	W14X90
FLOOR 29	923.6	0.0	0.0	1	0.89 Eq H1-1a	90.0	50	W14X90
FLOOR 28	1003.1	0.0	0.0	1	0.80 Eq H1-1a	90.0	50	W14X109
FLOOR 27	1082.5	0.0	0.0	1	0.86 Eq H1-1a	90.0	50	W14X109
FLOOR 26	1162.0	0.0	0.0	1	0.93 Eq H1-1a	90.0	50	W14X109
FLOOR 25	1241.4	0.0	0.0	1	0.99 Eq H1-1a	90.0	50	W14X109
FLOOR 24	1321.4	0.0	0.0	1	0.78 Eq H1-1a	90.0	50	W14X145
FLOOR 23	1401.3	0.0	0.0	1	0.83 Eq H1-1a	90.0	50	W14X145
FLOOR 22	1481.3	0.0	0.0	1	0.88 Eq H1-1a	90.0	50	W14X145
FLOOR 21	1561.3	0.0	0.0	1	0.92 Eq H1-1a	90.0	50	W14X145
FLOOR 20	1641.7	0.0	0.0	1	0.80 Eq H1-1a	90.0	50	W14X176
FLOOR 19	1722.1	0.0	0.0	1	0.84 Eq H1-1a	90.0	50	W14X176
FLOOR 18	1802.6	0.0	0.0	1	0.88 Eq H1-1a	90.0	50	W14X176
FLOOR 17	1883.0	0.0	0.0	1	0.92 Eq H1-1a	90.0	50	W14X176
FLOOR 16	1963.6	0.0	0.0	1	0.87 Eq H1-1a	90.0	50	W14X193
FLOOR 15	2044.3	0.0	0.0	1	0.91 Eq H1-1a	90.0	50	W14X193
FLOOR 14	2125.0	0.0	0.0	1	0.94 Eq H1-1a	90.0	50	W14X193
FLOOR 13	2205.7	0.0	0.0	1	0.98 Eq H1-1a	90.0	50	W14X193
FLOOR 12	2286.9	0.0	0.0	1	0.84 Eq H1-1a	90.0	50	W14X233
FLOOR 11	2368.2	0.0	0.0	1	0.87 Eq H1-1a	90.0	50	W14X233
FLOOR 10	2449.4	0.0	0.0	1	0.90 Eq H1-1a	90.0	50	W14X233
FLOOR 9	2530.7	0.0	0.0	1	0.93 Eq H1-1a	90.0	50	W14X233
FLOOR 8	2612.3	0.0	0.0	1	0.87 Eq H1-1a	90.0	50	W14X257
FLOOR 7	2693.9	0.0	0.0	1	0.90 Eq H1-1a	90.0	50	W14X257
FLOOR 6	2775.5	0.0	0.0	1	0.92 Eq H1-1a	90.0	50	W14X257
FLOOR 5	2857.1	0.0	0.0	1	0.95 Eq H1-1a	90.0	50	W14X257
FLOOR 4	2941.3	0.0	0.0	1	0.98 Eq H1-1a	90.0	50	W14X426
FLOOR 3.2	2947.6	0.0	0.0	1	0.98 Eq H1-1a	90.0	50	W14X426
FLOOR 3.1	2954.0	0.0	0.0	1	0.98 Eq H1-1a	90.0	50	W14X426
FLOOR 3	3037.2	0.0	0.0	1	0.83 Eq H1-1a	90.0	50	W14X311
FLOOR 2	3130.8	0.0	0.0	1	0.94 Eq H1-1a	90.0	50	W14X311

Gravity Column Design Summary

RAM Steel v11.2 Page 3/37
DataBase: Takeoff Model - PLANKS 04/08/08 04:28:40
Building Code: IBC Steel Code: AISC LRFD

Column Line 7 - D

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	102.6	2.5	52.3	2	0.98 Eq H1-1a	90.0	50	W14X48
FLOOR 39	197.5	4.7	0.1	2	0.47 Eq H1-1a	90.0	50	W14X48
FLOOR 38	296.4	4.1	0.1	2	0.69 Eq H1-1a	90.0	50	W14X48
FLOOR 37	394.7	3.9	0.1	2	0.91 Eq H1-1a	90.0	50	W14X48
FLOOR 36	493.1	3.8	0.1	2	0.59 Eq H1-1a	90.0	50	W14X82
FLOOR 35	594.1	3.8	0.1	2	0.71 Eq H1-1a	90.0	50	W14X82
FLOOR 34	695.4	3.8	0.1	2	0.83 Eq H1-1a	90.0	50	W14X82
FLOOR 33	796.6	3.8	0.1	2	0.95 Eq H1-1a	90.0	50	W14X82
FLOOR 32	898.2	3.8	0.1	2	0.72 Eq H1-1a	90.0	50	W14X109
FLOOR 31	999.8	3.8	0.1	2	0.80 Eq H1-1a	90.0	50	W14X109
FLOOR 30	1101.4	3.8	0.1	2	0.88 Eq H1-1a	90.0	50	W14X109
FLOOR 29	1203.0	3.8	0.1	2	0.96 Eq H1-1a	90.0	50	W14X109
FLOOR 28	1305.0	3.9	0.1	2	0.78 Eq H1-1a	90.0	50	W14X145
FLOOR 27	1407.1	3.9	0.1	2	0.84 Eq H1-1a	90.0	50	W14X145
FLOOR 26	1509.1	3.9	0.1	2	0.90 Eq H1-1a	90.0	50	W14X145
FLOOR 25	1611.1	3.9	0.1	2	0.96 Eq H1-1a	90.0	50	W14X145
FLOOR 24	1713.6	4.0	0.1	2	0.84 Eq H1-1a	90.0	50	W14X176
FLOOR 23	1816.0	4.0	0.1	2	0.89 Eq H1-1a	90.0	50	W14X176
FLOOR 22	1918.4	4.0	0.1	2	0.94 Eq H1-1a	90.0	50	W14X176
FLOOR 21	2020.9	4.0	0.1	2	0.99 Eq H1-1a	90.0	50	W14X176
FLOOR 20	2123.7	4.0	0.1	2	0.87 Eq H1-1a	90.0	50	W14X211
FLOOR 19	2226.6	4.0	0.1	2	0.91 Eq H1-1a	90.0	50	W14X211
FLOOR 18	2329.4	4.0	0.1	2	0.95 Eq H1-1a	90.0	50	W14X211
FLOOR 17	2432.3	4.0	0.1	2	0.99 Eq H1-1a	90.0	50	W14X211
FLOOR 16	2535.8	4.2	0.1	2	0.85 Eq H1-1a	90.0	50	W14X257
FLOOR 15	2639.2	4.2	0.1	2	0.88 Eq H1-1a	90.0	50	W14X257
FLOOR 14	2742.6	4.2	0.1	2	0.91 Eq H1-1a	90.0	50	W14X257
FLOOR 13	2846.1	4.2	0.1	2	0.95 Eq H1-1a	90.0	50	W14X257
FLOOR 12	2949.9	4.2	0.1	2	0.89 Eq H1-1a	90.0	50	W14X283
FLOOR 11	3053.6	4.2	0.1	2	0.92 Eq H1-1a	90.0	50	W14X283
FLOOR 10	3157.4	4.2	0.1	2	0.95 Eq H1-1a	90.0	50	W14X283
FLOOR 9	3261.2	4.2	0.1	2	0.99 Eq H1-1a	90.0	50	W14X283
FLOOR 8	3365.7	4.4	0.1	2	0.84 Eq H1-1a	90.0	50	W14X342
FLOOR 7	3470.2	4.4	0.1	2	0.86 Eq H1-1a	90.0	50	W14X342
FLOOR 6	3574.7	4.4	0.1	2	0.89 Eq H1-1a	90.0	50	W14X342
FLOOR 5	3679.3	6.6	0.1	2	0.92 Eq H1-1a	90.0	50	W14X342
FLOOR 4	3786.5	0.7	25.1	1	0.95 Eq H1-1a	90.0	50	W14X550
FLOOR 3.2	3793.6	0.7	25.2	1	0.95 Eq H1-1a	90.0	50	W14X550
FLOOR 3.1	3800.6	0.7	25.2	1	0.96 Eq H1-1a	90.0	50	W14X550
FLOOR 3	3893.7	2.1	50.0	1	0.86 Eq H1-1a	90.0	50	W14X398
FLOOR 2	3986.8	1.0	26.2	1	0.94 Eq H1-1a	90.0	50	W14X398

Gravity Column Design Summary

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Column Line 7 - C

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	102.1	20.1	53.0	1	0.93 Eq H1-1a	90.0	50	W14X53
FLOOR 39	158.6	25.2	3.2	1	0.54 Eq H1-1a	90.0	50	W14X43
FLOOR 38	218.1	20.7	2.7	1	0.67 Eq H1-1a	90.0	50	W14X43
FLOOR 37	277.7	20.4	2.6	1	0.82 Eq H1-1a	90.0	50	W14X43
FLOOR 36	337.4	20.4	3.0	1	0.61 Eq H1-1a	90.0	50	W14X61
FLOOR 35	397.0	20.2	3.0	1	0.70 Eq H1-1a	90.0	50	W14X61
FLOOR 34	456.5	20.1	3.0	1	0.80 Eq H1-1a	90.0	50	W14X61
FLOOR 33	515.9	20.0	3.0	1	0.89 Eq H1-1a	90.0	50	W14X61
FLOOR 32	577.3	20.4	3.0	1	0.73 Eq H1-1a	90.0	50	W14X82
FLOOR 31	638.8	20.4	3.0	1	0.80 Eq H1-1a	90.0	50	W14X82
FLOOR 30	700.2	20.4	3.0	1	0.88 Eq H1-1a	90.0	50	W14X82
FLOOR 29	761.6	20.4	3.0	1	0.95 Eq H1-1a	90.0	50	W14X82
FLOOR 28	823.3	20.3	3.9	1	0.76 Eq H1-1a	90.0	50	W14X99
FLOOR 27	884.9	20.3	3.9	1	0.82 Eq H1-1a	90.0	50	W14X99
FLOOR 26	946.6	20.3	3.9	1	0.87 Eq H1-1a	90.0	50	W14X99
FLOOR 25	1008.3	20.3	3.9	1	0.92 Eq H1-1a	90.0	50	W14X99
FLOOR 24	1070.2	20.7	3.9	1	0.81 Eq H1-1a	90.0	50	W14X120
FLOOR 23	1132.1	20.7	3.9	1	0.85 Eq H1-1a	90.0	50	W14X120
FLOOR 22	1194.1	20.7	3.9	1	0.90 Eq H1-1a	90.0	50	W14X120
FLOOR 21	1256.0	20.7	3.9	1	0.94 Eq H1-1a	90.0	50	W14X120
FLOOR 20	1318.3	21.0	4.1	1	0.81 Eq H1-1a	90.0	50	W14X145
FLOOR 19	1380.6	21.0	4.1	1	0.84 Eq H1-1a	90.0	50	W14X145
FLOOR 18	1442.8	21.0	4.1	1	0.88 Eq H1-1a	90.0	50	W14X145
FLOOR 17	1505.1	21.0	4.1	1	0.92 Eq H1-1a	90.0	50	W14X145
FLOOR 16	1567.5	21.2	4.1	1	0.87 Eq H1-1a	90.0	50	W14X159
FLOOR 15	1630.0	21.2	4.1	1	0.91 Eq H1-1a	90.0	50	W14X159
FLOOR 14	1692.4	21.2	4.1	1	0.94 Eq H1-1a	90.0	50	W14X159
FLOOR 13	1754.8	21.2	4.1	1	0.97 Eq H1-1a	90.0	50	W14X159
FLOOR 12	1817.5	21.4	4.1	1	0.91 Eq H1-1a	90.0	50	W14X176
FLOOR 11	1880.1	21.4	4.1	1	0.94 Eq H1-1a	90.0	50	W14X176
FLOOR 10	1942.8	21.4	4.1	1	0.97 Eq H1-1a	90.0	50	W14X176
FLOOR 9	2005.5	21.4	4.1	1	1.00 Eq H1-1a	90.0	50	W14X176
FLOOR 8	2068.5	21.9	4.2	1	0.86 Eq H1-1a	90.0	50	W14X211
FLOOR 7	2131.6	21.9	4.2	1	0.88 Eq H1-1a	90.0	50	W14X211
FLOOR 6	2194.7	21.7	4.3	1	0.91 Eq H1-1a	90.0	50	W14X211
FLOOR 5	2258.1	32.8	6.5	1	0.95 Eq H1-1a	90.0	50	W14X211
FLOOR 4	2323.0	11.9	15.8	1	0.92 Eq H1-1a	90.0	50	W14X370
FLOOR 3.2	2327.7	11.9	15.8	1	0.92 Eq H1-1a	90.0	50	W14X370
FLOOR 3.1	2332.5	11.9	15.9	1	0.92 Eq H1-1a	90.0	50	W14X370
FLOOR 3	2398.3	5.8	35.7	1	0.84 Eq H1-1a	90.0	50	W14X257
FLOOR 2	2463.3	2.5	18.3	1	0.92 Eq H1-1a	90.0	50	W14X257

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Column Line 4.00ft - 98.75ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	67.4	26.1	2.3	1	0.82 Eq H1-1a	90.0	50	W10X33
FLOOR 41M	67.8	26.1	2.3	1	0.82 Eq H1-1a	90.0	50	W10X33

Column Line 10.79ft - 66.75ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	93.2	4.2	0.3	1	0.89 Eq H1-1a	90.0	50	W10X33
FLOOR 41M	93.6	4.2	0.3	1	0.89 Eq H1-1a	90.0	50	W10X33

Column Line 6.2 - AA

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	43.0	1.9	7.2	3	0.43 Eq H1-1a	0.0	50	W14X43
FLOOR 41M	43.5	1.9	7.2	3	0.44 Eq H1-1a	0.0	50	W14X43
FLOOR 40M	108.9	1.2	7.8	2	0.51 Eq H1-1a	0.0	50	W14X43
FLOOR 39	141.6	1.2	4.2	2	0.43 Eq H1-1a	0.0	50	W14X43
FLOOR 38	176.7	1.1	3.5	2	0.51 Eq H1-1a	0.0	50	W14X43
FLOOR 37	212.5	1.1	3.4	2	0.60 Eq H1-1a	0.0	50	W14X43
FLOOR 36	248.5	1.0	3.4	2	0.69 Eq H1-1a	0.0	50	W14X43
FLOOR 35	284.6	1.0	3.4	2	0.78 Eq H1-1a	0.0	50	W14X43
FLOOR 34	320.8	1.0	3.3	2	0.87 Eq H1-1a	0.0	50	W14X43
FLOOR 33	357.0	0.9	3.3	2	0.97 Eq H1-1a	0.0	50	W14X43
FLOOR 32	393.4	0.9	3.8	2	0.66 Eq H1-1a	0.0	50	W14X61
FLOOR 31	429.8	0.9	3.8	2	0.71 Eq H1-1a	0.0	50	W14X61
FLOOR 30	466.2	0.9	3.8	2	0.77 Eq H1-1a	0.0	50	W14X61
FLOOR 29	502.6	0.9	3.8	2	0.83 Eq H1-1a	0.0	50	W14X61
FLOOR 28	539.9	0.9	3.8	2	0.79 Eq H1-1a	0.0	50	W14X68
FLOOR 27	577.6	0.9	3.8	2	0.85 Eq H1-1a	0.0	50	W14X68
FLOOR 26	615.2	0.9	3.8	2	0.90 Eq H1-1a	0.0	50	W14X68
FLOOR 25	652.9	0.9	3.8	2	0.95 Eq H1-1a	0.0	50	W14X68
FLOOR 24	690.7	0.9	3.8	2	0.84 Eq H1-1a	0.0	50	W14X82
FLOOR 23	728.6	0.9	3.8	2	0.88 Eq H1-1a	0.0	50	W14X82
FLOOR 22	766.4	0.9	3.8	2	0.93 Eq H1-1a	0.0	50	W14X82
FLOOR 21	804.2	0.9	3.8	2	0.97 Eq H1-1a	0.0	50	W14X82
FLOOR 20	842.2	0.9	4.9	2	0.83 Eq H1-1a	0.0	50	W14X90
FLOOR 19	880.1	0.9	4.9	2	0.87 Eq H1-1a	0.0	50	W14X90
FLOOR 18	918.0	0.9	4.9	2	0.90 Eq H1-1a	0.0	50	W14X90
FLOOR 17	956.0	0.9	4.9	2	0.94 Eq H1-1a	0.0	50	W14X90
FLOOR 16	994.0	0.9	4.9	2	0.89 Eq H1-1a	0.0	50	W14X99
FLOOR 15	1032.1	0.9	4.9	2	0.92 Eq H1-1a	0.0	50	W14X99
FLOOR 14	1070.1	0.9	4.9	2	0.96 Eq H1-1a	0.0	50	W14X99
FLOOR 13	1108.2	0.9	4.9	2	0.99 Eq H1-1a	0.0	50	W14X99

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FLOOR 12	1146.5	0.9	5.0	2	0.84 Eq H1-1a	0.0	50	W14X120
FLOOR 11	1184.8	0.9	5.0	2	0.87 Eq H1-1a	0.0	50	W14X120
FLOOR 10	1223.1	0.9	5.0	2	0.90 Eq H1-1a	0.0	50	W14X120
FLOOR 9	1261.4	0.9	5.0	2	0.92 Eq H1-1a	0.0	50	W14X120
FLOOR 8	1299.9	0.9	5.0	2	0.87 Eq H1-1a	0.0	50	W14X132
FLOOR 7	1338.3	0.9	5.0	2	0.89 Eq H1-1a	0.0	50	W14X132
FLOOR 6	1376.8	0.9	5.0	2	0.92 Eq H1-1a	0.0	50	W14X132
FLOOR 5	1415.3	1.4	7.5	2	0.95 Eq H1-1a	0.0	50	W14X132
FLOOR 4	1455.1	1.9	4.2	2	0.96 Eq H1-1a	0.0	50	W14X233
FLOOR 3.2	1458.1	1.9	4.2	2	0.96 Eq H1-1a	0.0	50	W14X233
FLOOR 3.1	1461.0	1.9	4.2	2	0.96 Eq H1-1a	0.0	50	W14X233
FLOOR 3	1523.8	4.2	12.6	2	0.85 Eq H1-1a	0.0	50	W14X159
FLOOR 2	1585.7	0.5	6.5	1	0.96 Eq H1-1a	0.0	50	W14X159

Column Line 6.3 - F.3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	41.8	1.1	18.3	8	0.37 Eq H1-1b	135.0	50	W14X43
FLOOR 39	75.8	0.1	11.0	1	0.27 Eq H1-1b	135.0	50	W14X43
FLOOR 38	110.9	0.1	8.8	1	0.41 Eq H1-1a	135.0	50	W14X43
FLOOR 37	145.5	0.1	8.6	1	0.49 Eq H1-1a	135.0	50	W14X43
FLOOR 36	179.8	0.1	8.4	1	0.58 Eq H1-1a	135.0	50	W14X43
FLOOR 35	213.9	0.1	8.3	1	0.67 Eq H1-1a	135.0	50	W14X43
FLOOR 34	247.9	0.1	8.3	1	0.75 Eq H1-1a	135.0	50	W14X43
FLOOR 33	281.8	0.1	8.2	1	0.84 Eq H1-1a	135.0	50	W14X43
FLOOR 32	315.7	0.1	8.2	1	0.74 Eq H1-1a	135.0	50	W14X53
FLOOR 31	349.6	0.1	8.2	1	0.81 Eq H1-1a	135.0	50	W14X53
FLOOR 30	383.4	0.1	8.2	1	0.88 Eq H1-1a	135.0	50	W14X53
FLOOR 29	417.2	0.1	8.1	1	0.95 Eq H1-1a	135.0	50	W14X53
FLOOR 28	452.4	0.1	9.1	1	0.79 Eq H1-1a	135.0	50	W14X61
FLOOR 27	487.2	0.1	9.1	1	0.84 Eq H1-1a	135.0	50	W14X61
FLOOR 26	522.0	0.1	9.1	1	0.90 Eq H1-1a	135.0	50	W14X61
FLOOR 25	556.8	0.1	9.1	1	0.95 Eq H1-1a	135.0	50	W14X61
FLOOR 24	591.8	0.1	9.1	1	0.82 Eq H1-1a	135.0	50	W14X74
FLOOR 23	626.8	0.1	9.1	1	0.87 Eq H1-1a	135.0	50	W14X74
FLOOR 22	661.8	0.1	9.1	1	0.91 Eq H1-1a	135.0	50	W14X74
FLOOR 21	696.7	0.1	9.1	1	0.96 Eq H1-1a	135.0	50	W14X74
FLOOR 20	732.0	0.1	11.8	1	0.75 Eq H1-1a	135.0	50	W14X90
FLOOR 19	767.2	0.1	11.8	1	0.78 Eq H1-1a	135.0	50	W14X90
FLOOR 18	802.4	0.1	11.8	1	0.81 Eq H1-1a	135.0	50	W14X90
FLOOR 17	837.6	0.1	11.8	1	0.85 Eq H1-1a	135.0	50	W14X90
FLOOR 16	872.8	0.1	11.8	1	0.88 Eq H1-1a	135.0	50	W14X90
FLOOR 15	908.0	0.1	11.8	1	0.92 Eq H1-1a	135.0	50	W14X90
FLOOR 14	943.2	0.1	11.8	1	0.95 Eq H1-1a	135.0	50	W14X90
FLOOR 13	978.5	0.1	11.8	1	0.98 Eq H1-1a	135.0	50	W14X90
FLOOR 12	1013.9	0.1	11.8	1	0.84 Eq H1-1a	135.0	50	W14X109
FLOOR 11	1049.4	0.1	11.8	1	0.87 Eq H1-1a	135.0	50	W14X109

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FLOOR 10	1084.9	0.1	11.8	1	0.90 Eq H1-1a	135.0	50	W14X109
FLOOR 9	1120.4	0.1	11.8	1	0.92 Eq H1-1a	135.0	50	W14X109
FLOOR 8	1156.1	0.1	11.9	1	0.86 Eq H1-1a	135.0	50	W14X120
FLOOR 7	1191.7	0.1	11.9	1	0.89 Eq H1-1a	135.0	50	W14X120
FLOOR 6	1227.4	0.1	11.9	1	0.92 Eq H1-1a	135.0	50	W14X120
FLOOR 5	1263.0	0.2	18.0	1	0.96 Eq H1-1a	135.0	50	W14X120
FLOOR 4	1300.1	0.2	7.1	1	0.95 Eq H1-1a	135.0	50	W14X211
FLOOR 3.2	1303.2	0.2	7.1	1	0.96 Eq H1-1a	135.0	50	W14X211
FLOOR 3.1	1306.4	0.2	7.1	1	0.96 Eq H1-1a	135.0	50	W14X211
FLOOR 3	1356.7	0.5	30.0	1	0.86 Eq H1-1a	135.0	50	W14X145
FLOOR 2	1414.3	0.2	15.7	1	0.95 Eq H1-1a	135.0	50	W14X145

Column Line 6 - E

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	52.1	28.2	5.8	4	0.57 Eq H1-1a	90.0	50	W14X43
FLOOR 41M	52.6	28.2	5.8	4	0.59 Eq H1-1a	90.0	50	W14X43
FLOOR 40M	138.2	3.0	10.3	6	0.65 Eq H1-1a	90.0	50	W14X43
FLOOR 39	175.8	2.8	1.6	2	0.48 Eq H1-1a	90.0	50	W14X43
FLOOR 38	200.9	2.3	1.5	2	0.54 Eq H1-1a	90.0	50	W14X43
FLOOR 37	226.6	2.3	1.4	2	0.61 Eq H1-1a	90.0	50	W14X43
FLOOR 36	252.7	2.2	1.4	2	0.68 Eq H1-1a	90.0	50	W14X43
FLOOR 35	278.9	2.2	1.4	2	0.74 Eq H1-1a	90.0	50	W14X43
FLOOR 34	305.1	2.2	1.4	2	0.81 Eq H1-1a	90.0	50	W14X43
FLOOR 33	331.5	2.2	1.4	2	0.88 Eq H1-1a	90.0	50	W14X43
FLOOR 32	358.0	2.2	1.3	2	0.76 Eq H1-1a	90.0	50	W14X53
FLOOR 31	384.5	2.2	1.3	2	0.81 Eq H1-1a	90.0	50	W14X53
FLOOR 30	411.1	2.2	1.3	2	0.86 Eq H1-1a	90.0	50	W14X53
FLOOR 29	437.6	2.2	1.3	2	0.92 Eq H1-1a	90.0	50	W14X53
FLOOR 28	464.2	2.2	1.5	2	0.75 Eq H1-1a	90.0	50	W14X61
FLOOR 27	490.9	2.2	1.5	2	0.80 Eq H1-1a	90.0	50	W14X61
FLOOR 26	518.1	2.2	1.5	2	0.84 Eq H1-1a	90.0	50	W14X61
FLOOR 25	545.8	2.2	1.5	2	0.88 Eq H1-1a	90.0	50	W14X61
FLOOR 24	573.5	2.2	1.5	2	0.83 Eq H1-1a	90.0	50	W14X68
FLOOR 23	601.3	2.2	1.5	2	0.87 Eq H1-1a	90.0	50	W14X68
FLOOR 22	629.0	2.2	1.5	2	0.91 Eq H1-1a	90.0	50	W14X68
FLOOR 21	656.8	2.2	1.5	2	0.95 Eq H1-1a	90.0	50	W14X68
FLOOR 20	684.7	2.2	1.5	2	0.82 Eq H1-1a	90.0	50	W14X82
FLOOR 19	712.7	2.2	1.5	2	0.85 Eq H1-1a	90.0	50	W14X82
FLOOR 18	740.6	2.2	1.5	2	0.89 Eq H1-1a	90.0	50	W14X82
FLOOR 17	768.5	2.2	1.5	2	0.92 Eq H1-1a	90.0	50	W14X82
FLOOR 16	796.5	2.2	1.9	2	0.78 Eq H1-1a	90.0	50	W14X90
FLOOR 15	824.6	2.2	1.9	2	0.81 Eq H1-1a	90.0	50	W14X90
FLOOR 14	852.6	2.2	1.9	2	0.83 Eq H1-1a	90.0	50	W14X90
FLOOR 13	880.6	2.2	1.9	2	0.86 Eq H1-1a	90.0	50	W14X90
FLOOR 12	908.7	2.2	1.9	2	0.89 Eq H1-1a	90.0	50	W14X90

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FLOOR 11	936.7	2.2	1.9	2	0.91 Eq H1-1a	90.0	50	W14X90
FLOOR 10	964.7	2.2	1.9	2	0.94 Eq H1-1a	90.0	50	W14X90
FLOOR 9	992.8	2.2	1.9	2	0.97 Eq H1-1a	90.0	50	W14X90
FLOOR 8	1020.9	2.2	1.9	2	0.91 Eq H1-1a	90.0	50	W14X99
FLOOR 7	1049.0	2.2	1.9	2	0.93 Eq H1-1a	90.0	50	W14X99
FLOOR 6	1077.2	2.2	1.9	2	0.95 Eq H1-1a	90.0	50	W14X99
FLOOR 5	1105.3	3.3	2.9	3	0.98 Eq H1-1a	90.0	50	W14X99
FLOOR 4	1134.7	1.8	7.5	4	0.92 Eq H1-1a	90.0	50	W14X193
FLOOR 3.2	1137.2	1.8	7.6	4	0.92 Eq H1-1a	90.0	50	W14X193
FLOOR 3.1	1139.7	1.8	7.6	4	0.92 Eq H1-1a	90.0	50	W14X193
FLOOR 3	1251.6	5.4	10.3	4	0.76 Eq H1-1a	90.0	50	W14X145
FLOOR 2	1364.5	2.8	0.1	1	0.89 Eq H1-1a	90.0	50	W14X145

Column Line 6 - D

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	201.7	16.1	0.0	1	0.84 Eq H1-1a	0.0	50	W10X39
FLOOR 39	202.6	0.0	0.0	1	0.66 Eq H1-1a	0.0	50	W10X33
FLOOR 38	203.4	0.0	0.0	1	0.67 Eq H1-1a	0.0	50	W10X33
FLOOR 37	204.2	0.0	0.0	1	0.67 Eq H1-1a	0.0	50	W10X33
FLOOR 36	205.1	0.0	0.0	1	0.67 Eq H1-1a	0.0	50	W10X33
FLOOR 35	205.9	0.0	0.0	1	0.68 Eq H1-1a	0.0	50	W10X33
FLOOR 34	206.7	0.0	0.0	1	0.68 Eq H1-1a	0.0	50	W10X33
FLOOR 33	207.6	0.0	0.0	1	0.68 Eq H1-1a	0.0	50	W10X33
FLOOR 32	208.4	0.0	0.0	1	0.68 Eq H1-1a	0.0	50	W10X33
FLOOR 31	209.3	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W10X33
FLOOR 30	210.1	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W10X33
FLOOR 29	210.9	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W10X33
FLOOR 28	211.8	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W10X33
FLOOR 27	212.6	0.0	0.0	1	0.70 Eq H1-1a	0.0	50	W10X33
FLOOR 26	213.5	0.0	0.0	1	0.70 Eq H1-1a	0.0	50	W10X33
FLOOR 25	214.3	0.0	0.0	1	0.70 Eq H1-1a	0.0	50	W10X33
FLOOR 24	215.1	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W10X33
FLOOR 23	216.0	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W10X33
FLOOR 22	216.8	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W10X33
FLOOR 21	217.6	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W10X33
FLOOR 20	218.5	0.0	0.0	1	0.72 Eq H1-1a	0.0	50	W10X33
FLOOR 19	219.3	0.0	0.0	1	0.72 Eq H1-1a	0.0	50	W10X33
FLOOR 18	220.2	0.0	0.0	1	0.72 Eq H1-1a	0.0	50	W10X33
FLOOR 17	221.0	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W10X33
FLOOR 16	221.8	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W10X33
FLOOR 15	222.7	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W10X33
FLOOR 14	223.5	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W10X33
FLOOR 13	224.4	0.0	0.0	1	0.74 Eq H1-1a	0.0	50	W10X33
FLOOR 12	225.2	0.0	0.0	1	0.74 Eq H1-1a	0.0	50	W10X33
FLOOR 11	226.0	0.0	0.0	1	0.74 Eq H1-1a	0.0	50	W10X33
FLOOR 10	226.9	0.0	0.0	1	0.74 Eq H1-1a	0.0	50	W10X33

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FLOOR 9	227.7	0.0	0.0	1	0.75 Eq H1-1a	0.0	50	W10X33
FLOOR 8	228.5	0.0	0.0	1	0.75 Eq H1-1a	0.0	50	W10X33
FLOOR 7	229.4	0.0	0.0	1	0.75 Eq H1-1a	0.0	50	W10X33
FLOOR 6	230.2	0.0	0.0	1	0.76 Eq H1-1a	0.0	50	W10X33
FLOOR 5	231.1	0.0	0.0	1	0.76 Eq H1-1a	0.0	50	W10X33
FLOOR 4	232.6	7.0	0.0	3	0.91 Eq H1-1a	0.0	50	W10X88
FLOOR 3.2	233.7	7.0	0.0	3	0.92 Eq H1-1a	0.0	50	W10X88
FLOOR 3.1	234.9	7.0	0.0	3	0.92 Eq H1-1a	0.0	50	W10X88
FLOOR 3	380.9	13.5	0.0	3	0.57 Eq H1-1a	0.0	50	W10X68
FLOOR 2	522.3	0.1	0.0	1	0.92 Eq H1-1a	0.0	50	W10X68

Column Line 6 - C

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	41.4	12.3	7.1	4	0.45 Eq H1-1a	90.0	50	W14X43
FLOOR 41M	41.8	12.3	7.1	4	0.45 Eq H1-1a	90.0	50	W14X43
FLOOR 40M	167.1	13.3	12.5	10	0.82 Eq H1-1a	90.0	50	W14X43
FLOOR 39	236.2	7.6	3.2	6	0.68 Eq H1-1a	90.0	50	W14X43
FLOOR 38	278.0	6.3	2.7	2	0.77 Eq H1-1a	90.0	50	W14X43
FLOOR 37	318.7	6.3	2.6	2	0.88 Eq H1-1a	90.0	50	W14X43
FLOOR 36	360.1	6.3	3.0	2	0.61 Eq H1-1a	90.0	50	W14X61
FLOOR 35	401.7	6.3	3.0	2	0.68 Eq H1-1a	90.0	50	W14X61
FLOOR 34	443.5	6.2	2.9	2	0.74 Eq H1-1a	90.0	50	W14X61
FLOOR 33	485.3	6.2	2.9	2	0.81 Eq H1-1a	90.0	50	W14X61
FLOOR 32	528.3	6.2	2.9	2	0.78 Eq H1-1a	90.0	50	W14X68
FLOOR 31	572.3	6.2	2.9	2	0.85 Eq H1-1a	90.0	50	W14X68
FLOOR 30	616.2	6.2	2.9	2	0.91 Eq H1-1a	90.0	50	W14X68
FLOOR 29	660.2	6.2	2.9	2	0.97 Eq H1-1a	90.0	50	W14X68
FLOOR 28	704.5	6.2	3.8	2	0.70 Eq H1-1a	90.0	50	W14X90
FLOOR 27	748.7	6.2	3.8	2	0.74 Eq H1-1a	90.0	50	W14X90
FLOOR 26	793.0	6.2	3.8	2	0.79 Eq H1-1a	90.0	50	W14X90
FLOOR 25	837.2	6.2	3.8	2	0.83 Eq H1-1a	90.0	50	W14X90
FLOOR 24	881.6	6.3	3.8	2	0.79 Eq H1-1a	90.0	50	W14X99
FLOOR 23	926.0	6.3	3.8	2	0.83 Eq H1-1a	90.0	50	W14X99
FLOOR 22	970.4	6.3	3.8	2	0.87 Eq H1-1a	90.0	50	W14X99
FLOOR 21	1014.8	6.3	3.8	2	0.91 Eq H1-1a	90.0	50	W14X99
FLOOR 20	1059.3	6.3	3.8	2	0.86 Eq H1-1a	90.0	50	W14X109
FLOOR 19	1103.8	6.3	3.8	2	0.90 Eq H1-1a	90.0	50	W14X109
FLOOR 18	1148.3	6.3	3.8	2	0.93 Eq H1-1a	90.0	50	W14X109
FLOOR 17	1192.8	6.3	3.8	2	0.97 Eq H1-1a	90.0	50	W14X109
FLOOR 16	1237.7	6.5	3.8	2	0.83 Eq H1-1a	90.0	50	W14X132
FLOOR 15	1282.5	6.5	3.8	2	0.86 Eq H1-1a	90.0	50	W14X132
FLOOR 14	1327.3	6.5	3.8	2	0.89 Eq H1-1a	90.0	50	W14X132
FLOOR 13	1372.1	6.5	3.8	2	0.92 Eq H1-1a	90.0	50	W14X132
FLOOR 12	1417.1	6.5	4.0	2	0.85 Eq H1-1a	90.0	50	W14X145
FLOOR 11	1462.0	6.5	4.0	2	0.88 Eq H1-1a	90.0	50	W14X145

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FLOOR 10	1507.0	6.5	4.0	2	0.91 Eq H1-1a	90.0	50	W14X145
FLOOR 9	1552.0	6.5	4.0	2	0.93 Eq H1-1a	90.0	50	W14X145
FLOOR 8	1597.1	6.6	4.0	2	0.88 Eq H1-1a	90.0	50	W14X159
FLOOR 7	1642.3	6.6	4.0	2	0.90 Eq H1-1a	90.0	50	W14X159
FLOOR 6	1687.4	6.6	4.0	2	0.93 Eq H1-1a	90.0	50	W14X159
FLOOR 5	1732.6	9.9	6.0	2	0.96 Eq H1-1a	90.0	50	W14X159
FLOOR 4	1779.3	5.4	7.8	5	0.95 Eq H1-1a	90.0	50	W14X283
FLOOR 3.2	1783.0	5.4	7.9	5	0.95 Eq H1-1a	90.0	50	W14X283
FLOOR 3.1	1786.6	5.4	7.9	5	0.95 Eq H1-1a	90.0	50	W14X283
FLOOR 3	1924.7	15.8	13.7	2	0.81 Eq H1-1a	90.0	50	W14X211
FLOOR 2	2064.0	8.3	2.1	1	0.93 Eq H1-1a	90.0	50	W14X211

Column Line 5 - G

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	60.1	0.0	0.0	1	0.22 Eq H1-1a	0.0	50	W14X43
FLOOR 39	135.0	0.0	0.0	1	0.35 Eq H1-1a	0.0	50	W14X43
FLOOR 38	210.6	0.0	0.0	1	0.54 Eq H1-1a	0.0	50	W14X43
FLOOR 37	285.4	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W14X43
FLOOR 36	359.8	0.0	0.0	1	0.57 Eq H1-1a	0.0	50	W14X61
FLOOR 35	434.0	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W14X61
FLOOR 34	507.8	0.0	0.0	1	0.81 Eq H1-1a	0.0	50	W14X61
FLOOR 33	581.9	0.0	0.0	1	0.93 Eq H1-1a	0.0	50	W14X61
FLOOR 32	657.9	0.0	0.0	1	0.64 Eq H1-1a	0.0	50	W14X90
FLOOR 31	733.8	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W14X90
FLOOR 30	809.8	0.0	0.0	1	0.78 Eq H1-1a	0.0	50	W14X90
FLOOR 29	885.8	0.0	0.0	1	0.86 Eq H1-1a	0.0	50	W14X90
FLOOR 28	962.0	0.0	0.0	1	0.77 Eq H1-1a	0.0	50	W14X109
FLOOR 27	1038.3	0.0	0.0	1	0.83 Eq H1-1a	0.0	50	W14X109
FLOOR 26	1114.5	0.0	0.0	1	0.89 Eq H1-1a	0.0	50	W14X109
FLOOR 25	1190.8	0.0	0.0	1	0.95 Eq H1-1a	0.0	50	W14X109
FLOOR 24	1267.3	0.0	0.0	1	0.83 Eq H1-1a	0.0	50	W14X132
FLOOR 23	1343.9	0.0	0.0	1	0.88 Eq H1-1a	0.0	50	W14X132
FLOOR 22	1420.5	0.0	0.0	1	0.93 Eq H1-1a	0.0	50	W14X132
FLOOR 21	1497.1	0.0	0.0	1	0.98 Eq H1-1a	0.0	50	W14X132
FLOOR 20	1574.1	0.0	0.0	1	0.85 Eq H1-1a	0.0	50	W14X159
FLOOR 19	1651.0	0.0	0.0	1	0.89 Eq H1-1a	0.0	50	W14X159
FLOOR 18	1728.0	0.0	0.0	1	0.94 Eq H1-1a	0.0	50	W14X159
FLOOR 17	1805.0	0.0	0.0	1	0.98 Eq H1-1a	0.0	50	W14X159
FLOOR 16	1882.5	0.0	0.0	1	0.84 Eq H1-1a	0.0	50	W14X193
FLOOR 15	1959.9	0.0	0.0	1	0.87 Eq H1-1a	0.0	50	W14X193
FLOOR 14	2037.4	0.0	0.0	1	0.90 Eq H1-1a	0.0	50	W14X193
FLOOR 13	2114.9	0.0	0.0	1	0.94 Eq H1-1a	0.0	50	W14X193
FLOOR 12	2192.6	0.0	0.0	1	0.89 Eq H1-1a	0.0	50	W14X211
FLOOR 11	2270.4	0.0	0.0	1	0.92 Eq H1-1a	0.0	50	W14X211
FLOOR 10	2348.1	0.0	0.0	1	0.95 Eq H1-1a	0.0	50	W14X211
FLOOR 9	2425.8	0.0	0.0	1	0.99 Eq H1-1a	0.0	50	W14X211

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FLOOR 8	2504.2	0.0	0.0	1	0.83 Eq H1-1a	0.0	50	W14X257
FLOOR 7	2582.6	0.0	0.0	1	0.86 Eq H1-1a	0.0	50	W14X257
FLOOR 6	2661.1	0.0	0.0	1	0.89 Eq H1-1a	0.0	50	W14X257
FLOOR 5	2739.5	0.0	0.0	1	0.91 Eq H1-1a	0.0	50	W14X257
FLOOR 4	2820.5	0.0	0.0	1	0.94 Eq H1-1a	0.0	50	W14X426
FLOOR 3.2	2826.8	0.0	0.0	1	0.94 Eq H1-1a	0.0	50	W14X426
FLOOR 3.1	2833.2	0.0	0.0	1	0.94 Eq H1-1a	0.0	50	W14X426
FLOOR 3	2911.2	0.0	0.0	1	0.88 Eq H1-1a	0.0	50	W14X283
FLOOR 2	2999.2	0.0	0.0	1	0.99 Eq H1-1a	0.0	50	W14X283

Column Line 5 - F

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	43.8	22.9	14.2	4	0.61 Eq H1-1a	0.0	50	W14X43
FLOOR 41M	44.3	22.9	14.2	4	0.62 Eq H1-1a	0.0	50	W14X43
FLOOR 40M	153.4	3.8	15.2	10	0.78 Eq H1-1a	0.0	50	W14X43
FLOOR 39	192.2	3.5	3.2	10	0.55 Eq H1-1a	0.0	50	W14X43
FLOOR 38	221.9	2.9	2.7	4	0.62 Eq H1-1a	0.0	50	W14X43
FLOOR 37	250.5	2.9	2.6	4	0.69 Eq H1-1a	0.0	50	W14X43
FLOOR 36	279.4	2.8	2.6	4	0.76 Eq H1-1a	0.0	50	W14X43
FLOOR 35	308.4	2.8	2.6	4	0.84 Eq H1-1a	0.0	50	W14X43
FLOOR 34	337.6	2.8	2.5	4	0.91 Eq H1-1a	0.0	50	W14X43
FLOOR 33	366.9	2.8	2.5	4	0.99 Eq H1-1a	0.0	50	W14X43
FLOOR 32	396.4	2.8	2.9	4	0.66 Eq H1-1a	0.0	50	W14X61
FLOOR 31	426.0	2.8	2.9	4	0.71 Eq H1-1a	0.0	50	W14X61
FLOOR 30	455.5	2.8	2.8	4	0.75 Eq H1-1a	0.0	50	W14X61
FLOOR 29	485.1	2.8	2.8	4	0.80 Eq H1-1a	0.0	50	W14X61
FLOOR 28	515.1	2.8	2.8	4	0.85 Eq H1-1a	0.0	50	W14X61
FLOOR 27	545.8	2.8	2.8	4	0.90 Eq H1-1a	0.0	50	W14X61
FLOOR 26	576.6	2.8	2.8	4	0.94 Eq H1-1a	0.0	50	W14X61
FLOOR 25	607.4	2.8	2.8	4	0.99 Eq H1-1a	0.0	50	W14X61
FLOOR 24	638.4	2.8	2.8	4	0.85 Eq H1-1a	0.0	50	W14X74
FLOOR 23	669.3	2.8	2.8	4	0.89 Eq H1-1a	0.0	50	W14X74
FLOOR 22	700.3	2.8	2.8	4	0.93 Eq H1-1a	0.0	50	W14X74
FLOOR 21	731.2	2.8	2.8	4	0.97 Eq H1-1a	0.0	50	W14X74
FLOOR 20	762.4	2.8	3.7	4	0.75 Eq H1-1a	0.0	50	W14X90
FLOOR 19	793.5	2.8	3.7	4	0.78 Eq H1-1a	0.0	50	W14X90
FLOOR 18	824.7	2.8	3.7	4	0.81 Eq H1-1a	0.0	50	W14X90
FLOOR 17	855.8	2.8	3.7	4	0.84 Eq H1-1a	0.0	50	W14X90
FLOOR 16	887.0	2.8	3.7	4	0.87 Eq H1-1a	0.0	50	W14X90
FLOOR 15	918.2	2.8	3.7	4	0.90 Eq H1-1a	0.0	50	W14X90
FLOOR 14	949.3	2.8	3.7	4	0.93 Eq H1-1a	0.0	50	W14X90
FLOOR 13	980.5	2.8	3.7	4	0.96 Eq H1-1a	0.0	50	W14X90
FLOOR 12	1011.7	2.8	3.7	4	0.90 Eq H1-1a	0.0	50	W14X99
FLOOR 11	1043.0	2.8	3.7	4	0.93 Eq H1-1a	0.0	50	W14X99
FLOOR 10	1074.3	2.8	3.7	4	0.96 Eq H1-1a	0.0	50	W14X99

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FLOOR 9	1105.5	2.8	3.7	4	0.99 Eq H1-1a	0.0	50	W14X99
FLOOR 8	1137.1	2.9	3.7	4	0.83 Eq H1-1a	0.0	50	W14X120
FLOOR 7	1168.6	2.9	3.7	4	0.86 Eq H1-1a	0.0	50	W14X120
FLOOR 6	1200.1	2.9	3.7	4	0.88 Eq H1-1a	0.0	50	W14X120
FLOOR 5	1231.6	4.3	5.6	4	0.91 Eq H1-1a	0.0	50	W14X120
FLOOR 4	1264.4	2.3	10.3	4	0.93 Eq H1-1a	0.0	50	W14X211
FLOOR 3.2	1267.1	2.3	10.3	4	0.93 Eq H1-1a	0.0	50	W14X211
FLOOR 3.1	1269.8	2.3	10.3	4	0.94 Eq H1-1a	0.0	50	W14X211
FLOOR 3	1395.7	6.9	18.1	4	0.79 Eq H1-1a	0.0	50	W14X159
FLOOR 2	1522.7	3.6	5.3	1	0.97 Eq H1-1a	0.0	50	W14X159

Column Line 5 - B

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	34.6	12.1	15.4	3	0.51 Eq H1-1a	0.0	50	W14X43
FLOOR 41M	35.1	12.1	15.4	3	0.52 Eq H1-1a	0.0	50	W14X43
FLOOR 40M	186.5	13.2	14.0	6	0.91 Eq H1-1a	0.0	50	W14X43
FLOOR 39	251.1	7.6	3.8	6	0.72 Eq H1-1a	0.0	50	W14X43
FLOOR 38	294.5	6.3	3.1	2	0.82 Eq H1-1a	0.0	50	W14X43
FLOOR 37	336.8	6.3	3.1	2	0.92 Eq H1-1a	0.0	50	W14X43
FLOOR 36	379.8	6.3	3.5	2	0.64 Eq H1-1a	0.0	50	W14X61
FLOOR 35	423.0	6.3	3.5	2	0.71 Eq H1-1a	0.0	50	W14X61
FLOOR 34	466.3	6.2	3.4	2	0.78 Eq H1-1a	0.0	50	W14X61
FLOOR 33	509.8	6.2	3.4	2	0.85 Eq H1-1a	0.0	50	W14X61
FLOOR 32	555.6	6.3	3.4	2	0.75 Eq H1-1a	0.0	50	W14X74
FLOOR 31	601.4	6.3	3.4	2	0.81 Eq H1-1a	0.0	50	W14X74
FLOOR 30	647.2	6.3	3.4	2	0.87 Eq H1-1a	0.0	50	W14X74
FLOOR 29	693.0	6.3	3.4	2	0.93 Eq H1-1a	0.0	50	W14X74
FLOOR 28	739.1	6.2	4.4	2	0.74 Eq H1-1a	0.0	50	W14X90
FLOOR 27	785.1	6.2	4.4	2	0.78 Eq H1-1a	0.0	50	W14X90
FLOOR 26	831.1	6.2	4.4	2	0.83 Eq H1-1a	0.0	50	W14X90
FLOOR 25	877.1	6.2	4.4	2	0.87 Eq H1-1a	0.0	50	W14X90
FLOOR 24	923.2	6.3	4.5	2	0.83 Eq H1-1a	0.0	50	W14X99
FLOOR 23	969.3	6.3	4.5	2	0.87 Eq H1-1a	0.0	50	W14X99
FLOOR 22	1015.4	6.3	4.5	2	0.91 Eq H1-1a	0.0	50	W14X99
FLOOR 21	1061.5	6.3	4.5	2	0.95 Eq H1-1a	0.0	50	W14X99
FLOOR 20	1107.8	6.4	4.5	2	0.82 Eq H1-1a	0.0	50	W14X120
FLOOR 19	1154.2	6.4	4.5	2	0.85 Eq H1-1a	0.0	50	W14X120
FLOOR 18	1200.5	6.4	4.5	2	0.89 Eq H1-1a	0.0	50	W14X120
FLOOR 17	1246.9	6.4	4.5	2	0.92 Eq H1-1a	0.0	50	W14X120
FLOOR 16	1293.4	6.5	4.5	2	0.87 Eq H1-1a	0.0	50	W14X132
FLOOR 15	1339.9	6.5	4.5	2	0.90 Eq H1-1a	0.0	50	W14X132
FLOOR 14	1386.4	6.5	4.5	2	0.93 Eq H1-1a	0.0	50	W14X132
FLOOR 13	1432.9	6.5	4.5	2	0.96 Eq H1-1a	0.0	50	W14X132
FLOOR 12	1479.5	6.5	4.7	2	0.89 Eq H1-1a	0.0	50	W14X145
FLOOR 11	1526.2	6.5	4.7	2	0.92 Eq H1-1a	0.0	50	W14X145

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Building Code: IBC — Steel Code: AISC LRFD

FLOOR 10	1572.9	6.5	4.7	2	0.95 Eq H1-1a	0.0	50	W14X145
FLOOR 9	1619.5	6.5	4.7	2	0.97 Eq H1-1a	0.0	50	W14X145
FLOOR 8	1666.4	6.6	4.7	2	0.91 Eq H1-1a	0.0	50	W14X159
FLOOR 7	1713.2	6.6	4.7	2	0.94 Eq H1-1a	0.0	50	W14X159
FLOOR 6	1760.0	6.6	4.7	2	0.97 Eq H1-1a	0.0	50	W14X159
FLOOR 5	1806.9	9.9	7.1	3	1.00 Eq H1-1a	0.0	50	W14X159
FLOOR 4	1855.3	5.4	12.3	3	0.99 Eq H1-1a	0.0	50	W14X283
FLOOR 3.2	1859.0	5.4	12.3	3	0.99 Eq H1-1a	0.0	50	W14X283
FLOOR 3.1	1862.6	5.4	12.4	3	0.99 Eq H1-1a	0.0	50	W14X283
FLOOR 3	2012.7	15.8	20.1	2	0.85 Eq H1-1a	0.0	50	W14X211
FLOOR 2	2164.0	8.3	6.2	1	0.98 Eq H1-1a	0.0	50	W14X211

Column Line 34.75ft - 130.17ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	69.6	26.8	2.4	1	0.85 Eq H1-1a	0.0	50	W10X33
FLOOR 41M	69.9	26.8	2.5	1	0.85 Eq H1-1a	0.0	50	W10X33

Column Line 5 - A

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	111.0	19.9	65.6	1	0.74 Eq H1-1a	0.0	50	W14X61
FLOOR 39	167.5	25.2	3.5	1	0.56 Eq H1-1a	0.0	50	W14X43
FLOOR 38	227.5	20.7	2.9	1	0.69 Eq H1-1a	0.0	50	W14X43
FLOOR 37	287.8	20.4	2.8	1	0.85 Eq H1-1a	0.0	50	W14X43
FLOOR 36	348.2	20.4	3.2	1	0.63 Eq H1-1a	0.0	50	W14X61
FLOOR 35	408.5	20.3	3.2	1	0.72 Eq H1-1a	0.0	50	W14X61
FLOOR 34	468.7	20.2	3.2	1	0.82 Eq H1-1a	0.0	50	W14X61
FLOOR 33	529.1	20.1	3.2	1	0.91 Eq H1-1a	0.0	50	W14X61
FLOOR 32	591.3	20.5	3.2	1	0.75 Eq H1-1a	0.0	50	W14X82
FLOOR 31	653.6	20.5	3.2	1	0.82 Eq H1-1a	0.0	50	W14X82
FLOOR 30	715.8	20.5	3.2	1	0.90 Eq H1-1a	0.0	50	W14X82
FLOOR 29	778.1	20.5	3.2	1	0.97 Eq H1-1a	0.0	50	W14X82
FLOOR 28	840.6	20.4	4.2	1	0.78 Eq H1-1a	0.0	50	W14X99
FLOOR 27	903.0	20.4	4.2	1	0.83 Eq H1-1a	0.0	50	W14X99
FLOOR 26	965.5	20.4	4.2	1	0.89 Eq H1-1a	0.0	50	W14X99
FLOOR 25	1028.0	20.4	4.2	1	0.94 Eq H1-1a	0.0	50	W14X99
FLOOR 24	1090.7	20.7	4.2	1	0.82 Eq H1-1a	0.0	50	W14X120
FLOOR 23	1153.4	20.7	4.2	1	0.87 Eq H1-1a	0.0	50	W14X120
FLOOR 22	1216.1	20.7	4.2	1	0.91 Eq H1-1a	0.0	50	W14X120
FLOOR 21	1278.8	20.7	4.2	1	0.96 Eq H1-1a	0.0	50	W14X120
FLOOR 20	1341.8	21.0	4.4	1	0.82 Eq H1-1a	0.0	50	W14X145
FLOOR 19	1404.8	21.0	4.4	1	0.86 Eq H1-1a	0.0	50	W14X145
FLOOR 18	1467.8	21.0	4.4	1	0.90 Eq H1-1a	0.0	50	W14X145
FLOOR 17	1530.8	21.0	4.4	1	0.93 Eq H1-1a	0.0	50	W14X145
FLOOR 16	1594.0	21.3	4.4	1	0.89 Eq H1-1a	0.0	50	W14X159
FLOOR 15	1657.2	21.3	4.4	1	0.92 Eq H1-1a	0.0	50	W14X159

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FLOOR 14	1720.4	21.3	4.4	1	0.96 Eq H1-1a	0.0	50	W14X159
FLOOR 13	1783.5	21.3	4.4	1	0.99 Eq H1-1a	0.0	50	W14X159
FLOOR 12	1847.2	21.8	4.4	1	0.84 Eq H1-1a	0.0	50	W14X193
FLOOR 11	1910.8	21.8	4.4	1	0.87 Eq H1-1a	0.0	50	W14X193
FLOOR 10	1974.4	21.8	4.4	1	0.90 Eq H1-1a	0.0	50	W14X193
FLOOR 9	2038.0	21.8	4.4	1	0.93 Eq H1-1a	0.0	50	W14X193
FLOOR 8	2101.8	22.0	4.4	1	0.87 Eq H1-1a	0.0	50	W14X211
FLOOR 7	2165.6	22.0	4.4	1	0.90 Eq H1-1a	0.0	50	W14X211
FLOOR 6	2229.5	22.0	4.4	1	0.93 Eq H1-1a	0.0	50	W14X211
FLOOR 5	2293.3	33.2	6.7	1	0.96 Eq H1-1a	0.0	50	W14X211
FLOOR 4	2359.2	12.0	16.3	1	0.93 Eq H1-1a	0.0	50	W14X370
FLOOR 3.2	2364.0	12.0	16.4	1	0.94 Eq H1-1a	0.0	50	W14X370
FLOOR 3.1	2368.7	12.0	16.4	1	0.94 Eq H1-1a	0.0	50	W14X370
FLOOR 3	2435.4	5.8	36.2	1	0.85 Eq H1-1a	0.0	50	W14X257
FLOOR 2	2501.1	2.5	18.6	1	0.93 Eq H1-1a	0.0	50	W14X257

Column Line 57.42ft - 57.17ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 23	2.9	0.1	0.1	1	0.01 Eq H1-1b	90.0	50	W10X33
FLOOR 22	5.7	0.0	0.1	1	0.02 Eq H1-1b	90.0	50	W10X33
FLOOR 21	8.6	0.0	0.1	1	0.03 Eq H1-1b	90.0	50	W10X33
FLOOR 20	11.5	0.0	0.1	1	0.04 Eq H1-1b	90.0	50	W10X33
FLOOR 19	14.3	0.0	0.1	1	0.05 Eq H1-1b	90.0	50	W10X33
FLOOR 18	17.2	0.0	0.1	1	0.06 Eq H1-1b	90.0	50	W10X33
FLOOR 17	20.0	0.0	0.1	1	0.07 Eq H1-1b	90.0	50	W10X33
FLOOR 16	22.9	0.0	0.1	1	0.08 Eq H1-1b	90.0	50	W10X33
FLOOR 15	25.8	0.0	0.1	1	0.08 Eq H1-1b	90.0	50	W10X33
FLOOR 14	28.6	0.0	0.1	1	0.09 Eq H1-1b	90.0	50	W10X33
FLOOR 13	31.5	0.0	0.1	1	0.10 Eq H1-1b	90.0	50	W10X33
FLOOR 12	34.4	0.0	0.1	1	0.11 Eq H1-1b	90.0	50	W10X33
FLOOR 11	37.2	0.0	0.1	1	0.12 Eq H1-1b	90.0	50	W10X33
FLOOR 10	40.1	0.0	0.1	1	0.13 Eq H1-1b	90.0	50	W10X33
FLOOR 9	42.9	0.0	0.1	1	0.14 Eq H1-1b	90.0	50	W10X33
FLOOR 8	45.8	0.0	0.1	1	0.15 Eq H1-1b	90.0	50	W10X33
FLOOR 7	48.7	0.0	0.1	1	0.16 Eq H1-1b	90.0	50	W10X33
FLOOR 6	51.5	0.0	0.1	1	0.17 Eq H1-1b	90.0	50	W10X33
FLOOR 5	54.4	0.1	0.1	1	0.18 Eq H1-1b	90.0	50	W10X33
FLOOR 4	57.3	2.8	0.0	3	0.90 Eq H1-1a	90.0	50	W10X39
FLOOR 3.2	57.8	2.8	0.0	3	0.91 Eq H1-1a	90.0	50	W10X39
FLOOR 3.1	58.3	2.8	0.0	3	0.91 Eq H1-1a	90.0	50	W10X39
FLOOR 3	110.7	5.5	0.1	3	0.40 Eq H1-1a	90.0	50	W10X33
FLOOR 2	152.1	0.7	0.1	1	0.76 Eq H1-1a	90.0	50	W10X33

Column Line 57.42ft - 74.67ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size

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FLOOR 41M	105.0	0.1	28.4	10	0.65 Eq H1-1a	90.0	50	W14X43
FLOOR 40M	182.3	0.0	7.3	4	0.76 Eq H1-1a	90.0	50	W14X43
FLOOR 39	227.3	0.0	5.4	10	0.66 Eq H1-1a	90.0	50	W14X43
FLOOR 38	283.5	0.0	4.5	4	0.79 Eq H1-1a	90.0	50	W14X43
FLOOR 37	336.5	0.0	4.4	4	0.93 Eq H1-1a	90.0	50	W14X43
FLOOR 36	390.3	0.0	5.0	4	0.66 Eq H1-1a	90.0	50	W14X61
FLOOR 35	444.3	0.0	4.9	4	0.74 Eq H1-1a	90.0	50	W14X61
FLOOR 34	501.1	0.0	4.9	4	0.83 Eq H1-1a	90.0	50	W14X61
FLOOR 33	558.5	0.0	4.9	4	0.93 Eq H1-1a	90.0	50	W14X61
FLOOR 32	616.1	0.0	5.0	4	0.75 Eq H1-1a	90.0	50	W14X82
FLOOR 31	673.6	0.0	5.0	4	0.82 Eq H1-1a	90.0	50	W14X82
FLOOR 30	731.2	0.0	5.0	4	0.89 Eq H1-1a	90.0	50	W14X82
FLOOR 29	788.8	0.0	5.0	4	0.96 Eq H1-1a	90.0	50	W14X82
FLOOR 28	846.6	0.0	6.5	4	0.76 Eq H1-1a	90.0	50	W14X99
FLOOR 27	904.4	0.0	6.5	4	0.81 Eq H1-1a	90.0	50	W14X99
FLOOR 26	962.3	0.0	6.5	4	0.86 Eq H1-1a	90.0	50	W14X99
FLOOR 25	1020.1	0.0	6.5	4	0.91 Eq H1-1a	90.0	50	W14X99
FLOOR 24	1078.0	0.3	14.0	1	0.90 Eq H1-1a	90.0	50	W14X109
FLOOR 23	1114.9	0.3	14.0	1	0.93 Eq H1-1a	90.0	50	W14X109
FLOOR 22	1151.8	0.3	14.0	1	0.96 Eq H1-1a	90.0	50	W14X109
FLOOR 21	1188.7	0.3	14.0	1	0.98 Eq H1-1a	90.0	50	W14X109
FLOOR 20	1225.7	0.3	14.0	1	0.92 Eq H1-1a	90.0	50	W14X120
FLOOR 19	1262.7	0.3	14.0	1	0.95 Eq H1-1a	90.0	50	W14X120
FLOOR 18	1299.8	0.3	14.0	1	0.97 Eq H1-1a	90.0	50	W14X120
FLOOR 17	1336.8	0.3	14.0	1	1.00 Eq H1-1a	90.0	50	W14X120
FLOOR 16	1374.2	0.3	14.6	1	0.84 Eq H1-1a	90.0	50	W14X145
FLOOR 15	1411.5	0.3	14.6	1	0.86 Eq H1-1a	90.0	50	W14X145
FLOOR 14	1448.9	0.3	14.6	1	0.88 Eq H1-1a	90.0	50	W14X145
FLOOR 13	1486.2	0.3	14.6	1	0.91 Eq H1-1a	90.0	50	W14X145
FLOOR 12	1523.6	0.3	14.6	1	0.93 Eq H1-1a	90.0	50	W14X145
FLOOR 11	1560.9	0.3	14.6	1	0.95 Eq H1-1a	90.0	50	W14X145
FLOOR 10	1598.3	0.3	14.6	1	0.97 Eq H1-1a	90.0	50	W14X145
FLOOR 9	1635.6	0.3	14.6	1	1.00 Eq H1-1a	90.0	50	W14X145
FLOOR 8	1673.4	0.3	14.7	1	0.84 Eq H1-1a	90.0	50	W14X176
FLOOR 7	1711.1	0.3	14.7	1	0.86 Eq H1-1a	90.0	50	W14X176
FLOOR 6	1748.8	0.3	14.7	1	0.87 Eq H1-1a	90.0	50	W14X176
FLOOR 5	1786.6	0.5	22.2	1	0.90 Eq H1-1a	90.0	50	W14X176
FLOOR 4	1825.7	4.4	11.5	3	0.97 Eq H1-1a	90.0	50	W14X283
FLOOR 3.2	1829.4	4.4	11.6	3	0.98 Eq H1-1a	90.0	50	W14X283
FLOOR 3.1	1833.0	4.4	11.6	3	0.98 Eq H1-1a	90.0	50	W14X283
FLOOR 3	1862.6	12.7	4.5	1	0.84 Eq H1-1a	90.0	50	W14X193
FLOOR 2	1893.5	6.6	2.4	1	0.93 Eq H1-1a	90.0	50	W14X193

Column Line 57.42ft - 86.67ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41M	48.3	23.9	0.1	8	0.17 Eq H1-1b	0.0	50	W12X40

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FLOOR 40M	70.7	2.7	0.0	1	0.28 Eq H1-1a	0.0	50	W12X40
FLOOR 39	80.5	2.7	0.0	1	0.23 Eq H1-1a	0.0	50	W12X40
FLOOR 38	86.4	2.3	0.0	2	0.25 Eq H1-1a	0.0	50	W12X40
FLOOR 37	92.5	2.3	0.0	2	0.26 Eq H1-1a	0.0	50	W12X40
FLOOR 36	98.8	2.2	0.0	2	0.28 Eq H1-1a	0.0	50	W12X40
FLOOR 35	105.2	2.2	0.0	2	0.30 Eq H1-1a	0.0	50	W12X40
FLOOR 34	111.7	2.2	0.0	2	0.31 Eq H1-1a	0.0	50	W12X40
FLOOR 33	118.3	2.2	0.0	2	0.33 Eq H1-1a	0.0	50	W12X40
FLOOR 32	124.9	2.2	0.0	2	0.35 Eq H1-1a	0.0	50	W12X40
FLOOR 31	131.6	2.2	0.0	2	0.37 Eq H1-1a	0.0	50	W12X40
FLOOR 30	138.3	2.1	0.0	2	0.39 Eq H1-1a	0.0	50	W12X40
FLOOR 29	145.1	2.1	0.0	2	0.40 Eq H1-1a	0.0	50	W12X40
FLOOR 28	151.8	2.1	0.0	2	0.42 Eq H1-1a	0.0	50	W12X40
FLOOR 27	158.6	2.1	0.0	2	0.44 Eq H1-1a	0.0	50	W12X40
FLOOR 26	165.4	2.1	0.0	2	0.46 Eq H1-1a	0.0	50	W12X40
FLOOR 25	172.3	2.1	0.0	2	0.48 Eq H1-1a	0.0	50	W12X40
FLOOR 24	179.1	3.3	0.0	2	0.50 Eq H1-1a	0.0	50	W12X40
FLOOR 23	189.1	3.3	0.0	2	0.53 Eq H1-1a	0.0	50	W12X40
FLOOR 22	199.2	3.3	0.0	2	0.56 Eq H1-1a	0.0	50	W12X40
FLOOR 21	209.3	3.3	0.0	2	0.58 Eq H1-1a	0.0	50	W12X40
FLOOR 20	219.4	3.3	0.0	2	0.61 Eq H1-1a	0.0	50	W12X40
FLOOR 19	229.5	3.3	0.0	2	0.64 Eq H1-1a	0.0	50	W12X40
FLOOR 18	239.6	3.3	0.0	2	0.67 Eq H1-1a	0.0	50	W12X40
FLOOR 17	249.7	3.3	0.0	2	0.69 Eq H1-1a	0.0	50	W12X40
FLOOR 16	259.8	3.3	0.0	2	0.72 Eq H1-1a	0.0	50	W12X40
FLOOR 15	269.9	3.3	0.0	2	0.75 Eq H1-1a	0.0	50	W12X40
FLOOR 14	280.0	3.3	0.0	2	0.78 Eq H1-1a	0.0	50	W12X40
FLOOR 13	290.2	3.2	0.0	2	0.80 Eq H1-1a	0.0	50	W12X40
FLOOR 12	300.3	3.2	0.0	2	0.83 Eq H1-1a	0.0	50	W12X40
FLOOR 11	310.4	3.2	0.0	2	0.86 Eq H1-1a	0.0	50	W12X40
FLOOR 10	320.6	3.2	0.0	2	0.89 Eq H1-1a	0.0	50	W12X40
FLOOR 9	330.7	3.2	0.0	2	0.91 Eq H1-1a	0.0	50	W12X40
FLOOR 8	340.9	3.3	0.0	2	0.84 Eq H1-1a	0.0	50	W12X45
FLOOR 7	351.1	3.3	0.0	2	0.86 Eq H1-1a	0.0	50	W12X45
FLOOR 6	361.3	3.2	0.0	2	0.89 Eq H1-1a	0.0	50	W12X45
FLOOR 5	371.5	4.9	0.0	2	0.92 Eq H1-1a	0.0	50	W12X45
FLOOR 4	382.3	2.2	0.0	2	0.98 Eq H1-1a	0.0	50	W12X96
FLOOR 3.2	383.5	2.2	0.0	2	0.99 Eq H1-1a	0.0	50	W12X96
FLOOR 3.1	384.8	2.2	0.0	2	0.99 Eq H1-1a	0.0	50	W12X96
FLOOR 3	398.4	6.5	0.0	1	0.74 Eq H1-1a	0.0	50	W12X53
FLOOR 2	412.3	3.4	0.0	1	0.98 Eq H1-1a	0.0	50	W12X53

Column Line 4 - G

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	105.0	2.4	51.9	2	0.98 Eq H1-1a	0.0	50	W14X48
FLOOR 39	200.3	4.7	0.1	2	0.47 Eq H1-1a	0.0	50	W14X48

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FLOOR 38	299.2	4.1	0.1	2	0.70 Eq H1-1a	0.0	50	W14X48
FLOOR 37	397.5	3.8	0.1	2	0.92 Eq H1-1a	0.0	50	W14X48
FLOOR 36	495.9	3.7	0.1	2	0.59 Eq H1-1a	0.0	50	W14X82
FLOOR 35	597.0	3.7	0.1	2	0.71 Eq H1-1a	0.0	50	W14X82
FLOOR 34	698.3	3.7	0.1	2	0.83 Eq H1-1a	0.0	50	W14X82
FLOOR 33	799.6	3.7	0.1	2	0.95 Eq H1-1a	0.0	50	W14X82
FLOOR 32	901.3	3.7	0.1	2	0.72 Eq H1-1a	0.0	50	W14X109
FLOOR 31	1002.9	3.7	0.1	2	0.81 Eq H1-1a	0.0	50	W14X109
FLOOR 30	1104.6	3.7	0.1	2	0.89 Eq H1-1a	0.0	50	W14X109
FLOOR 29	1206.2	3.7	0.1	2	0.97 Eq H1-1a	0.0	50	W14X109
FLOOR 28	1308.3	3.8	0.1	2	0.78 Eq H1-1a	0.0	50	W14X145
FLOOR 27	1410.4	3.8	0.1	2	0.84 Eq H1-1a	0.0	50	W14X145
FLOOR 26	1512.5	3.8	0.1	2	0.90 Eq H1-1a	0.0	50	W14X145
FLOOR 25	1614.6	3.8	0.1	2	0.96 Eq H1-1a	0.0	50	W14X145
FLOOR 24	1717.1	3.8	0.1	2	0.84 Eq H1-1a	0.0	50	W14X176
FLOOR 23	1819.3	3.8	0.1	2	0.89 Eq H1-1a	0.0	50	W14X176
FLOOR 22	1921.5	3.8	0.1	2	0.94 Eq H1-1a	0.0	50	W14X176
FLOOR 21	2023.7	3.8	0.1	2	0.99 Eq H1-1a	0.0	50	W14X176
FLOOR 20	2126.4	3.8	0.1	2	0.87 Eq H1-1a	0.0	50	W14X211
FLOOR 19	2229.0	3.8	0.1	2	0.91 Eq H1-1a	0.0	50	W14X211
FLOOR 18	2331.7	3.8	0.1	2	0.95 Eq H1-1a	0.0	50	W14X211
FLOOR 17	2434.3	3.8	0.1	2	0.99 Eq H1-1a	0.0	50	W14X211
FLOOR 16	2537.6	4.0	0.1	2	0.85 Eq H1-1a	0.0	50	W14X257
FLOOR 15	2640.8	4.0	0.1	2	0.88 Eq H1-1a	0.0	50	W14X257
FLOOR 14	2744.0	4.0	0.1	2	0.92 Eq H1-1a	0.0	50	W14X257
FLOOR 13	2847.3	4.0	0.1	2	0.95 Eq H1-1a	0.0	50	W14X257
FLOOR 12	2950.8	4.0	0.1	2	0.89 Eq H1-1a	0.0	50	W14X283
FLOOR 11	3054.4	4.0	0.1	2	0.92 Eq H1-1a	0.0	50	W14X283
FLOOR 10	3158.0	4.0	0.1	2	0.95 Eq H1-1a	0.0	50	W14X283
FLOOR 9	3261.5	4.0	0.1	2	0.99 Eq H1-1a	0.0	50	W14X283
FLOOR 8	3365.8	4.2	0.1	2	0.84 Eq H1-1a	0.0	50	W14X342
FLOOR 7	3470.1	4.2	0.1	2	0.86 Eq H1-1a	0.0	50	W14X342
FLOOR 6	3574.4	4.2	0.1	2	0.89 Eq H1-1a	0.0	50	W14X342
FLOOR 5	3678.8	6.3	0.1	2	0.92 Eq H1-1a	0.0	50	W14X342
FLOOR 4	3785.8	0.7	25.1	1	0.95 Eq H1-1a	0.0	50	W14X550
FLOOR 3.2	3792.9	0.7	25.1	1	0.95 Eq H1-1a	0.0	50	W14X550
FLOOR 3.1	3799.9	0.7	25.2	1	0.96 Eq H1-1a	0.0	50	W14X550
FLOOR 3	3893.3	1.9	50.0	1	0.86 Eq H1-1a	0.0	50	W14X398
FLOOR 2	3986.7	0.9	26.2	1	0.94 Eq H1-1a	0.0	50	W14X398

Column Line 66.75ft - 10.91ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	91.6	4.3	0.3	1	0.87 Eq H1-1a	0.0	50	W10X33
FLOOR 41M	92.0	4.3	0.3	1	0.88 Eq H1-1a	0.0	50	W10X33

Gravity Column Design Summary

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Column Line 4 - F

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	202.7	16.9	0.0	1	0.85 Eq H1-1a	90.0	50	W10X39
FLOOR 39	203.6	0.0	0.0	1	0.67 Eq H1-1a	90.0	50	W10X33
FLOOR 38	204.4	0.0	0.0	1	0.67 Eq H1-1a	90.0	50	W10X33
FLOOR 37	205.2	0.0	0.0	1	0.67 Eq H1-1a	90.0	50	W10X33
FLOOR 36	206.1	0.0	0.0	1	0.68 Eq H1-1a	90.0	50	W10X33
FLOOR 35	206.9	0.0	0.0	1	0.68 Eq H1-1a	90.0	50	W10X33
FLOOR 34	207.8	0.0	0.0	1	0.68 Eq H1-1a	90.0	50	W10X33
FLOOR 33	208.6	0.0	0.0	1	0.68 Eq H1-1a	90.0	50	W10X33
FLOOR 32	209.4	0.0	0.0	1	0.69 Eq H1-1a	90.0	50	W10X33
FLOOR 31	210.3	0.0	0.0	1	0.69 Eq H1-1a	90.0	50	W10X33
FLOOR 30	211.1	0.0	0.0	1	0.69 Eq H1-1a	90.0	50	W10X33
FLOOR 29	212.0	0.0	0.0	1	0.70 Eq H1-1a	90.0	50	W10X33
FLOOR 28	212.8	0.0	0.0	1	0.70 Eq H1-1a	90.0	50	W10X33
FLOOR 27	213.6	0.0	0.0	1	0.70 Eq H1-1a	90.0	50	W10X33
FLOOR 26	214.5	0.0	0.0	1	0.70 Eq H1-1a	90.0	50	W10X33
FLOOR 25	215.3	0.0	0.0	1	0.71 Eq H1-1a	90.0	50	W10X33
FLOOR 24	216.2	0.0	0.0	1	0.71 Eq H1-1a	90.0	50	W10X33
FLOOR 23	217.0	0.0	0.0	1	0.71 Eq H1-1a	90.0	50	W10X33
FLOOR 22	217.8	0.0	0.0	1	0.71 Eq H1-1a	90.0	50	W10X33
FLOOR 21	218.7	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W10X33
FLOOR 20	219.5	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W10X33
FLOOR 19	220.3	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W10X33
FLOOR 18	221.2	0.0	0.0	1	0.73 Eq H1-1a	90.0	50	W10X33
FLOOR 17	222.0	0.0	0.0	1	0.73 Eq H1-1a	90.0	50	W10X33
FLOOR 16	222.9	0.0	0.0	1	0.73 Eq H1-1a	90.0	50	W10X33
FLOOR 15	223.7	0.0	0.0	1	0.73 Eq H1-1a	90.0	50	W10X33
FLOOR 14	224.5	0.0	0.0	1	0.74 Eq H1-1a	90.0	50	W10X33
FLOOR 13	225.4	0.0	0.0	1	0.74 Eq H1-1a	90.0	50	W10X33
FLOOR 12	226.2	0.0	0.0	1	0.74 Eq H1-1a	90.0	50	W10X33
FLOOR 11	227.1	0.0	0.0	1	0.75 Eq H1-1a	90.0	50	W10X33
FLOOR 10	227.9	0.0	0.0	1	0.75 Eq H1-1a	90.0	50	W10X33
FLOOR 9	228.7	0.0	0.0	1	0.75 Eq H1-1a	90.0	50	W10X33
FLOOR 8	229.6	0.0	0.0	1	0.75 Eq H1-1a	90.0	50	W10X33
FLOOR 7	230.4	0.0	0.0	1	0.76 Eq H1-1a	90.0	50	W10X33
FLOOR 6	231.2	0.0	0.0	1	0.76 Eq H1-1a	90.0	50	W10X33
FLOOR 5	232.1	0.0	0.0	1	0.76 Eq H1-1a	90.0	50	W10X33
FLOOR 4	233.6	6.9	0.0	3	0.92 Eq H1-1a	90.0	50	W10X88
FLOOR 3.2	234.8	6.9	0.0	3	0.92 Eq H1-1a	90.0	50	W10X88
FLOOR 3.1	235.9	6.9	0.0	3	0.93 Eq H1-1a	90.0	50	W10X88
FLOOR 3	381.9	13.5	0.0	3	0.57 Eq H1-1a	90.0	50	W10X68
FLOOR 2	523.3	0.1	0.0	1	0.92 Eq H1-1a	90.0	50	W10X68

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Column Line 4 - B

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	202.9	17.1	0.0	1	0.85 Eq H1-1a	90.0	50	W10X39
FLOOR 39	203.7	0.0	0.0	1	0.67 Eq H1-1a	90.0	50	W10X33
FLOOR 38	204.5	0.0	0.0	1	0.67 Eq H1-1a	90.0	50	W10X33
FLOOR 37	205.4	0.0	0.0	1	0.67 Eq H1-1a	90.0	50	W10X33
FLOOR 36	206.2	0.0	0.0	1	0.68 Eq H1-1a	90.0	50	W10X33
FLOOR 35	207.1	0.0	0.0	1	0.68 Eq H1-1a	90.0	50	W10X33
FLOOR 34	207.9	0.0	0.0	1	0.68 Eq H1-1a	90.0	50	W10X33
FLOOR 33	208.7	0.0	0.0	1	0.68 Eq H1-1a	90.0	50	W10X33
FLOOR 32	209.6	0.0	0.0	1	0.69 Eq H1-1a	90.0	50	W10X33
FLOOR 31	210.4	0.0	0.0	1	0.69 Eq H1-1a	90.0	50	W10X33
FLOOR 30	211.3	0.0	0.0	1	0.69 Eq H1-1a	90.0	50	W10X33
FLOOR 29	212.1	0.0	0.0	1	0.70 Eq H1-1a	90.0	50	W10X33
FLOOR 28	212.9	0.0	0.0	1	0.70 Eq H1-1a	90.0	50	W10X33
FLOOR 27	213.8	0.0	0.0	1	0.70 Eq H1-1a	90.0	50	W10X33
FLOOR 26	214.6	0.0	0.0	1	0.70 Eq H1-1a	90.0	50	W10X33
FLOOR 25	215.5	0.0	0.0	1	0.71 Eq H1-1a	90.0	50	W10X33
FLOOR 24	216.3	0.0	0.0	1	0.71 Eq H1-1a	90.0	50	W10X33
FLOOR 23	217.1	0.0	0.0	1	0.71 Eq H1-1a	90.0	50	W10X33
FLOOR 22	218.0	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W10X33
FLOOR 21	218.8	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W10X33
FLOOR 20	219.7	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W10X33
FLOOR 19	220.5	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W10X33
FLOOR 18	221.3	0.0	0.0	1	0.73 Eq H1-1a	90.0	50	W10X33
FLOOR 17	222.2	0.0	0.0	1	0.73 Eq H1-1a	90.0	50	W10X33
FLOOR 16	223.0	0.0	0.0	1	0.73 Eq H1-1a	90.0	50	W10X33
FLOOR 15	223.9	0.0	0.0	1	0.73 Eq H1-1a	90.0	50	W10X33
FLOOR 14	224.7	0.0	0.0	1	0.74 Eq H1-1a	90.0	50	W10X33
FLOOR 13	225.5	0.0	0.0	1	0.74 Eq H1-1a	90.0	50	W10X33
FLOOR 12	226.4	0.0	0.0	1	0.74 Eq H1-1a	90.0	50	W10X33
FLOOR 11	227.2	0.0	0.0	1	0.75 Eq H1-1a	90.0	50	W10X33
FLOOR 10	228.1	0.0	0.0	1	0.75 Eq H1-1a	90.0	50	W10X33
FLOOR 9	228.9	0.0	0.0	1	0.75 Eq H1-1a	90.0	50	W10X33
FLOOR 8	229.7	0.0	0.0	1	0.75 Eq H1-1a	90.0	50	W10X33
FLOOR 7	230.6	0.0	0.0	1	0.76 Eq H1-1a	90.0	50	W10X33
FLOOR 6	231.4	0.0	0.0	1	0.76 Eq H1-1a	90.0	50	W10X33
FLOOR 5	232.3	0.0	0.0	1	0.76 Eq H1-1a	90.0	50	W10X33
FLOOR 4	233.8	6.8	0.0	3	0.92 Eq H1-1a	90.0	50	W10X88
FLOOR 3.2	234.9	6.8	0.0	3	0.92 Eq H1-1a	90.0	50	W10X88
FLOOR 3.1	236.1	6.8	0.0	3	0.93 Eq H1-1a	90.0	50	W10X88
FLOOR 3	382.2	13.4	0.0	3	0.57 Eq H1-1a	90.0	50	W10X68
FLOOR 2	524.1	0.1	0.0	1	0.92 Eq H1-1a	90.0	50	W10X68

Gravity Column Design Summary

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Column Line 66.75ft - 124.35ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	98.7	3.4	0.4	1	0.93 Eq H1-1a	0.0	50	W10X33
FLOOR 41M	99.0	3.4	0.4	1	0.94 Eq H1-1a	0.0	50	W10X33

Column Line 4 - A

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	117.7	2.5	59.1	3	1.00 Eq H1-1a	0.0	50	W14X53
FLOOR 39	212.9	4.7	0.1	3	0.50 Eq H1-1a	0.0	50	W14X48
FLOOR 38	311.7	4.1	0.1	3	0.72 Eq H1-1a	0.0	50	W14X48
FLOOR 37	410.2	3.8	0.1	3	0.95 Eq H1-1a	0.0	50	W14X48
FLOOR 36	508.7	3.8	0.1	3	0.61 Eq H1-1a	0.0	50	W14X82
FLOOR 35	610.2	3.8	0.1	3	0.73 Eq H1-1a	0.0	50	W14X82
FLOOR 34	711.8	3.8	0.1	3	0.85 Eq H1-1a	0.0	50	W14X82
FLOOR 33	813.4	3.8	0.1	3	0.97 Eq H1-1a	0.0	50	W14X82
FLOOR 32	915.3	3.8	0.1	3	0.74 Eq H1-1a	0.0	50	W14X109
FLOOR 31	1017.2	3.8	0.1	3	0.82 Eq H1-1a	0.0	50	W14X109
FLOOR 30	1119.1	3.8	0.1	3	0.90 Eq H1-1a	0.0	50	W14X109
FLOOR 29	1221.0	3.8	0.1	3	0.98 Eq H1-1a	0.0	50	W14X109
FLOOR 28	1323.4	3.9	0.1	3	0.79 Eq H1-1a	0.0	50	W14X145
FLOOR 27	1425.8	3.9	0.1	3	0.85 Eq H1-1a	0.0	50	W14X145
FLOOR 26	1528.1	3.9	0.1	3	0.91 Eq H1-1a	0.0	50	W14X145
FLOOR 25	1630.5	3.9	0.1	3	0.97 Eq H1-1a	0.0	50	W14X145
FLOOR 24	1733.3	3.9	0.1	3	0.85 Eq H1-1a	0.0	50	W14X176
FLOOR 23	1836.0	3.9	0.1	3	0.90 Eq H1-1a	0.0	50	W14X176
FLOOR 22	1938.8	3.9	0.1	3	0.95 Eq H1-1a	0.0	50	W14X176
FLOOR 21	2041.5	3.9	0.1	3	1.00 Eq H1-1a	0.0	50	W14X176
FLOOR 20	2145.0	4.1	0.1	3	0.79 Eq H1-1a	0.0	50	W14X233
FLOOR 19	2248.5	4.1	0.1	3	0.83 Eq H1-1a	0.0	50	W14X233
FLOOR 18	2351.9	4.1	0.1	3	0.87 Eq H1-1a	0.0	50	W14X233
FLOOR 17	2455.4	4.1	0.1	3	0.91 Eq H1-1a	0.0	50	W14X233
FLOOR 16	2559.2	4.2	0.1	3	0.85 Eq H1-1a	0.0	50	W14X257
FLOOR 15	2662.9	4.2	0.1	3	0.89 Eq H1-1a	0.0	50	W14X257
FLOOR 14	2766.7	4.2	0.1	3	0.92 Eq H1-1a	0.0	50	W14X257
FLOOR 13	2870.5	4.2	0.1	3	0.96 Eq H1-1a	0.0	50	W14X257
FLOOR 12	2974.6	4.2	0.1	3	0.90 Eq H1-1a	0.0	50	W14X283
FLOOR 11	3078.7	4.2	0.1	3	0.93 Eq H1-1a	0.0	50	W14X283
FLOOR 10	3182.8	4.2	0.1	3	0.96 Eq H1-1a	0.0	50	W14X283
FLOOR 9	3286.9	4.2	0.1	3	0.99 Eq H1-1a	0.0	50	W14X283
FLOOR 8	3391.7	4.4	0.1	3	0.84 Eq H1-1a	0.0	50	W14X342
FLOOR 7	3496.6	4.4	0.1	3	0.87 Eq H1-1a	0.0	50	W14X342
FLOOR 6	3601.4	4.4	0.1	3	0.90 Eq H1-1a	0.0	50	W14X342
FLOOR 5	3706.3	6.6	0.1	3	0.92 Eq H1-1a	0.0	50	W14X342
FLOOR 4	3813.9	0.7	25.4	1	0.96 Eq H1-1a	0.0	50	W14X550
FLOOR 3.2	3820.9	0.7	25.4	1	0.96 Eq H1-1a	0.0	50	W14X550

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FLOOR 3.1	3828.0	0.7	25.5	1	0.96 Eq H1-1a	0.0	50	W14X550
FLOOR 3	3921.1	2.0	50.0	1	0.87 Eq H1-1a	0.0	50	W14X398
FLOOR 2	4014.0	0.9	26.2	1	0.95 Eq H1-1a	0.0	50	W14X398

Column Line 75.92ft - 57.17ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41M	61.5	0.2	32.8	3	0.59 Eq H1-1b	90.0	50	W14X43
FLOOR 40M	87.4	0.1	6.7	3	0.41 Eq H1-1a	90.0	50	W14X43
FLOOR 39	118.7	0.1	9.6	3	0.44 Eq H1-1a	90.0	50	W14X43
FLOOR 38	147.3	0.1	7.9	3	0.49 Eq H1-1a	90.0	50	W14X43
FLOOR 37	176.2	0.1	7.8	3	0.56 Eq H1-1a	90.0	50	W14X43
FLOOR 36	205.2	0.1	7.8	3	0.64 Eq H1-1a	90.0	50	W14X43
FLOOR 35	234.2	0.1	7.7	3	0.71 Eq H1-1a	90.0	50	W14X43
FLOOR 34	263.3	0.1	7.7	3	0.78 Eq H1-1a	90.0	50	W14X43
FLOOR 33	292.3	0.1	7.6	3	0.86 Eq H1-1a	90.0	50	W14X43
FLOOR 32	321.5	0.1	7.6	3	0.74 Eq H1-1a	90.0	50	W14X53
FLOOR 31	350.6	0.1	7.6	3	0.80 Eq H1-1a	90.0	50	W14X53
FLOOR 30	379.8	0.1	7.6	3	0.86 Eq H1-1a	90.0	50	W14X53
FLOOR 29	408.9	0.1	7.5	3	0.92 Eq H1-1a	90.0	50	W14X53
FLOOR 28	438.1	0.1	8.6	3	0.76 Eq H1-1a	90.0	50	W14X61
FLOOR 27	467.3	0.1	8.6	3	0.81 Eq H1-1a	90.0	50	W14X61
FLOOR 26	496.5	0.1	8.6	3	0.85 Eq H1-1a	90.0	50	W14X61
FLOOR 25	525.6	0.1	8.6	3	0.90 Eq H1-1a	90.0	50	W14X61
FLOOR 24	554.9	0.1	8.6	3	0.84 Eq H1-1a	90.0	50	W14X68
FLOOR 23	585.1	0.1	8.5	3	0.89 Eq H1-1a	90.0	50	W14X68
FLOOR 22	615.5	0.1	8.5	3	0.93 Eq H1-1a	90.0	50	W14X68
FLOOR 21	646.0	0.1	8.5	3	0.97 Eq H1-1a	90.0	50	W14X68
FLOOR 20	676.6	0.1	8.6	3	0.84 Eq H1-1a	90.0	50	W14X82
FLOOR 19	707.2	0.1	8.6	3	0.88 Eq H1-1a	90.0	50	W14X82
FLOOR 18	737.8	0.1	8.6	3	0.92 Eq H1-1a	90.0	50	W14X82
FLOOR 17	768.4	0.1	8.6	3	0.95 Eq H1-1a	90.0	50	W14X82
FLOOR 16	799.1	0.1	11.1	3	0.81 Eq H1-1a	90.0	50	W14X90
FLOOR 15	829.9	0.1	11.1	3	0.84 Eq H1-1a	90.0	50	W14X90
FLOOR 14	860.6	0.1	11.1	3	0.87 Eq H1-1a	90.0	50	W14X90
FLOOR 13	891.3	0.1	11.1	3	0.90 Eq H1-1a	90.0	50	W14X90
FLOOR 12	922.1	0.1	11.1	3	0.84 Eq H1-1a	90.0	50	W14X99
FLOOR 11	953.0	0.1	11.1	3	0.87 Eq H1-1a	90.0	50	W14X99
FLOOR 10	983.8	0.1	11.1	3	0.90 Eq H1-1a	90.0	50	W14X99
FLOOR 9	1014.6	0.1	11.1	3	0.92 Eq H1-1a	90.0	50	W14X99
FLOOR 8	1045.6	0.1	11.1	3	0.86 Eq H1-1a	90.0	50	W14X109
FLOOR 7	1076.5	0.1	11.1	3	0.89 Eq H1-1a	90.0	50	W14X109
FLOOR 6	1107.5	0.1	11.1	3	0.91 Eq H1-1a	90.0	50	W14X109
FLOOR 5	1138.4	0.1	16.8	3	0.95 Eq H1-1a	90.0	50	W14X109
FLOOR 4	1170.5	0.1	7.9	3	0.95 Eq H1-1a	90.0	50	W14X193
FLOOR 3.2	1173.0	0.1	7.9	3	0.95 Eq H1-1a	90.0	50	W14X193
FLOOR 3.1	1175.5	0.1	7.9	3	0.95 Eq H1-1a	90.0	50	W14X193

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FLOOR 3	1217.0	0.2	23.0	3	0.85 Eq H1-1a	90.0	50	W14X132
FLOOR 2	1259.5	0.0	12.0	1	0.95 Eq H1-1a	90.0	50	W14X132

Column Line 75.92ft - 74.67ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41M	107.7	0.4	32.0	11	0.71 Eq H1-1a	90.0	50	W14X43
FLOOR 40M	172.3	0.3	3.6	3	0.67 Eq H1-1a	90.0	50	W14X43
FLOOR 39	194.0	0.4	3.4	6	0.55 Eq H1-1a	90.0	50	W14X43
FLOOR 38	219.8	0.3	2.9	2	0.61 Eq H1-1a	90.0	50	W14X43
FLOOR 37	250.9	0.3	2.9	2	0.69 Eq H1-1a	90.0	50	W14X43
FLOOR 36	275.7	0.3	2.9	2	0.75 Eq H1-1a	90.0	50	W14X43
FLOOR 35	300.8	0.3	2.8	2	0.81 Eq H1-1a	90.0	50	W14X43
FLOOR 34	326.1	0.3	2.8	2	0.88 Eq H1-1a	90.0	50	W14X43
FLOOR 33	351.5	0.3	2.8	2	0.94 Eq H1-1a	90.0	50	W14X43
FLOOR 32	377.1	0.3	2.8	2	0.81 Eq H1-1a	90.0	50	W14X53
FLOOR 31	402.8	0.3	2.8	2	0.86 Eq H1-1a	90.0	50	W14X53
FLOOR 30	428.6	0.3	2.8	2	0.91 Eq H1-1a	90.0	50	W14X53
FLOOR 29	454.4	0.3	2.8	2	0.96 Eq H1-1a	90.0	50	W14X53
FLOOR 28	480.3	0.3	3.2	2	0.79 Eq H1-1a	90.0	50	W14X61
FLOOR 27	506.3	0.3	3.2	2	0.83 Eq H1-1a	90.0	50	W14X61
FLOOR 26	532.3	0.3	3.1	2	0.87 Eq H1-1a	90.0	50	W14X61
FLOOR 25	558.3	0.3	3.1	2	0.91 Eq H1-1a	90.0	50	W14X61
FLOOR 24	584.5	0.3	5.3	1	0.87 Eq H1-1a	90.0	50	W14X68
FLOOR 23	602.9	0.3	5.3	1	0.89 Eq H1-1a	90.0	50	W14X68
FLOOR 22	622.1	0.3	5.3	1	0.92 Eq H1-1a	90.0	50	W14X68
FLOOR 21	641.2	0.3	5.3	1	0.95 Eq H1-1a	90.0	50	W14X68
FLOOR 20	660.4	0.3	5.3	1	0.89 Eq H1-1a	90.0	50	W14X74
FLOOR 19	679.6	0.3	5.3	1	0.92 Eq H1-1a	90.0	50	W14X74
FLOOR 18	698.8	0.3	5.3	1	0.94 Eq H1-1a	90.0	50	W14X74
FLOOR 17	718.0	0.3	5.3	1	0.97 Eq H1-1a	90.0	50	W14X74
FLOOR 16	737.3	0.3	5.3	1	0.90 Eq H1-1a	90.0	50	W14X82
FLOOR 15	756.6	0.3	5.3	1	0.92 Eq H1-1a	90.0	50	W14X82
FLOOR 14	775.9	0.3	5.3	1	0.94 Eq H1-1a	90.0	50	W14X82
FLOOR 13	795.2	0.3	5.3	1	0.97 Eq H1-1a	90.0	50	W14X82
FLOOR 12	814.6	0.3	5.9	1	0.81 Eq H1-1a	90.0	50	W14X90
FLOOR 11	834.1	0.3	5.9	1	0.83 Eq H1-1a	90.0	50	W14X90
FLOOR 10	853.5	0.3	5.9	1	0.85 Eq H1-1a	90.0	50	W14X90
FLOOR 9	872.9	0.3	5.9	1	0.87 Eq H1-1a	90.0	50	W14X90
FLOOR 8	892.3	0.3	5.9	1	0.88 Eq H1-1a	90.0	50	W14X90
FLOOR 7	911.7	0.3	5.9	1	0.90 Eq H1-1a	90.0	50	W14X90
FLOOR 6	931.1	0.3	5.9	1	0.92 Eq H1-1a	90.0	50	W14X90
FLOOR 5	950.5	0.5	10.4	1	0.95 Eq H1-1a	90.0	50	W14X90
FLOOR 4	970.8	0.2	5.4	1	0.97 Eq H1-1a	90.0	50	W14X159
FLOOR 3.2	972.8	0.2	5.5	1	0.97 Eq H1-1a	90.0	50	W14X159
FLOOR 3.1	974.9	0.2	5.5	1	0.97 Eq H1-1a	90.0	50	W14X159
FLOOR 3	1003.3	0.6	15.7	1	0.84 Eq H1-1a	90.0	50	W14X109

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FLOOR 2	1032.5	0.3	8.2	1	0.94 Eq H1-1a	90.0	50	W14X109

Column Line 75.92ft - 86.67ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41M	59.2	29.3	9.2	1	0.36 Eq H1-1b	0.0	50	W12X40
FLOOR 40M	73.1	1.9	2.5	1	0.32 Eq H1-1a	0.0	50	W12X40
FLOOR 39	89.7	1.4	3.4	3	0.30 Eq H1-1a	0.0	50	W12X40
FLOOR 38	107.7	1.3	2.8	3	0.34 Eq H1-1a	0.0	50	W12X40
FLOOR 37	126.3	1.3	2.8	3	0.39 Eq H1-1a	0.0	50	W12X40
FLOOR 36	145.2	1.3	2.8	3	0.44 Eq H1-1a	0.0	50	W12X40
FLOOR 35	164.2	1.2	2.7	3	0.49 Eq H1-1a	0.0	50	W12X40
FLOOR 34	183.4	1.2	2.7	3	0.54 Eq H1-1a	0.0	50	W12X40
FLOOR 33	202.6	1.2	2.7	3	0.60 Eq H1-1a	0.0	50	W12X40
FLOOR 32	221.8	1.2	2.7	3	0.65 Eq H1-1a	0.0	50	W12X40
FLOOR 31	241.0	1.2	2.7	3	0.70 Eq H1-1a	0.0	50	W12X40
FLOOR 30	260.3	1.2	2.7	3	0.75 Eq H1-1a	0.0	50	W12X40
FLOOR 29	279.5	1.2	2.7	3	0.80 Eq H1-1a	0.0	50	W12X40
FLOOR 28	298.8	1.2	2.7	3	0.76 Eq H1-1a	0.0	50	W12X45
FLOOR 27	318.2	1.2	2.6	3	0.81 Eq H1-1a	0.0	50	W12X45
FLOOR 26	337.5	1.2	2.6	3	0.86 Eq H1-1a	0.0	50	W12X45
FLOOR 25	356.8	1.2	2.6	3	0.90 Eq H1-1a	0.0	50	W12X45
FLOOR 24	376.2	2.4	2.6	3	0.85 Eq H1-1a	0.0	50	W12X50
FLOOR 23	389.6	2.4	0.0	3	0.85 Eq H1-1a	0.0	50	W12X50
FLOOR 22	402.9	2.4	0.0	3	0.88 Eq H1-1a	0.0	50	W12X50
FLOOR 21	416.3	2.4	0.0	3	0.91 Eq H1-1a	0.0	50	W12X50
FLOOR 20	429.7	2.4	0.0	3	0.79 Eq H1-1a	0.0	50	W12X53
FLOOR 19	443.1	2.4	0.0	3	0.81 Eq H1-1a	0.0	50	W12X53
FLOOR 18	456.5	2.3	0.0	3	0.84 Eq H1-1a	0.0	50	W12X53
FLOOR 17	469.9	2.3	0.0	3	0.86 Eq H1-1a	0.0	50	W12X53
FLOOR 16	483.3	2.3	0.0	3	0.89 Eq H1-1a	0.0	50	W12X53
FLOOR 15	496.7	2.3	0.0	3	0.91 Eq H1-1a	0.0	50	W12X53
FLOOR 14	510.1	2.3	0.0	3	0.93 Eq H1-1a	0.0	50	W12X53
FLOOR 13	523.5	2.3	0.0	3	0.96 Eq H1-1a	0.0	50	W12X53
FLOOR 12	537.0	2.3	0.0	3	0.90 Eq H1-1a	0.0	50	W12X58
FLOOR 11	550.4	2.3	0.0	3	0.92 Eq H1-1a	0.0	50	W12X58
FLOOR 10	563.9	2.3	0.0	3	0.94 Eq H1-1a	0.0	50	W12X58
FLOOR 9	577.3	2.3	0.0	3	0.96 Eq H1-1a	0.0	50	W12X58
FLOOR 8	591.3	2.3	0.0	3	0.83 Eq H1-1a	0.0	50	W12X65
FLOOR 7	605.3	2.3	0.0	3	0.85 Eq H1-1a	0.0	50	W12X65
FLOOR 6	619.3	2.3	0.0	3	0.87 Eq H1-1a	0.0	50	W12X65
FLOOR 5	633.3	3.5	0.0	3	0.89 Eq H1-1a	0.0	50	W12X65
FLOOR 4	648.4	2.3	0.0	3	0.99 Eq H1-1a	0.0	50	W12X152
FLOOR 3.2	650.3	2.3	0.0	3	0.99 Eq H1-1a	0.0	50	W12X152
FLOOR 3.1	652.3	2.3	0.0	3	1.00 Eq H1-1a	0.0	50	W12X152
FLOOR 3	666.5	6.5	0.0	1	0.78 Eq H1-1a	0.0	50	W12X79
FLOOR 2	681.2	3.4	0.0	1	0.93 Eq H1-1a	0.0	50	W12X79

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Column Line 3 - G

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	104.6	20.1	53.5	1	0.95 Eq H1-1a	0.0	50	W14X53
FLOOR 39	160.6	25.2	3.2	1	0.54 Eq H1-1a	0.0	50	W14X43
FLOOR 38	220.0	20.7	2.7	1	0.67 Eq H1-1a	0.0	50	W14X43
FLOOR 37	279.5	20.3	2.6	1	0.82 Eq H1-1a	0.0	50	W14X43
FLOOR 36	339.2	20.3	3.0	1	0.61 Eq H1-1a	0.0	50	W14X61
FLOOR 35	398.7	20.2	3.0	1	0.70 Eq H1-1a	0.0	50	W14X61
FLOOR 34	458.1	20.1	3.0	1	0.80 Eq H1-1a	0.0	50	W14X61
FLOOR 33	517.5	20.0	3.0	1	0.89 Eq H1-1a	0.0	50	W14X61
FLOOR 32	578.9	20.4	3.0	1	0.73 Eq H1-1a	0.0	50	W14X82
FLOOR 31	640.3	20.4	3.0	1	0.81 Eq H1-1a	0.0	50	W14X82
FLOOR 30	701.7	20.4	3.0	1	0.88 Eq H1-1a	0.0	50	W14X82
FLOOR 29	763.1	20.4	3.0	1	0.95 Eq H1-1a	0.0	50	W14X82
FLOOR 28	824.7	20.3	3.9	1	0.76 Eq H1-1a	0.0	50	W14X99
FLOOR 27	886.3	20.3	3.9	1	0.82 Eq H1-1a	0.0	50	W14X99
FLOOR 26	947.9	20.3	3.9	1	0.87 Eq H1-1a	0.0	50	W14X99
FLOOR 25	1009.5	20.3	3.9	1	0.93 Eq H1-1a	0.0	50	W14X99
FLOOR 24	1071.4	20.6	3.9	1	0.81 Eq H1-1a	0.0	50	W14X120
FLOOR 23	1133.0	20.5	3.9	1	0.85 Eq H1-1a	0.0	50	W14X120
FLOOR 22	1194.6	20.5	3.9	1	0.90 Eq H1-1a	0.0	50	W14X120
FLOOR 21	1256.2	20.5	3.9	1	0.94 Eq H1-1a	0.0	50	W14X120
FLOOR 20	1318.1	20.8	4.1	1	0.81 Eq H1-1a	0.0	50	W14X145
FLOOR 19	1380.0	20.8	4.1	1	0.84 Eq H1-1a	0.0	50	W14X145
FLOOR 18	1442.0	20.8	4.1	1	0.88 Eq H1-1a	0.0	50	W14X145
FLOOR 17	1503.9	20.8	4.1	1	0.92 Eq H1-1a	0.0	50	W14X145
FLOOR 16	1566.0	21.1	4.1	1	0.87 Eq H1-1a	0.0	50	W14X159
FLOOR 15	1628.1	21.1	4.1	1	0.91 Eq H1-1a	0.0	50	W14X159
FLOOR 14	1690.1	21.1	4.1	1	0.94 Eq H1-1a	0.0	50	W14X159
FLOOR 13	1752.2	21.1	4.1	1	0.97 Eq H1-1a	0.0	50	W14X159
FLOOR 12	1814.5	21.3	4.1	1	0.91 Eq H1-1a	0.0	50	W14X176
FLOOR 11	1876.9	21.3	4.1	1	0.94 Eq H1-1a	0.0	50	W14X176
FLOOR 10	1939.2	21.3	4.1	1	0.97 Eq H1-1a	0.0	50	W14X176
FLOOR 9	2001.5	21.3	4.1	1	1.00 Eq H1-1a	0.0	50	W14X176
FLOOR 8	2064.2	21.8	4.1	1	0.86 Eq H1-1a	0.0	50	W14X211
FLOOR 7	2127.0	21.8	4.1	1	0.88 Eq H1-1a	0.0	50	W14X211
FLOOR 6	2189.7	21.8	4.1	1	0.91 Eq H1-1a	0.0	50	W14X211
FLOOR 5	2252.4	32.9	5.3	1	0.94 Eq H1-1a	0.0	50	W14X211
FLOOR 4	2317.3	11.8	15.7	1	0.92 Eq H1-1a	0.0	50	W14X370
FLOOR 3.2	2322.0	11.8	15.8	1	0.92 Eq H1-1a	0.0	50	W14X370
FLOOR 3.1	2326.8	11.8	15.8	1	0.92 Eq H1-1a	0.0	50	W14X370
FLOOR 3	2392.6	5.8	35.7	1	0.83 Eq H1-1a	0.0	50	W14X257
FLOOR 2	2457.6	2.5	18.3	1	0.91 Eq H1-1a	0.0	50	W14X257

Column Line 98.75ft - 4.00ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	67.2	25.7	2.3	1	0.81 Eq H1-1a	0.0	50	W10X33
FLOOR 41M	67.5	25.7	2.3	1	0.82 Eq H1-1a	0.0	50	W10X33

Column Line 3 - F

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	34.4	12.1	14.9	5	0.51 Eq H1-1a	0.0	50	W14X43
FLOOR 41M	34.9	12.1	14.9	5	0.51 Eq H1-1a	0.0	50	W14X43
FLOOR 40M	187.2	13.2	13.4	10	0.91 Eq H1-1a	0.0	50	W14X43
FLOOR 39	251.1	7.6	3.7	10	0.72 Eq H1-1a	0.0	50	W14X43
FLOOR 38	294.4	6.3	3.1	4	0.82 Eq H1-1a	0.0	50	W14X43
FLOOR 37	336.6	6.3	3.0	4	0.93 Eq H1-1a	0.0	50	W14X43
FLOOR 36	379.4	6.3	3.5	4	0.64 Eq H1-1a	0.0	50	W14X61
FLOOR 35	422.5	6.3	3.4	4	0.71 Eq H1-1a	0.0	50	W14X61
FLOOR 34	465.7	6.2	3.4	4	0.78 Eq H1-1a	0.0	50	W14X61
FLOOR 33	509.1	6.2	3.4	4	0.85 Eq H1-1a	0.0	50	W14X61
FLOOR 32	554.7	6.3	3.4	4	0.75 Eq H1-1a	0.0	50	W14X74
FLOOR 31	600.4	6.3	3.4	4	0.81 Eq H1-1a	0.0	50	W14X74
FLOOR 30	646.0	6.3	3.4	4	0.87 Eq H1-1a	0.0	50	W14X74
FLOOR 29	691.7	6.3	3.4	4	0.93 Eq H1-1a	0.0	50	W14X74
FLOOR 28	737.6	6.2	4.4	4	0.74 Eq H1-1a	0.0	50	W14X90
FLOOR 27	783.5	6.2	4.4	4	0.78 Eq H1-1a	0.0	50	W14X90
FLOOR 26	829.4	6.2	4.4	4	0.82 Eq H1-1a	0.0	50	W14X90
FLOOR 25	875.3	6.2	4.4	4	0.87 Eq H1-1a	0.0	50	W14X90
FLOOR 24	921.3	6.3	4.4	4	0.83 Eq H1-1a	0.0	50	W14X99
FLOOR 23	967.2	6.3	4.4	4	0.87 Eq H1-1a	0.0	50	W14X99
FLOOR 22	1013.2	6.3	4.4	4	0.91 Eq H1-1a	0.0	50	W14X99
FLOOR 21	1059.2	6.3	4.4	4	0.95 Eq H1-1a	0.0	50	W14X99
FLOOR 20	1105.5	6.4	4.5	4	0.82 Eq H1-1a	0.0	50	W14X120
FLOOR 19	1151.8	6.4	4.5	4	0.85 Eq H1-1a	0.0	50	W14X120
FLOOR 18	1198.0	6.4	4.5	4	0.88 Eq H1-1a	0.0	50	W14X120
FLOOR 17	1244.3	6.4	4.5	4	0.92 Eq H1-1a	0.0	50	W14X120
FLOOR 16	1290.7	6.5	4.5	4	0.86 Eq H1-1a	0.0	50	W14X132
FLOOR 15	1337.1	6.5	4.5	4	0.90 Eq H1-1a	0.0	50	W14X132
FLOOR 14	1383.5	6.5	4.5	4	0.93 Eq H1-1a	0.0	50	W14X132
FLOOR 13	1429.9	6.5	4.5	4	0.96 Eq H1-1a	0.0	50	W14X132
FLOOR 12	1476.5	6.5	4.6	4	0.89 Eq H1-1a	0.0	50	W14X145
FLOOR 11	1523.0	6.5	4.6	4	0.92 Eq H1-1a	0.0	50	W14X145
FLOOR 10	1569.6	6.5	4.6	4	0.94 Eq H1-1a	0.0	50	W14X145
FLOOR 9	1616.2	6.5	4.6	4	0.97 Eq H1-1a	0.0	50	W14X145
FLOOR 8	1662.9	6.6	4.7	4	0.91 Eq H1-1a	0.0	50	W14X159
FLOOR 7	1709.7	6.6	4.7	4	0.94 Eq H1-1a	0.0	50	W14X159
FLOOR 6	1756.4	6.6	4.7	4	0.96 Eq H1-1a	0.0	50	W14X159

FLOOR 5	1803.2	9.9	7.0	5	1.00 Eq H1-1a	0.0	50	W14X159
FLOOR 4	1851.5	5.4	11.9	5	0.99 Eq H1-1a	0.0	50	W14X283
FLOOR 3.2	1855.2	5.4	12.0	5	0.99 Eq H1-1a	0.0	50	W14X283
FLOOR 3.1	1858.8	5.4	12.0	5	0.99 Eq H1-1a	0.0	50	W14X283
FLOOR 3	2008.4	15.9	19.7	4	0.85 Eq H1-1a	0.0	50	W14X211
FLOOR 2	2159.2	8.3	6.0	1	0.98 Eq H1-1a	0.0	50	W14X211

Column Line 3 - B

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	135.9	7.2	25.9	10	0.88 Eq H1-1a	0.0	50	W14X43
FLOOR 39	197.3	3.4	3.1	6	0.56 Eq H1-1a	0.0	50	W14X43
FLOOR 38	227.2	2.9	2.6	2	0.63 Eq H1-1a	0.0	50	W14X43
FLOOR 37	255.9	2.8	2.5	2	0.70 Eq H1-1a	0.0	50	W14X43
FLOOR 36	285.1	2.8	2.5	2	0.69 Eq H1-1a	0.0	50	W14X48
FLOOR 35	314.5	2.8	2.5	2	0.76 Eq H1-1a	0.0	50	W14X48
FLOOR 34	343.9	2.8	2.5	2	0.82 Eq H1-1a	0.0	50	W14X48
FLOOR 33	373.5	2.8	2.4	2	0.89 Eq H1-1a	0.0	50	W14X48
FLOOR 32	403.3	2.8	2.8	2	0.67 Eq H1-1a	0.0	50	W14X61
FLOOR 31	433.1	2.8	2.8	2	0.72 Eq H1-1a	0.0	50	W14X61
FLOOR 30	462.9	2.8	2.8	2	0.76 Eq H1-1a	0.0	50	W14X61
FLOOR 29	492.8	2.7	2.7	2	0.81 Eq H1-1a	0.0	50	W14X61
FLOOR 28	523.6	2.8	2.7	2	0.77 Eq H1-1a	0.0	50	W14X68
FLOOR 27	554.8	2.8	2.7	2	0.81 Eq H1-1a	0.0	50	W14X68
FLOOR 26	586.0	2.8	2.7	2	0.86 Eq H1-1a	0.0	50	W14X68
FLOOR 25	617.3	2.8	2.7	2	0.90 Eq H1-1a	0.0	50	W14X68
FLOOR 24	648.6	2.8	2.8	2	0.86 Eq H1-1a	0.0	50	W14X74
FLOOR 23	679.8	2.8	2.8	2	0.91 Eq H1-1a	0.0	50	W14X74
FLOOR 22	711.1	2.8	2.8	2	0.95 Eq H1-1a	0.0	50	W14X74
FLOOR 21	742.4	2.8	2.8	2	0.99 Eq H1-1a	0.0	50	W14X74
FLOOR 20	773.9	2.8	3.6	2	0.76 Eq H1-1a	0.0	50	W14X90
FLOOR 19	805.4	2.8	3.6	2	0.79 Eq H1-1a	0.0	50	W14X90
FLOOR 18	836.9	2.8	3.6	2	0.82 Eq H1-1a	0.0	50	W14X90
FLOOR 17	868.3	2.8	3.6	2	0.85 Eq H1-1a	0.0	50	W14X90
FLOOR 16	899.8	2.8	3.6	2	0.88 Eq H1-1a	0.0	50	W14X90
FLOOR 15	931.3	2.8	3.6	2	0.91 Eq H1-1a	0.0	50	W14X90
FLOOR 14	962.8	2.8	3.6	2	0.95 Eq H1-1a	0.0	50	W14X90
FLOOR 13	994.3	2.8	3.6	2	0.98 Eq H1-1a	0.0	50	W14X90
FLOOR 12	1025.9	2.8	3.6	2	0.92 Eq H1-1a	0.0	50	W14X99
FLOOR 11	1057.5	2.8	3.6	2	0.94 Eq H1-1a	0.0	50	W14X99
FLOOR 10	1089.1	2.8	3.6	2	0.97 Eq H1-1a	0.0	50	W14X99
FLOOR 9	1120.6	2.8	3.6	2	1.00 Eq H1-1a	0.0	50	W14X99
FLOOR 8	1152.5	2.8	3.6	2	0.85 Eq H1-1a	0.0	50	W14X120
FLOOR 7	1184.4	2.8	3.6	2	0.87 Eq H1-1a	0.0	50	W14X120
FLOOR 6	1216.2	2.8	3.6	2	0.89 Eq H1-1a	0.0	50	W14X120
FLOOR 5	1248.1	4.3	5.4	2	0.92 Eq H1-1a	0.0	50	W14X120
FLOOR 4	1281.1	2.3	10.7	2	0.94 Eq H1-1a	0.0	50	W14X211

FLOOR 3.2	1283.8	2.3	10.7	2	0.95 Eq H1-1a	0.0	50	W14X211
FLOOR 3.1	1286.5	2.3	10.8	2	0.95 Eq H1-1a	0.0	50	W14X211
FLOOR 3	1413.7	6.9	18.2	2	0.80 Eq H1-1a	0.0	50	W14X159
FLOOR 2	1541.8	3.6	5.4	1	0.93 Eq H1-1a	0.0	50	W14X159

Column Line 98.75ft - 118.53ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	60.0	24.7	7.2	1	0.83 Eq H1-1a	0.0	50	W10X33
FLOOR 41M	60.4	24.7	7.2	1	0.83 Eq H1-1a	0.0	50	W10X33

Column Line 3 - A

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	74.0	0.0	0.0	1	0.27 Eq H1-1a	0.0	50	W14X43
FLOOR 39	150.0	0.0	0.0	1	0.39 Eq H1-1a	0.0	50	W14X43
FLOOR 38	226.8	0.0	0.0	1	0.58 Eq H1-1a	0.0	50	W14X43
FLOOR 37	302.9	0.0	0.0	1	0.78 Eq H1-1a	0.0	50	W14X43
FLOOR 36	378.8	0.0	0.0	1	0.60 Eq H1-1a	0.0	50	W14X61
FLOOR 35	454.4	0.0	0.0	1	0.72 Eq H1-1a	0.0	50	W14X61
FLOOR 34	529.8	0.0	0.0	1	0.84 Eq H1-1a	0.0	50	W14X61
FLOOR 33	605.0	0.0	0.0	1	0.96 Eq H1-1a	0.0	50	W14X61
FLOOR 32	682.4	0.0	0.0	1	0.66 Eq H1-1a	0.0	50	W14X90
FLOOR 31	760.0	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W14X90
FLOOR 30	837.5	0.0	0.0	1	0.81 Eq H1-1a	0.0	50	W14X90
FLOOR 29	915.1	0.0	0.0	1	0.88 Eq H1-1a	0.0	50	W14X90
FLOOR 28	992.9	0.0	0.0	1	0.79 Eq H1-1a	0.0	50	W14X109
FLOOR 27	1070.7	0.0	0.0	1	0.85 Eq H1-1a	0.0	50	W14X109
FLOOR 26	1148.5	0.0	0.0	1	0.92 Eq H1-1a	0.0	50	W14X109
FLOOR 25	1226.3	0.0	0.0	1	0.98 Eq H1-1a	0.0	50	W14X109
FLOOR 24	1304.7	0.0	0.0	1	0.77 Eq H1-1a	0.0	50	W14X145
FLOOR 23	1383.1	0.0	0.0	1	0.82 Eq H1-1a	0.0	50	W14X145
FLOOR 22	1461.4	0.0	0.0	1	0.87 Eq H1-1a	0.0	50	W14X145
FLOOR 21	1539.8	0.0	0.0	1	0.91 Eq H1-1a	0.0	50	W14X145
FLOOR 20	1618.6	0.0	0.0	1	0.79 Eq H1-1a	0.0	50	W14X176
FLOOR 19	1697.4	0.0	0.0	1	0.83 Eq H1-1a	0.0	50	W14X176
FLOOR 18	1776.2	0.0	0.0	1	0.87 Eq H1-1a	0.0	50	W14X176
FLOOR 17	1855.0	0.0	0.0	1	0.90 Eq H1-1a	0.0	50	W14X176
FLOOR 16	1934.1	0.0	0.0	1	0.86 Eq H1-1a	0.0	50	W14X193
FLOOR 15	2013.1	0.0	0.0	1	0.89 Eq H1-1a	0.0	50	W14X193
FLOOR 14	2092.2	0.0	0.0	1	0.93 Eq H1-1a	0.0	50	W14X193
FLOOR 13	2171.2	0.0	0.0	1	0.96 Eq H1-1a	0.0	50	W14X193
FLOOR 12	2250.9	0.0	0.0	1	0.83 Eq H1-1a	0.0	50	W14X233
FLOOR 11	2330.5	0.0	0.0	1	0.86 Eq H1-1a	0.0	50	W14X233
FLOOR 10	2410.1	0.0	0.0	1	0.89 Eq H1-1a	0.0	50	W14X233
FLOOR 9	2489.8	0.0	0.0	1	0.92 Eq H1-1a	0.0	50	W14X233
FLOOR 8	2569.7	0.0	0.0	1	0.86 Eq H1-1a	0.0	50	W14X257

FLOOR 7	2649.7	0.0	0.0	1	0.88 Eq H1-1a	0.0	50	W14X257
FLOOR 6	2729.7	0.0	0.0	1	0.91 Eq H1-1a	0.0	50	W14X257
FLOOR 5	2809.7	0.0	0.0	1	0.94 Eq H1-1a	0.0	50	W14X257
FLOOR 4	2892.3	0.0	0.0	1	0.96 Eq H1-1a	0.0	50	W14X426
FLOOR 3.2	2898.6	0.0	0.0	1	0.97 Eq H1-1a	0.0	50	W14X426
FLOOR 3.1	2905.0	0.0	0.0	1	0.97 Eq H1-1a	0.0	50	W14X426
FLOOR 3	2986.7	0.0	0.0	1	0.82 Eq H1-1a	0.0	50	W14X311
FLOOR 2	3077.2	0.0	0.0	1	0.92 Eq H1-1a	0.0	50	W14X311

Column Line 2 - E

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	41.4	12.3	7.1	2	0.45 Eq H1-1a	90.0	50	W14X43
FLOOR 41M	41.9	12.3	7.2	2	0.45 Eq H1-1a	90.0	50	W14X43
FLOOR 40M	167.6	13.3	12.7	6	0.83 Eq H1-1a	90.0	50	W14X43
FLOOR 39	236.7	7.6	3.2	10	0.68 Eq H1-1a	90.0	50	W14X43
FLOOR 38	278.5	6.3	2.7	4	0.77 Eq H1-1a	90.0	50	W14X43
FLOOR 37	319.2	6.3	2.6	4	0.88 Eq H1-1a	90.0	50	W14X43
FLOOR 36	360.6	6.3	3.0	4	0.61 Eq H1-1a	90.0	50	W14X61
FLOOR 35	402.2	6.3	3.0	4	0.68 Eq H1-1a	90.0	50	W14X61
FLOOR 34	444.0	6.2	2.9	4	0.74 Eq H1-1a	90.0	50	W14X61
FLOOR 33	485.8	6.2	2.9	4	0.81 Eq H1-1a	90.0	50	W14X61
FLOOR 32	528.9	6.2	2.9	4	0.78 Eq H1-1a	90.0	50	W14X68
FLOOR 31	572.9	6.2	2.9	4	0.85 Eq H1-1a	90.0	50	W14X68
FLOOR 30	616.9	6.2	2.9	4	0.91 Eq H1-1a	90.0	50	W14X68
FLOOR 29	660.8	6.2	2.9	4	0.97 Eq H1-1a	90.0	50	W14X68
FLOOR 28	705.1	6.2	3.8	4	0.70 Eq H1-1a	90.0	50	W14X90
FLOOR 27	749.4	6.2	3.8	4	0.75 Eq H1-1a	90.0	50	W14X90
FLOOR 26	793.7	6.2	3.8	4	0.79 Eq H1-1a	90.0	50	W14X90
FLOOR 25	837.9	6.2	3.8	4	0.83 Eq H1-1a	90.0	50	W14X90
FLOOR 24	882.3	6.3	3.8	4	0.79 Eq H1-1a	90.0	50	W14X99
FLOOR 23	926.7	6.3	3.8	4	0.83 Eq H1-1a	90.0	50	W14X99
FLOOR 22	971.1	6.3	3.8	4	0.87 Eq H1-1a	90.0	50	W14X99
FLOOR 21	1015.4	6.3	3.8	4	0.91 Eq H1-1a	90.0	50	W14X99
FLOOR 20	1059.9	6.3	3.8	4	0.86 Eq H1-1a	90.0	50	W14X109
FLOOR 19	1104.4	6.3	3.8	4	0.90 Eq H1-1a	90.0	50	W14X109
FLOOR 18	1148.9	6.3	3.8	4	0.93 Eq H1-1a	90.0	50	W14X109
FLOOR 17	1193.4	6.3	3.8	4	0.97 Eq H1-1a	90.0	50	W14X109
FLOOR 16	1238.2	6.5	3.8	4	0.83 Eq H1-1a	90.0	50	W14X132
FLOOR 15	1283.0	6.5	3.8	4	0.86 Eq H1-1a	90.0	50	W14X132
FLOOR 14	1327.8	6.5	3.8	4	0.89 Eq H1-1a	90.0	50	W14X132
FLOOR 13	1372.6	6.5	3.8	4	0.92 Eq H1-1a	90.0	50	W14X132
FLOOR 12	1417.6	6.5	4.0	4	0.85 Eq H1-1a	90.0	50	W14X145
FLOOR 11	1462.5	6.5	4.0	4	0.88 Eq H1-1a	90.0	50	W14X145
FLOOR 10	1507.5	6.5	4.0	4	0.91 Eq H1-1a	90.0	50	W14X145
FLOOR 9	1552.5	6.5	4.0	4	0.93 Eq H1-1a	90.0	50	W14X145

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Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 8	1597.6	6.6	4.0	4	0.88 Eq H1-1a	90.0	50	W14X159
FLOOR 7	1642.7	6.6	4.0	4	0.90 Eq H1-1a	90.0	50	W14X159
FLOOR 6	1687.8	6.6	4.0	4	0.93 Eq H1-1a	90.0	50	W14X159
FLOOR 5	1733.0	9.9	6.0	4	0.96 Eq H1-1a	90.0	50	W14X159
FLOOR 4	1779.7	5.4	7.8	3	0.95 Eq H1-1a	90.0	50	W14X283
FLOOR 3.2	1783.4	5.4	7.9	3	0.95 Eq H1-1a	90.0	50	W14X283
FLOOR 3.1	1787.0	5.4	7.9	3	0.95 Eq H1-1a	90.0	50	W14X283
FLOOR 3	1925.1	15.8	13.7	4	0.81 Eq H1-1a	90.0	50	W14X211
FLOOR 2	2064.4	8.3	2.1	1	0.93 Eq H1-1a	90.0	50	W14X211

Column Line 2 - D

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	203.3	16.7	0.0	1	0.85 Eq H1-1a	0.0	50	W10X39
FLOOR 39	204.1	0.0	0.0	1	0.67 Eq H1-1a	0.0	50	W10X33
FLOOR 38	205.0	0.0	0.0	1	0.67 Eq H1-1a	0.0	50	W10X33
FLOOR 37	205.8	0.0	0.0	1	0.68 Eq H1-1a	0.0	50	W10X33
FLOOR 36	206.6	0.0	0.0	1	0.68 Eq H1-1a	0.0	50	W10X33
FLOOR 35	207.5	0.0	0.0	1	0.68 Eq H1-1a	0.0	50	W10X33
FLOOR 34	208.3	0.0	0.0	1	0.68 Eq H1-1a	0.0	50	W10X33
FLOOR 33	209.2	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W10X33
FLOOR 32	210.0	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W10X33
FLOOR 31	210.8	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W10X33
FLOOR 30	211.7	0.0	0.0	1	0.69 Eq H1-1a	0.0	50	W10X33
FLOOR 29	212.5	0.0	0.0	1	0.70 Eq H1-1a	0.0	50	W10X33
FLOOR 28	213.4	0.0	0.0	1	0.70 Eq H1-1a	0.0	50	W10X33
FLOOR 27	214.2	0.0	0.0	1	0.70 Eq H1-1a	0.0	50	W10X33
FLOOR 26	215.0	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W10X33
FLOOR 25	215.9	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W10X33
FLOOR 24	216.7	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W10X33
FLOOR 23	217.6	0.0	0.0	1	0.71 Eq H1-1a	0.0	50	W10X33
FLOOR 22	218.4	0.0	0.0	1	0.72 Eq H1-1a	0.0	50	W10X33
FLOOR 21	219.2	0.0	0.0	1	0.72 Eq H1-1a	0.0	50	W10X33
FLOOR 20	220.1	0.0	0.0	1	0.72 Eq H1-1a	0.0	50	W10X33
FLOOR 19	220.9	0.0	0.0	1	0.72 Eq H1-1a	0.0	50	W10X33
FLOOR 18	221.8	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W10X33
FLOOR 17	222.6	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W10X33
FLOOR 16	223.4	0.0	0.0	1	0.73 Eq H1-1a	0.0	50	W10X33
FLOOR 15	224.3	0.0	0.0	1	0.74 Eq H1-1a	0.0	50	W10X33
FLOOR 14	225.1	0.0	0.0	1	0.74 Eq H1-1a	0.0	50	W10X33
FLOOR 13	226.0	0.0	0.0	1	0.74 Eq H1-1a	0.0	50	W10X33
FLOOR 12	226.8	0.0	0.0	1	0.74 Eq H1-1a	0.0	50	W10X33
FLOOR 11	227.6	0.0	0.0	1	0.75 Eq H1-1a	0.0	50	W10X33
FLOOR 10	228.5	0.0	0.0	1	0.75 Eq H1-1a	0.0	50	W10X33
FLOOR 9	229.3	0.0	0.0	1	0.75 Eq H1-1a	0.0	50	W10X33
FLOOR 8	230.2	0.0	0.0	1	0.76 Eq H1-1a	0.0	50	W10X33
FLOOR 7	231.0	0.0	0.0	1	0.76 Eq H1-1a	0.0	50	W10X33

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Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 6	231.8	0.0	0.0	1	0.76 Eq H1-1a	0.0	50	W10X33
FLOOR 5	232.7	0.0	0.0	1	0.76 Eq H1-1a	0.0	50	W10X33
FLOOR 4	234.2	6.9	0.0	3	0.92 Eq H1-1a	0.0	50	W10X88
FLOOR 3.2	235.4	6.9	0.0	3	0.92 Eq H1-1a	0.0	50	W10X88
FLOOR 3.1	236.5	6.9	0.0	3	0.93 Eq H1-1a	0.0	50	W10X88
FLOOR 3	382.9	13.4	0.0	3	0.57 Eq H1-1a	0.0	50	W10X68
FLOOR 2	524.8	0.0	0.0	1	0.92 Eq H1-1a	0.0	50	W10X68

Column Line 2 - C

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	54.2	26.7	6.1	2	0.59 Eq H1-1a	90.0	50	W14X43
FLOOR 41M	54.7	26.7	6.1	2	0.60 Eq H1-1a	90.0	50	W14X43
FLOOR 40M	145.2	3.9	10.9	10	0.69 Eq H1-1a	90.0	50	W14X43
FLOOR 39	185.8	3.1	1.8	4	0.51 Eq H1-1a	90.0	50	W14X43
FLOOR 38	211.6	2.5	1.8	4	0.58 Eq H1-1a	90.0	50	W14X43
FLOOR 37	238.2	2.5	1.7	4	0.64 Eq H1-1a	90.0	50	W14X43
FLOOR 36	265.0	2.5	1.7	4	0.71 Eq H1-1a	90.0	50	W14X43
FLOOR 35	292.0	2.5	1.7	4	0.78 Eq H1-1a	90.0	50	W14X43
FLOOR 34	319.1	2.5	1.6	4	0.85 Eq H1-1a	90.0	50	W14X43
FLOOR 33	346.3	2.5	1.6	4	0.92 Eq H1-1a	90.0	50	W14X43
FLOOR 32	373.6	2.5	1.6	4	0.79 Eq H1-1a	90.0	50	W14X53
FLOOR 31	401.0	2.5	1.6	4	0.85 Eq H1-1a	90.0	50	W14X53
FLOOR 30	428.3	2.5	1.6	4	0.90 Eq H1-1a	90.0	50	W14X53
FLOOR 29	455.7	2.4	1.6	4	0.96 Eq H1-1a	90.0	50	W14X53
FLOOR 28	483.2	2.4	1.8	4	0.79 Eq H1-1a	90.0	50	W14X61
FLOOR 27	510.9	2.4	1.8	4	0.83 Eq H1-1a	90.0	50	W14X61
FLOOR 26	539.5	2.4	1.8	4	0.88 Eq H1-1a	90.0	50	W14X61
FLOOR 25	568.0	2.4	1.8	4	0.92 Eq H1-1a	90.0	50	W14X61
FLOOR 24	596.7	2.4	1.8	4	0.86 Eq H1-1a	90.0	50	W14X68
FLOOR 23	625.3	2.4	1.8	4	0.91 Eq H1-1a	90.0	50	W14X68
FLOOR 22	653.9	2.4	1.8	4	0.95 Eq H1-1a	90.0	50	W14X68
FLOOR 21	682.5	2.4	1.8	4	0.99 Eq H1-1a	90.0	50	W14X68
FLOOR 20	711.2	2.5	1.8	4	0.85 Eq H1-1a	90.0	50	W14X82
FLOOR 19	740.0	2.5	1.8	4	0.89 Eq H1-1a	90.0	50	W14X82
FLOOR 18	768.8	2.5	1.8	4	0.92 Eq H1-1a	90.0	50	W14X82
FLOOR 17	797.5	2.5	1.8	4	0.95 Eq H1-1a	90.0	50	W14X82
FLOOR 16	826.4	2.4	2.3	4	0.81 Eq H1-1a	90.0	50	W14X90
FLOOR 15	855.3	2.4	2.3	4	0.84 Eq H1-1a	90.0	50	W14X90
FLOOR 14	884.1	2.4	2.3	4	0.86 Eq H1-1a	90.0	50	W14X90
FLOOR 13	913.0	2.4	2.3	4	0.89 Eq H1-1a	90.0	50	W14X90
FLOOR 12	942.0	2.5	2.3	4	0.84 Eq H1-1a	90.0	50	W14X99
FLOOR 11	971.0	2.5	2.3	4	0.86 Eq H1-1a	90.0	50	W14X99
FLOOR 10	1000.0	2.5	2.3	4	0.89 Eq H1-1a	90.0	50	W14X99
FLOOR 9	1028.9	2.5	2.3	4	0.91 Eq H1-1a	90.0	50	W14X99
FLOOR 8	1058.0	2.5	2.3	4	0.85 Eq H1-1a	90.0	50	W14X109

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Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 7	1087.1	2.5	2.3	4	0.88 Eq H1-1a	90.0	50	W14X109
FLOOR 6	1116.2	2.5	2.3	4	0.90 Eq H1-1a	90.0	50	W14X109
FLOOR 5	1145.4	3.8	3.5	5	0.93 Eq H1-1a	90.0	50	W14X109
FLOOR 4	1175.6	2.0	7.8	2	0.95 Eq H1-1a	90.0	50	W14X193
FLOOR 3.2	1178.0	2.0	7.8	2	0.95 Eq H1-1a	90.0	50	W14X193
FLOOR 3.1	1180.5	2.0	7.9	2	0.96 Eq H1-1a	90.0	50	W14X193
FLOOR 3	1294.1	6.0	10.9	4	0.79 Eq H1-1a	90.0	50	W14X145
FLOOR 2	1408.6	3.2	0.5	1	0.92 Eq H1-1a	90.0	50	W14X145

Column Line 1.7 - A.8

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	41.0	0.2	19.4	12	0.38 Eq H1-1b	135.0	50	W14X43
FLOOR 39	77.1	0.1	11.3	1	0.28 Eq H1-1b	135.0	50	W14X43
FLOOR 38	113.0	0.1	9.1	1	0.42 Eq H1-1a	135.0	50	W14X43
FLOOR 37	148.4	0.1	8.8	1	0.50 Eq H1-1a	135.0	50	W14X43
FLOOR 36	183.6	0.1	8.7	1	0.59 Eq H1-1a	135.0	50	W14X43
FLOOR 35	218.7	0.1	8.6	1	0.68 Eq H1-1a	135.0	50	W14X43
FLOOR 34	253.6	0.1	8.5	1	0.77 Eq H1-1a	135.0	50	W14X43
FLOOR 33	288.4	0.1	8.5	1	0.86 Eq H1-1a	135.0	50	W14X43
FLOOR 32	323.3	0.1	8.5	1	0.76 Eq H1-1a	135.0	50	W14X53
FLOOR 31	358.1	0.1	8.4	1	0.83 Eq H1-1a	135.0	50	W14X53
FLOOR 30	392.8	0.1	8.4	1	0.90 Eq H1-1a	135.0	50	W14X53
FLOOR 29	427.5	0.1	8.4	1	0.97 Eq H1-1a	135.0	50	W14X53
FLOOR 28	462.2	0.1	9.6	1	0.81 Eq H1-1a	135.0	50	W14X61
FLOOR 27	499.0	0.1	9.4	1	0.86 Eq H1-1a	135.0	50	W14X61
FLOOR 26	534.8	0.1	9.4	1	0.92 Eq H1-1a	135.0	50	W14X61
FLOOR 25	570.5	0.1	9.4	1	0.98 Eq H1-1a	135.0	50	W14X61
FLOOR 24	606.5	0.1	9.4	1	0.84 Eq H1-1a	135.0	50	W14X74
FLOOR 23	642.4	0.1	9.4	1	0.89 Eq H1-1a	135.0	50	W14X74
FLOOR 22	678.4	0.1	9.4	1	0.94 Eq H1-1a	135.0	50	W14X74
FLOOR 21	714.3	0.1	9.4	1	0.98 Eq H1-1a	135.0	50	W14X74
FLOOR 20	750.5	0.1	12.2	1	0.76 Eq H1-1a	135.0	50	W14X90
FLOOR 19	786.7	0.1	12.2	1	0.80 Eq H1-1a	135.0	50	W14X90
FLOOR 18	822.9	0.1	12.2	1	0.83 Eq H1-1a	135.0	50	W14X90
FLOOR 17	859.1	0.1	12.2	1	0.87 Eq H1-1a	135.0	50	W14X90
FLOOR 16	895.4	0.1	12.2	1	0.82 Eq H1-1a	135.0	50	W14X99
FLOOR 15	931.7	0.1	12.2	1	0.85 Eq H1-1a	135.0	50	W14X99
FLOOR 14	968.0	0.1	12.2	1	0.89 Eq H1-1a	135.0	50	W14X99
FLOOR 13	1004.3	0.1	12.2	1	0.92 Eq H1-1a	135.0	50	W14X99
FLOOR 12	1040.7	0.1	12.2	1	0.86 Eq H1-1a	135.0	50	W14X109
FLOOR 11	1077.2	0.1	12.2	1	0.89 Eq H1-1a	135.0	50	W14X109
FLOOR 10	1113.7	0.1	12.2	1	0.92 Eq H1-1a	135.0	50	W14X109
FLOOR 9	1150.1	0.1	12.2	1	0.95 Eq H1-1a	135.0	50	W14X109
FLOOR 8	1186.7	0.1	12.3	1	0.89 Eq H1-1a	135.0	50	W14X120
FLOOR 7	1223.3	0.1	12.3	1	0.91 Eq H1-1a	135.0	50	W14X120
FLOOR 6	1260.0	0.1	12.3	1	0.94 Eq H1-1a	135.0	50	W14X120

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Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 5	1296.6	0.1	18.6	1	0.98 Eq H1-1a	135.0	50	W14X120
FLOOR 4	1334.6	0.1	7.3	1	0.98 Eq H1-1a	135.0	50	W14X211
FLOOR 3.2	1337.7	0.1	7.3	1	0.98 Eq H1-1a	135.0	50	W14X211
FLOOR 3.1	1340.9	0.1	7.3	1	0.98 Eq H1-1a	135.0	50	W14X211
FLOOR 3	1394.1	0.2	31.1	1	0.88 Eq H1-1a	135.0	50	W14X145
FLOOR 2	1453.1	0.0	16.2	1	0.98 Eq H1-1a	135.0	50	W14X145

Column Line 1.8 - G.1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	42.7	1.6	7.3	2	0.43 Eq H1-1a	0.0	50	W14X43
FLOOR 41M	43.2	1.6	7.3	2	0.43 Eq H1-1a	0.0	50	W14X43
FLOOR 40M	108.5	1.1	8.0	3	0.51 Eq H1-1a	0.0	50	W14X43
FLOOR 39	140.9	1.1	4.2	3	0.42 Eq H1-1a	0.0	50	W14X43
FLOOR 38	175.7	1.0	3.5	3	0.50 Eq H1-1a	0.0	50	W14X43
FLOOR 37	211.2	0.9	3.4	3	0.59 Eq H1-1a	0.0	50	W14X43
FLOOR 36	246.9	0.9	3.4	3	0.68 Eq H1-1a	0.0	50	W14X43
FLOOR 35	282.8	0.8	3.4	3	0.78 Eq H1-1a	0.0	50	W14X43
FLOOR 34	318.7	0.8	3.4	3	0.87 Eq H1-1a	0.0	50	W14X43
FLOOR 33	354.6	0.8	3.3	3	0.96 Eq H1-1a	0.0	50	W14X43
FLOOR 32	390.7	0.8	3.8	3	0.65 Eq H1-1a	0.0	50	W14X61
FLOOR 31	426.8	0.8	3.8	3	0.71 Eq H1-1a	0.0	50	W14X61
FLOOR 30	462.9	0.8	3.8	3	0.77 Eq H1-1a	0.0	50	W14X61
FLOOR 29	499.0	0.7	3.8	3	0.82 Eq H1-1a	0.0	50	W14X61
FLOOR 28	535.9	0.7	3.8	3	0.79 Eq H1-1a	0.0	50	W14X68
FLOOR 27	573.3	0.7	3.8	3	0.84 Eq H1-1a	0.0	50	W14X68
FLOOR 26	610.6	0.7	3.8	3	0.89 Eq H1-1a	0.0	50	W14X68
FLOOR 25	648.0	0.7	3.8	3	0.95 Eq H1-1a	0.0	50	W14X68
FLOOR 24	685.5	0.8	3.8	3	0.83 Eq H1-1a	0.0	50	W14X82
FLOOR 23	723.1	0.8	3.8	3	0.88 Eq H1-1a	0.0	50	W14X82
FLOOR 22	760.6	0.8	3.8	3	0.92 Eq H1-1a	0.0	50	W14X82
FLOOR 21	798.1	0.8	3.8	3	0.96 Eq H1-1a	0.0	50	W14X82
FLOOR 20	835.8	0.7	5.0	3	0.82 Eq H1-1a	0.0	50	W14X90
FLOOR 19	873.4	0.7	5.0	3	0.86 Eq H1-1a	0.0	50	W14X90
FLOOR 18	911.1	0.7	5.0	3	0.90 Eq H1-1a	0.0	50	W14X90
FLOOR 17	948.7	0.7	5.0	3	0.93 Eq H1-1a	0.0	50	W14X90
FLOOR 16	986.4	0.7	5.0	3	0.88 Eq H1-1a	0.0	50	W14X99
FLOOR 15	1024.2	0.7	5.0	3	0.91 Eq H1-1a	0.0	50	W14X99
FLOOR 14	1061.9	0.7	5.0	3	0.95 Eq H1-1a	0.0	50	W14X99
FLOOR 13	1099.7	0.7	5.0	3	0.98 Eq H1-1a	0.0	50	W14X99
FLOOR 12	1137.7	0.8	5.0	3	0.84 Eq H1-1a	0.0	50	W14X120
FLOOR 11	1175.7	0.8	5.0	3	0.86 Eq H1-1a	0.0	50	W14X120
FLOOR 10	1213.7	0.8	5.0	3	0.89 Eq H1-1a	0.0	50	W14X120
FLOOR 9	1251.7	0.8	5.0	3	0.92 Eq H1-1a	0.0	50	W14X120
FLOOR 8	1289.9	0.8	5.0	3	0.86 Eq H1-1a	0.0	50	W14X132
FLOOR 7	1328.1	0.8	5.0	3	0.88 Eq H1-1a	0.0	50	W14X132

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Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 6	1366.2	0.8	5.0	3	0.91 Eq H1-1a	0.0	50	W14X132
FLOOR 5	1404.4	1.2	7.6	4	0.94 Eq H1-1a	0.0	50	W14X132
FLOOR 4	1443.9	1.8	4.2	4	0.95 Eq H1-1a	0.0	50	W14X233
FLOOR 3.2	1446.9	1.8	4.2	4	0.95 Eq H1-1a	0.0	50	W14X233
FLOOR 3.1	1449.8	1.8	4.2	4	0.95 Eq H1-1a	0.0	50	W14X233
FLOOR 3	1512.1	3.9	12.7	3	0.84 Eq H1-1a	0.0	50	W14X159
FLOOR 2	1573.6	0.3	6.5	1	0.95 Eq H1-1a	0.0	50	W14X159

Column Line 122.71ft - 66.75ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	92.1	4.2	0.3	1	0.88 Eq H1-1a	90.0	50	W10X33
FLOOR 41M	92.5	4.2	0.3	1	0.88 Eq H1-1a	90.0	50	W10X33

Column Line 129.50ft - 34.75ft

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	67.3	26.0	2.3	1	0.82 Eq H1-1a	90.0	50	W10X33
FLOOR 41M	67.7	26.0	2.3	1	0.82 Eq H1-1a	90.0	50	W10X33

Column Line 1 - E

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	103.4	20.2	53.6	1	0.94 Eq H1-1a	90.0	50	W14X53
FLOOR 39	159.7	25.3	3.2	1	0.54 Eq H1-1a	90.0	50	W14X43
FLOOR 38	219.3	20.8	2.7	1	0.67 Eq H1-1a	90.0	50	W14X43
FLOOR 37	279.1	20.4	2.6	1	0.82 Eq H1-1a	90.0	50	W14X43
FLOOR 36	339.0	20.4	3.0	1	0.61 Eq H1-1a	90.0	50	W14X61
FLOOR 35	398.7	20.3	3.0	1	0.70 Eq H1-1a	90.0	50	W14X61
FLOOR 34	458.4	20.2	3.0	1	0.80 Eq H1-1a	90.0	50	W14X61
FLOOR 33	518.1	20.1	3.0	1	0.89 Eq H1-1a	90.0	50	W14X61
FLOOR 32	579.7	20.5	3.0	1	0.74 Eq H1-1a	90.0	50	W14X82
FLOOR 31	641.4	20.5	3.0	1	0.81 Eq H1-1a	90.0	50	W14X82
FLOOR 30	703.0	20.5	3.0	1	0.88 Eq H1-1a	90.0	50	W14X82
FLOOR 29	764.6	20.5	3.0	1	0.95 Eq H1-1a	90.0	50	W14X82
FLOOR 28	826.5	20.4	3.9	1	0.77 Eq H1-1a	90.0	50	W14X99
FLOOR 27	888.4	20.4	3.9	1	0.82 Eq H1-1a	90.0	50	W14X99
FLOOR 26	950.2	20.4	3.9	1	0.87 Eq H1-1a	90.0	50	W14X99
FLOOR 25	1012.1	20.4	3.9	1	0.93 Eq H1-1a	90.0	50	W14X99
FLOOR 24	1074.2	20.7	3.9	1	0.81 Eq H1-1a	90.0	50	W14X120
FLOOR 23	1136.4	20.7	3.9	1	0.85 Eq H1-1a	90.0	50	W14X120
FLOOR 22	1198.5	20.7	3.9	1	0.90 Eq H1-1a	90.0	50	W14X120
FLOOR 21	1260.6	20.7	3.9	1	0.94 Eq H1-1a	90.0	50	W14X120
FLOOR 20	1323.1	21.1	4.1	1	0.81 Eq H1-1a	90.0	50	W14X145
FLOOR 19	1385.5	21.1	4.1	1	0.85 Eq H1-1a	90.0	50	W14X145
FLOOR 18	1447.9	21.1	4.1	1	0.88 Eq H1-1a	90.0	50	W14X145

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Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 17	1510.4	21.1	4.1	1	0.92 Eq H1-1a	90.0	50	W14X145
FLOOR 16	1573.0	21.3	4.1	1	0.88 Eq H1-1a	90.0	50	W14X159
FLOOR 15	1635.6	21.3	4.1	1	0.91 Eq H1-1a	90.0	50	W14X159
FLOOR 14	1698.2	21.3	4.1	1	0.94 Eq H1-1a	90.0	50	W14X159
FLOOR 13	1760.8	21.3	4.1	1	0.98 Eq H1-1a	90.0	50	W14X159
FLOOR 12	1823.9	21.8	4.1	1	0.83 Eq H1-1a	90.0	50	W14X193
FLOOR 11	1886.9	21.8	4.1	1	0.86 Eq H1-1a	90.0	50	W14X193
FLOOR 10	1950.0	21.8	4.1	1	0.89 Eq H1-1a	90.0	50	W14X193
FLOOR 9	2013.0	21.8	4.1	1	0.91 Eq H1-1a	90.0	50	W14X193
FLOOR 8	2076.3	22.0	4.1	1	0.86 Eq H1-1a	90.0	50	W14X211
FLOOR 7	2139.5	22.0	4.1	1	0.89 Eq H1-1a	90.0	50	W14X211
FLOOR 6	2202.8	22.0	4.1	1	0.91 Eq H1-1a	90.0	50	W14X211
FLOOR 5	2266.1	33.2	5.3	1	0.95 Eq H1-1a	90.0	50	W14X211
FLOOR 4	2331.4	12.0	15.9	1	0.92 Eq H1-1a	90.0	50	W14X370
FLOOR 3.2	2336.2	12.0	15.9	1	0.92 Eq H1-1a	90.0	50	W14X370
FLOOR 3.1	2340.9	12.0	15.0	1	0.93 Eq H1-1a	90.0	50	W14X370
FLOOR 3	2406.8	5.8	35.7	1	0.84 Eq H1-1a	90.0	50	W14X257
FLOOR 2	2471.6	2.5	13.3	1	0.92 Eq H1-1a	90.0	50	W14X257

Column Line 1 - D

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	103.4	2.5	52.3	3	0.98 Eq H1-1a	90.0	50	W14X48
FLOOR 39	198.4	4.8	0.1	3	0.47 Eq H1-1a	90.0	50	W14X48
FLOOR 38	297.6	4.2	0.1	3	0.69 Eq H1-1a	90.0	50	W14X48
FLOOR 37	396.2	3.9	0.1	3	0.92 Eq H1-1a	90.0	50	W14X48
FLOOR 36	494.9	3.8	0.1	3	0.59 Eq H1-1a	90.0	50	W14X82
FLOOR 35	596.3	3.8	0.1	3	0.71 Eq H1-1a	90.0	50	W14X82
FLOOR 34	697.9	3.8	0.1	3	0.83 Eq H1-1a	90.0	50	W14X82
FLOOR 33	799.5	3.8	0.1	3	0.95 Eq H1-1a	90.0	50	W14X82
FLOOR 32	901.5	3.8	0.1	3	0.72 Eq H1-1a	90.0	50	W14X109
FLOOR 31	1003.4	3.8	0.1	3	0.81 Eq H1-1a	90.0	50	W14X109
FLOOR 30	1105.4	3.8	0.1	3	0.89 Eq H1-1a	90.0	50	W14X109
FLOOR 29	1207.3	3.8	0.1	3	0.97 Eq H1-1a	90.0	50	W14X109
FLOOR 28	1309.7	3.9	0.1	3	0.78 Eq H1-1a	90.0	50	W14X145
FLOOR 27	1412.1	3.9	0.1	3	0.84 Eq H1-1a	90.0	50	W14X145
FLOOR 26	1514.5	3.9	0.1	3	0.90 Eq H1-1a	90.0	50	W14X145
FLOOR 25	1616.9	3.9	0.1	3	0.96 Eq H1-1a	90.0	50	W14X145
FLOOR 24	1719.7	4.0	0.1	3	0.84 Eq H1-1a	90.0	50	W14X176
FLOOR 23	1822.5	4.0	0.1	3	0.89 Eq H1-1a	90.0	50	W14X176
FLOOR 22	1925.2	4.0	0.1	3	0.94 Eq H1-1a	90.0	50	W14X176
FLOOR 21	2028.0	4.0	0.1	3	0.99 Eq H1-1a	90.0	50	W14X176
FLOOR 20	2131.2	4.1	0.1	3	0.87 Eq H1-1a	90.0	50	W14X211
FLOOR 19	2234.5	4.1	0.1	3	0.91 Eq H1-1a	90.0	50	W14X211
FLOOR 18	2337.7	4.1	0.1	3	0.95 Eq H1-1a	90.0	50	W14X211
FLOOR 17	2440.9	4.1	0.1	3	0.99 Eq H1-1a	90.0	50	W14X211
FLOOR 16	2544.7	4.2	0.1	3	0.83 Eq H1-1a	90.0	50	W14X257

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Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 15	2648.5	4.2	0.1	3	0.88 Eq H1-1a	90.0	50	W14X257
FLOOR 14	2752.3	4.2	0.1	3	0.92 Eq H1-1a	90.0	50	W14X257
FLOOR 13	2856.1	4.2	0.1	3	0.95 Eq H1-1a	90.0	50	W14X257
FLOOR 12	2960.2	4.3	0.1	3	0.90 Eq H1-1a	90.0	50	W14X283
FLOOR 11	3064.3	4.3	0.1	3	0.93 Eq H1-1a	90.0	50	W14X283
FLOOR 10	3168.4	4.3	0.1	3	0.96 Eq H1-1a	90.0	50	W14X283
FLOOR 9	3272.6	4.3	0.1	3	0.99 Eq H1-1a	90.0	50	W14X283
FLOOR 8	3377.4	4.4	0.1	3	0.84 Eq H1-1a	90.0	50	W14X342
FLOOR 7	3482.3	4.4	0.1	3	0.87 Eq H1-1a	90.0	50	W14X342
FLOOR 6	3587.2	4.4	0.1	3	0.89 Eq H1-1a	90.0	50	W14X342
FLOOR 5	3692.1	6.7	0.1	3	0.92 Eq H1-1a	90.0	50	W14X342
FLOOR 4	3799.7	0.7	25.2	1	0.96 Eq H1-1a	90.0	50	W14X550
FLOOR 3.2	3806.8	0.7	25.3	1	0.96 Eq H1-1a	90.0	50	W14X550
FLOOR 3.1	3813.8	0.7	25.4	1	0.96 Eq H1-1a	90.0	50	W14X550
FLOOR 3	3906.8	2.1	50.0	1	0.87 Eq H1-1a	90.0	50	W14X398
FLOOR 2	3999.6	1.0	26.2	1	0.95 Eq H1-1a	90.0	50	W14X398

Column Line 1 - C

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 40M	62.1	0.0	0.0	1	0.22 Eq H1-1a	90.0	50	W14X43
FLOOR 39	140.0	0.0	0.0	1	0.36 Eq H1-1a	90.0	50	W14X43
FLOOR 38	218.7	0.0	0.0	1	0.56 Eq H1-1a	90.0	50	W14X43
FLOOR 37	296.5	0.0	0.0	1	0.76 Eq H1-1a	90.0	50	W14X43
FLOOR 36	374.0	0.0	0.0	1	0.60 Eq H1-1a	90.0	50	W14X61
FLOOR 35	451.2	0.0	0.0	1	0.72 Eq H1-1a	90.0	50	W14X61
FLOOR 34	528.2	0.0	0.0	1	0.84 Eq H1-1a	90.0	50	W14X61
FLOOR 33	605.2	0.0	0.0	1	0.96 Eq H1-1a	90.0	50	W14X61
FLOOR 32	684.3	0.0	0.0	1	0.66 Eq H1-1a	90.0	50	W14X90
FLOOR 31	763.4	0.0	0.0	1	0.74 Eq H1-1a	90.0	50	W14X90
FLOOR 30	842.6	0.0	0.0	1	0.81 Eq H1-1a	90.0	50	W14X90
FLOOR 29	921.7	0.0	0.0	1	0.89 Eq H1-1a	90.0	50	W14X90
FLOOR 28	1001.1	0.0	0.0	1	0.80 Eq H1-1a	90.0	50	W14X109
FLOOR 27	1080.5	0.0	0.0	1	0.86 Eq H1-1a	90.0	50	W14X109
FLOOR 26	1159.9	0.0	0.0	1	0.93 Eq H1-1a	90.0	50	W14X109
FLOOR 25	1239.3	0.0	0.0	1	0.99 Eq H1-1a	90.0	50	W14X109
FLOOR 24	1319.2	0.0	0.0	1	0.78 Eq H1-1a	90.0	50	W14X145
FLOOR 23	1399.2	0.0	0.0	1	0.83 Eq H1-1a	90.0	50	W14X145
FLOOR 22	1479.1	0.0	0.0	1	0.88 Eq H1-1a	90.0	50	W14X145
FLOOR 21	1559.0	0.0	0.0	1	0.92 Eq H1-1a	90.0	50	W14X145
FLOOR 20	1639.4	0.0	0.0	1	0.80 Eq H1-1a	90.0	50	W14X176
FLOOR 19	1719.8	0.0	0.0	1	0.84 Eq H1-1a	90.0	50	W14X176
FLOOR 18	1800.2	0.0	0.0	1	0.88 Eq H1-1a	90.0	50	W14X176
FLOOR 17	1880.6	0.0	0.0	1	0.92 Eq H1-1a	90.0	50	W14X176
FLOOR 16	1961.2	0.0	0.0	1	0.87 Eq H1-1a	90.0	50	W14X193
FLOOR 15	2041.8	0.0	0.0	1	0.91 Eq H1-1a	90.0	50	W14X193
FLOOR 14	2122.4	0.0	0.0	1	0.94 Eq H1-1a	90.0	50	W14X193

Gravity Column Design Summary

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DataBase: Takeoff Model - PLANKS — 04/08/08 04:28:40
Building Code: IBC — Steel Code: AISC LRFD

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 13	2203.1	0.0	0.0	1	0.98 Eq H1-1a	90.0	50	W14X193
FLOOR 12	2284.3	0.0	0.0	1	0.84 Eq H1-1a	90.0	50	W14X233
FLOOR 11	2365.5	0.0	0.0	1	0.87 Eq H1-1a	90.0	50	W14X233
FLOOR 10	2446.7	0.0	0.0	1	0.90 Eq H1-1a	90.0	50	W14X233
FLOOR 9	2527.9	0.0	0.0	1	0.93 Eq H1-1a	90.0	50	W14X233
FLOOR 8	2609.5	0.0	0.0	1	0.87 Eq H1-1a	90.0	50	W14X257
FLOOR 7	2691.0	0.0	0.0	1	0.90 Eq H1-1a	90.0	50	W14X257
FLOOR 6	2772.6	0.0	0.0	1	0.92 Eq H1-1a	90.0	50	W14X257
FLOOR 5	2854.2	0.0	0.0	1	0.95 Eq H1-1a	90.0	50	W14X257
FLOOR 4	2938.3	0.0	0.0	1	0.98 Eq H1-1a	90.0	50	W14X426
FLOOR 3.2	2944.7	0.0	0.0	1	0.98 Eq H1-1a	90.0	50	W14X426
FLOOR 3.1	2951.0	0.0	0.0	1	0.98 Eq H1-1a	90.0	50	W14X426
FLOOR 3	3035.5	0.0	0.0	1	0.83 Eq H1-1a	90.0	50	W14X311
FLOOR 2	3128.4	0.0	0.0	1	0.94 Eq H1-1a	90.0	50	W14X311

Column Line 0.9 - F.2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
FLOOR 41ROOF	42.0	1.6	7.1	3	0.42 Eq H1-1a	90.0	50	W14X43
FLOOR 41M	42.5	1.6	7.1	3	0.43 Eq H1-1a	90.0	50	W14X43
FLOOR 40M	107.8	1.1	7.9	2	0.50 Eq H1-1a	90.0	50	W14X43
FLOOR 39	140.3	1.1	4.2	2	0.42 Eq H1-1a	90.0	50	W14X43
FLOOR 38	175.1	1.0	3.5	2	0.50 Eq H1-1a	90.0	50	W14X43
FLOOR 37	210.7	0.9	3.4	2	0.59 Eq H1-1a	90.0	50	W14X43
FLOOR 36	246.4	0.8	3.4	2	0.68 Eq H1-1a	90.0	50	W14X43
FLOOR 35	282.3	0.8	3.4	2	0.77 Eq H1-1a	90.0	50	W14X43
FLOOR 34	318.2	0.8	3.3	2	0.87 Eq H1-1a	90.0	50	W14X43
FLOOR 33	354.1	0.8	3.3	2	0.96 Eq H1-1a	90.0	50	W14X43
FLOOR 32	390.2	0.8	3.8	2	0.65 Eq H1-1a	90.0	50	W14X61
FLOOR 31	426.4	0.7	3.8	2	0.71 Eq H1-1a	90.0	50	W14X61
FLOOR 30	462.5	0.7	3.8	2	0.77 Eq H1-1a	90.0	50	W14X61
FLOOR 29	498.6	0.7	3.8	2	0.82 Eq H1-1a	90.0	50	W14X61
FLOOR 28	535.6	0.7	3.8	2	0.79 Eq H1-1a	90.0	50	W14X68
FLOOR 27	573.0	0.7	3.8	2	0.84 Eq H1-1a	90.0	50	W14X68
FLOOR 26	610.4	0.7	3.8	2	0.89 Eq H1-1a	90.0	50	W14X68
FLOOR 25	647.8	0.7	3.8	2	0.95 Eq H1-1a	90.0	50	W14X68
FLOOR 24	685.3	0.7	3.8	2	0.83 Eq H1-1a	90.0	50	W14X82
FLOOR 23	722.9	0.7	3.8	2	0.87 Eq H1-1a	90.0	50	W14X82
FLOOR 22	760.4	0.7	3.8	2	0.92 Eq H1-1a	90.0	50	W14X82
FLOOR 21	798.0	0.7	3.8	2	0.96 Eq H1-1a	90.0	50	W14X82
FLOOR 20	835.6	0.7	4.9	2	0.82 Eq H1-1a	90.0	50	W14X90
FLOOR 19	873.3	0.7	4.9	2	0.86 Eq H1-1a	90.0	50	W14X90
FLOOR 18	911.0	0.7	4.9	2	0.90 Eq H1-1a	90.0	50	W14X90
FLOOR 17	948.6	0.7	4.9	2	0.93 Eq H1-1a	90.0	50	W14X90
FLOOR 16	986.4	0.7	4.9	2	0.88 Eq H1-1a	90.0	50	W14X99
FLOOR 15	1024.2	0.7	4.9	2	0.91 Eq H1-1a	90.0	50	W14X99

Gravity Column Design Summary

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Building Code: IBC | Steel Code: AISC LRFD

FLOOR 14	1062.0	0.7	4.9	2	0.95 Eq H1-1a	90.0	50	W14X99
FLOOR 13	1099.7	0.7	4.9	2	0.98 Eq H1-1a	90.0	50	W14X99
FLOOR 12	1137.8	0.7	5.0	2	0.84 Eq H1-1a	90.0	50	W14X120
FLOOR 11	1175.8	0.7	5.0	2	0.86 Eq H1-1a	90.0	50	W14X120
FLOOR 10	1213.9	0.7	5.0	2	0.89 Eq H1-1a	90.0	50	W14X120
FLOOR 9	1251.9	0.7	5.0	2	0.92 Eq H1-1a	90.0	50	W14X120
FLOOR 8	1290.1	0.8	5.0	2	0.86 Eq H1-1a	90.0	50	W14X132
FLOOR 7	1328.3	0.8	5.0	2	0.88 Eq H1-1a	90.0	50	W14X132
FLOOR 6	1366.5	0.8	5.0	2	0.91 Eq H1-1a	90.0	50	W14X132
FLOOR 5	1404.6	1.1	7.5	5	0.94 Eq H1-1a	90.0	50	W14X132
FLOOR 4	1444.2	1.8	4.2	5	0.95 Eq H1-1a	90.0	50	W14X233
FLOOR 3.2	1447.1	1.8	4.2	5	0.95 Eq H1-1a	90.0	50	W14X233
FLOOR 3.1	1450.1	1.8	4.2	5	0.95 Eq H1-1a	90.0	50	W14X233
FLOOR 3	1512.4	3.9	12.6	2	0.84 Eq H1-1a	90.0	50	W14X159
FLOOR 2	1573.9	0.3	6.5	1	0.95 Eq H1-1a	90.0	50	W14X159

RAM FRAME MASS AND SELF WEIGHT OUTPUT

Calculated Values:

Story	Diaph #	Weight kips	Mass k-s2/ft
FLOOR 41ROOF	1	1536.8	47.73
FLOOR 41M	1	380.5	11.82
	None	8.6	0.27
FLOOR 40M	1	2055.0	63.82
FLOOR 39	1	1906.5	59.21
FLOOR 38	1	1897.3	58.92
FLOOR 37	1	1897.3	58.92
FLOOR 36	1	1899.2	58.98
FLOOR 35	1	1901.2	59.04
FLOOR 34	1	1901.2	59.04
FLOOR 33	1	1904.9	59.16
FLOOR 32	1	1911.5	59.36
FLOOR 31	1	1914.2	59.45
FLOOR 30	1	1914.2	59.45
FLOOR 29	1	1914.2	59.45
FLOOR 28	1	1916.7	59.52
FLOOR 27	1	1919.1	59.60
FLOOR 26	1	1919.1	59.60
FLOOR 25	1	1930.8	59.96
FLOOR 24	1	1948.8	60.52
FLOOR 23	1	1913.6	59.43
FLOOR 22	1	1913.8	59.43
FLOOR 21	1	1913.8	59.43
FLOOR 20	1	1916.9	59.53
FLOOR 19	1	1920.0	59.63
FLOOR 18	1	1920.0	59.63
FLOOR 17	1	1936.4	60.14

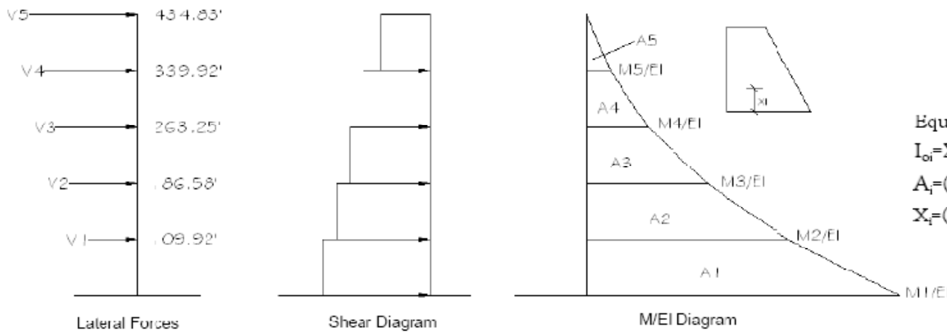
Story	Diaph #	Weight	Mass
FLOOR 16	1	1959.9	60.87
FLOOR 15	1	1962.3	60.94
FLOOR 14	1	1962.3	60.94
FLOOR 13	1	1962.3	60.94
FLOOR 12	1	1965.2	61.03
FLOOR 11	1	1968.2	61.12
FLOOR 10	1	1968.2	61.12
FLOOR 9	1	1978.0	61.43
FLOOR 8	1	1996.1	61.99
FLOOR 7	1	2000.2	62.12
FLOOR 6	1	2000.7	62.13
FLOOR 5	1	2010.6	62.44
FLOOR 4	1	2048.1	63.61
FLOOR 3.2	None	346.9	10.77
FLOOR 3.1	None	346.9	10.77
FLOOR 3	1	2423.9	75.28
FLOOR 2	1	2422.3	75.23

Appendix C

Classical Methods – Initial Braced Frame Member Sizes

Project	AE 482
Date	4/8/2008
Engineer	Steve Reichwein

Moment Area Method - Braced Frame Column Areas



Equations:

$I_{oi}=\Sigma(A_{oi}d_i^2)$

$A_i=((M_i+M_{i+1})*h_i)/(2EI_{oi})$

$X_i=(h_i/3)(M_i+2M_{i+1})/(M_i+M_{i+1})$

E	29000	ksi

h1	94.910	ft
h2	171.580	ft
h3	218.250	ft
h4	324.910	ft
h5	434.830	ft

V5	1354.500	kips
V4	856.200	kips
V3	388.000	kips
V2	409.900	kips
V1	160.000	kips

M5	1.543E+06	in-kips
M4	3.586E+06	in-kips
M3	5.986E+06	in-kips
M2	8.763E+06	in-kips
M1	1.296E+07	in-kips

M5/EI	53.195	in^3/I
M4/EI	123.648	in^3/I
M3/EI	206.411	in^3/I
M2/EI	302.165	in^3/I
M1/E1	446.741	in^3/I

x1	379.640	in
x2	398.931	in
x3	421.570	in
x4	431.093	in
x5	617.080	in

Target	H/400	
Δ1	2.847	in
Δ2	5.147	in
Δ3	7.448	in
Δ4	9.747	in
Δ5	13.045	in

y1	759.280	in
y2	1660.029	in
y3	2557.430	in
y4	3467.827	in
y5	4600.880	in

A5	30292.663	in^4/I
A4	62702.386	in^4/I
A3	100774.725	in^4/I
A2	144817.807	in^4/I
A1	240168.492	in^4/I

A5 x y1	2.300E+07	in^5/I
A4 x y2	1.041E+08	in^5/I
A3 x y3	2.577E+08	in^5/I
A2 x y4	5.022E+08	in^5/I
A1 x y5	1.105E+09	in^5/I

Number of Columns	4	Restisting Lateral Force Per Direction
d	25	ft
I	360000	in^2*Acol

Acol5	**22.44**	in^2
Acol4	**68.58**	in^2
Acol3	**143.53**	in^2
Acol2	**252.78**	in^2
Acol1	**424.18**	in^2

Assumptions
- Torsional effects are neglected
- Gravity is neglected

Project AE 482
Date 4/8/2008
Enginee Steve Reichwein

Classical Work Energy Method - Concentric Braced Frame Optimization

mptions: All frames consist of concentric inverted V configurations
Bay Size = 25 feet
Frame Force = Story Wind Load / 4
Effects of torsion are neglected
Braces A 36 Steel ; Columns and Girders A992

				1	2	3	4	5	6	7	8	9
Level	**Story Wind Load (Kips)**	**Elevation (Feet)**	**Floor Height**	**WINDF**	**STYSHR**	**STYMOM**	**COLP**	**GIRDP**	**BRACEP**	**COLP1**	**GIRDP1**	**BRACP1**
41.00	143.55	434.83	27.83	35.89	35.89	998.87	0.00	17.94	43.80	0.00	0.00	1.22
40.00	174.98	407.00	9.58	43.74	79.63	763.13	39.95	39.82	50.17	1.44	0.50	0.63
39.00	106.58	397.42	9.58	26.64	106.28	1018.47	70.48	53.14	66.96	3.19	0.50	0.63
38.00	99.53	387.83	9.58	24.88	131.16	1256.91	111.22	65.58	82.63	4.25	0.50	0.63
37.00	103.50	378.25	9.58	25.88	157.03	1504.88	161.50	78.52	98.94	5.25	0.50	0.63
36.00	100.88	368.67	9.58	25.22	182.25	1746.56	221.69	91.13	114.82	6.28	0.50	0.63
35.00	98.25	359.08	9.58	24.56	206.81	1981.95	291.55	103.41	130.30	7.29	0.50	0.63
34.00	95.63	349.50	9.58	23.91	230.72	2211.05	370.83	115.36	145.36	8.27	0.50	0.63
33.00	93.00	339.92	9.58	23.25	253.97	2433.87	459.27	126.98	160.01	9.23	0.50	0.63
32.00	90.38	330.33	9.58	22.59	276.56	2650.39	556.63	138.28	174.24	10.16	0.50	0.63
31.00	87.68	320.75	9.58	21.92	298.48	2860.45	662.64	149.24	188.05	11.06	0.50	0.63
30.00	85.05	311.17	9.58	21.26	319.74	3064.21	777.06	159.87	201.45	11.94	0.50	0.63
29.00	82.58	301.58	9.58	20.64	340.39	3262.05	899.63	170.19	214.46	12.79	0.50	0.63
28.00	79.95	292.00	9.58	19.99	360.38	3453.59	1030.11	180.19	227.05	13.62	0.50	0.63
27.00	77.33	282.42	9.58	19.33	379.71	3638.85	1168.26	189.85	239.23	14.42	0.50	0.63
26.00	74.70	272.83	9.58	18.68	398.38	3817.82	1313.81	199.19	250.99	15.19	0.50	0.63
25.00	72.00	263.25	9.58	18.00	416.38	3990.32	1466.52	208.19	262.33	15.94	0.50	0.63
24.00	67.95	253.67	9.58	16.99	433.37	4153.12	1626.14	216.68	273.04	16.66	0.50	0.63
23.00	65.40	244.08	9.58	16.35	449.72	4309.80	1792.26	224.86	283.34	17.33	0.50	0.63
22.00	62.78	234.50	9.58	15.69	465.41	4460.20	1964.65	232.71	293.23	17.99	0.50	0.63
21.00	60.23	224.92	9.58	15.06	480.47	4604.49	2143.06	240.23	302.71	18.62	0.50	0.63
20.00	57.68	215.33	9.58	14.42	494.89	4742.67	2327.24	247.44	311.80	19.22	0.50	0.63
19.00	55.05	205.75	9.58	13.76	508.65	4874.56	2516.95	254.33	320.47	19.80	0.50	0.63
18.00	52.58	196.17	9.58	13.14	521.79	5000.52	2711.93	260.90	328.75	20.35	0.50	0.63
17.00	50.03	186.58	9.58	12.51	534.30	5120.38	2911.95	267.15	336.63	20.87	0.50	0.63
16.00	47.48	177.00	9.58	11.87	546.17	5234.12	3116.77	273.08	344.11	21.37	0.50	0.63
15.00	44.85	167.42	9.58	11.21	557.38	5341.57	3326.13	278.69	351.17	21.85	0.50	0.63
14.00	42.30	157.83	9.58	10.58	567.96	5442.91	3539.79	283.98	357.83	22.30	0.50	0.63
13.00	39.75	148.25	9.58	9.94	577.89	5538.15	3757.51	288.95	364.09	22.72	0.50	0.63
12.00	37.13	138.67	9.58	9.28	587.18	5627.09	3979.04	293.59	369.94	23.12	0.50	0.63
11.00	34.58	129.08	9.58	8.64	595.82	5709.93	4204.12	297.91	375.39	23.49	0.50	0.63
10.00	31.95	119.50	9.58	7.99	603.81	5786.48	4432.52	301.90	380.42	23.83	0.50	0.63
9.00	29.40	109.92	9.58	7.35	611.16	5856.91	4663.98	305.58	385.05	24.15	0.50	0.63
8.00	26.85	100.33	9.58	6.71	617.87	5921.24	4898.25	308.93	389.28	24.45	0.50	0.63
7.00	24.38	90.75	9.58	6.09	623.96	5979.64	5135.10	311.98	393.12	24.71	0.50	0.63
6.00	21.83	81.17	9.58	5.46	629.42	6031.93	5374.29	314.71	396.56	24.96	0.50	0.63
5.00	19.20	71.58	9.58	4.80	634.22	6077.93	5615.56	317.11	399.58	25.18	0.50	0.63
4.00	30.83	62.00	36.00	7.71	641.93	23109.30	5858.68	320.96	978.51	25.37	0.50	1.52
3.00	9.45	26.00	10.00	2.36	644.29	6442.88	6783.05	322.14	412.55	25.68	0.50	0.64
2.00	6.60	16.00	16.00	1.65	645.94	10335.00	7040.77	322.97	524.60	25.77	0.50	0.81

1 — WINDF: Story wind force (kip)
2 — STYSHR: Story wind shear = WINDF (I) + STYSHR (I + 1)
3 — STYMOM: Story moment = STYSHR (I) x HT (I)
4 — COLP: Col. axial load = COLP (I + 1) + STYMOM (I + 1) / L
5 — GIRDP: Girder axial load = STYSHR (I) / 2
6 — BRACEP: Brace axial load = STYSHR (I) / 2 x [brace L / (L / 2)]
7 — COLP1: Col. virtual load = COLP (I + 1) + (1) x HT (I + 1) / L
8 — GIRDP1: Girder virtual load = ½ = .5
9 — BRACP1: Brace virtual load = .5 x [brace L / (L / 2)] = .707

HT (I) = Story height
L = Bay length (c.t.c. columns)
brace L = Brace length

10	11	12	13	14	15
COLAR	**GIRDAR**	**BRACAR**	**COLD**	**GIRDD**	**BRACED**
0.00	0.00	7.31	0.00	0.00	0.08
7.57	4.46	5.62	0.02	0.05	0.06
14.98	5.15	6.50	0.02	0.05	0.07
21.74	5.73	7.22	0.02	0.06	0.07
29.11	6.27	7.90	0.02	0.06	0.08
37.32	6.75	8.51	0.02	0.07	0.09
46.10	7.19	9.06	0.03	0.07	0.09
55.39	7.59	9.57	0.03	0.08	0.10
65.10	7.97	10.04	0.03	0.08	0.10
75.20	8.32	10.48	0.03	0.09	0.11
85.62	8.64	10.88	0.03	0.09	0.11
96.32	8.94	11.27	0.03	0.09	0.12
107.27	9.22	11.62	0.03	0.10	0.12
118.43	9.49	11.96	0.03	0.10	0.12
129.77	9.74	12.28	0.04	0.10	0.13
141.26	9.98	12.58	0.04	0.10	0.13
152.87	10.20	12.86	0.04	0.11	0.13
164.57	10.41	13.12	0.04	0.11	0.14
176.26	10.60	13.36	0.04	0.11	0.14
187.99	10.79	13.59	0.04	0.11	0.14
199.74	10.96	13.81	0.04	0.11	0.14
211.49	11.12	14.02	0.04	0.12	0.14
223.21	11.28	14.21	0.04	0.12	0.15
234.90	11.42	14.39	0.05	0.12	0.15
246.53	11.56	14.56	0.05	0.12	0.15
258.09	11.69	14.72	0.05	0.12	0.15
269.56	11.80	14.87	0.05	0.12	0.15
280.93	11.92	15.01	0.05	0.12	0.16
292.17	12.02	15.15	0.05	0.12	0.16
303.28	12.12	15.27	0.05	0.13	0.16
314.23	12.20	15.38	0.05	0.13	0.16
325.02	12.29	15.48	0.05	0.13	0.16
335.63	12.36	15.58	0.06	0.13	0.16
346.04	12.43	15.66	0.06	0.13	0.16
356.25	12.49	15.74	0.06	0.13	0.16
366.24	12.54	15.81	0.06	0.13	0.16
376.01	12.59	15.87	0.06	0.13	0.16
385.52	12.67	38.62	0.23	0.13	0.40
417.33	12.69	16.25	0.07	0.13	0.17
425.97	12.71	20.64	0.11	0.13	0.21

10 — COLAR: Col. area = $\sqrt{(P_i n_i)/\lambda}$ = √(col4) x (col7)
11 — GIRDAR: Girder area = $\sqrt{(P_i n_i)/\lambda}$ = √(col5) x (col8)
12 — BRACAR: Brace area = $\sqrt{(P_i n_i)/\lambda}$ = √(col6) x (col9)
13 — COLD: Column strain = [COLP x HT (I)] / (COLAR x E)
= [(col4) x HT (I)] / [(col10) x E]
14 — GIRDD: Girder strain = (GIRP x L / 2) / (GIRDAR x E)
= [(col5) x L / 2] / [(col11) x E]
15 — BRACED: Brace strain = (BRACEP x BRACEL) / (BRACAR x E)
= [(col6) x BRACEL] / [(col12) x E]

E – Young's modulus – 29.0 ksi.

16	17	18	19	20	21	22
COLRHO	**SUMROC**	**GIRRHO**	**BRARHO**	**SUMRHO**	**FLDEL**	**TOTDEL**
0.00	0.01	0.00	0.01	0.02	0.53	15.22
0.00	0.01	0.00	0.01	0.02	0.24	14.69
0.00	0.01	0.01	0.01	0.03	0.25	14.46
0.00	0.01	0.01	0.01	0.03	0.27	14.20
0.00	0.01	0.01	0.01	0.03	0.28	13.94
0.00	0.01	0.01	0.01	0.03	0.29	13.66
0.00	0.01	0.01	0.01	0.03	0.30	13.36
0.00	0.01	0.01	0.01	0.03	0.31	13.06
0.00	0.01	0.01	0.01	0.03	0.32	12.75
0.00	0.01	0.01	0.01	0.03	0.33	12.43
0.00	0.01	0.01	0.01	0.03	0.33	12.11
0.00	0.01	0.01	0.02	0.04	0.34	11.77
0.00	0.01	0.01	0.02	0.04	0.35	11.43
0.00	0.01	0.01	0.02	0.04	0.35	11.09
0.00	0.01	0.01	0.02	0.04	0.35	10.74
0.00	0.01	0.01	0.02	0.04	0.36	10.38
0.00	0.01	0.01	0.02	0.04	0.36	10.02
0.00	0.01	0.01	0.02	0.04	0.36	9.66
0.00	0.01	0.01	0.02	0.04	0.37	9.30
0.00	0.01	0.01	0.02	0.04	0.37	8.93
0.00	0.01	0.01	0.02	0.04	0.37	8.56
0.00	0.01	0.01	0.02	0.04	0.37	8.19
0.00	0.01	0.01	0.02	0.04	0.37	7.81
0.00	0.01	0.01	0.02	0.04	0.38	7.44
0.00	0.01	0.01	0.02	0.04	0.38	7.06
0.00	0.01	0.01	0.02	0.04	0.38	6.69
0.00	0.01	0.01	0.02	0.04	0.38	6.31
0.00	0.01	0.01	0.02	0.04	0.38	5.94
0.00	0.01	0.01	0.02	0.04	0.38	5.56
0.00	0.01	0.01	0.02	0.04	0.38	5.18
0.00	0.00	0.01	0.02	0.04	0.37	4.81
0.00	0.00	0.01	0.02	0.04	0.37	4.43
0.00	0.00	0.01	0.02	0.04	0.37	4.06
0.00	0.00	0.01	0.02	0.04	0.37	3.69
0.00	0.00	0.01	0.02	0.04	0.37	3.32
0.00	0.00	0.01	0.02	0.04	0.37	2.95
0.00	0.00	0.01	0.02	0.04	0.36	2.59
0.00	0.00	0.00	0.03	0.04	1.39	2.22
0.00	0.00	0.01	0.02	0.04	0.35	0.83
0.00	0.00	0.01	0.02	0.03	0.48	0.48

16 — COLRHO: Col. floor RHO = 2 x COLD / L = 2 x (col13) / L
17 — SUMROC: Sum of col. RHO — 1st story: SUMROC = (col17) = 0
Above: SUMROC (I) = SUMROC (I - 1) + COLRHO (I)
= (col17) + (col16)
18 — GIRRHO: Girder fl. RHO = GIRDD / HT = (col14) / HT
19 — BRARHO: Brace fl. RHO = BRACED x (2 x brace L) / (L x HT)
= (col15) x (2 x brace L) / (L x HT)
20 — SUMRHO: Sum of RHOs @ FL = SUMROC + GIRRHO + BRARHO
= (col17) + (col18) + (col19)
21 — FLDEL: Floor deflection = SUMRHO x HT = (col20) x HT
22 TOTDEL: Total floor deflection = FLDEL (I) + TOTDEL (I - 1)
= col21 (I) + col22 (I - 1)

* Max Δ, λ = 1.0.

23	24	25	26	27	28	29
COLAR	**GIRDAR**	**BRACAR**	**C.R.**	**ACOL**	**AGIRD**	**ABRAC**
0.00	0.00	7.31	1.17	**0.00**	**0.00**	**8.56**
7.57	4.46	5.62	1.17	**8.87**	**5.22**	**6.58**
14.98	5.15	6.50	1.17	**17.54**	**6.04**	**7.60**
21.74	5.73	7.22	1.17	**25.46**	**6.70**	**8.45**
29.11	6.27	7.90	1.17	**34.08**	**7.34**	**9.24**
37.32	6.75	8.51	1.17	**43.69**	**7.90**	**9.96**
46.10	7.19	9.06	1.17	**53.98**	**8.42**	**10.61**
55.39	7.59	9.57	1.17	**64.85**	**8.89**	**11.20**
65.10	7.97	10.04	1.17	**76.23**	**9.33**	**11.76**
75.20	8.32	10.48	1.17	**88.04**	**9.74**	**12.27**
85.62	8.64	10.88	1.17	**100.25**	**10.11**	**12.74**
96.32	8.94	11.27	1.17	**112.78**	**10.47**	**13.19**
107.27	9.22	11.62	1.17	**125.59**	**10.80**	**13.61**
118.43	9.49	11.96	1.17	**138.66**	**11.11**	**14.00**
129.77	9.74	12.28	1.17	**151.94**	**11.41**	**14.37**
141.26	9.98	12.58	1.17	**165.39**	**11.68**	**14.72**
152.87	10.20	12.86	1.17	**178.99**	**11.95**	**15.05**
164.57	10.41	13.12	1.17	**192.69**	**12.19**	**15.36**
176.26	10.60	13.36	1.17	**206.37**	**12.41**	**15.64**
187.99	10.79	13.59	1.17	**220.11**	**12.63**	**15.91**
199.74	10.96	13.81	1.17	**233.86**	**12.83**	**16.17**
211.49	11.12	14.02	1.17	**247.62**	**13.02**	**16.41**
223.21	11.28	14.21	1.17	**261.35**	**13.20**	**16.64**
234.90	11.42	14.39	1.17	**275.03**	**13.37**	**16.85**
246.53	11.56	14.56	1.17	**288.65**	**13.53**	**17.05**
258.09	11.69	14.72	1.17	**302.18**	**13.68**	**17.24**
269.56	11.80	14.87	1.17	**315.62**	**13.82**	**17.42**
280.93	11.92	15.01	1.17	**328.92**	**13.95**	**17.58**
292.17	12.02	15.15	1.17	**342.09**	**14.07**	**17.73**
303.28	12.12	15.27	1.17	**355.09**	**14.19**	**17.87**
314.23	12.20	15.38	1.17	**367.92**	**14.29**	**18.01**
325.02	12.29	15.48	1.17	**380.55**	**14.39**	**18.13**
335.63	12.36	15.58	1.17	**392.97**	**14.47**	**18.24**
346.04	12.43	15.66	1.17	**405.16**	**14.55**	**18.34**
356.25	12.49	15.74	1.17	**417.11**	**14.62**	**18.43**
366.24	12.54	15.81	1.17	**428.81**	**14.69**	**18.51**
376.01	12.59	15.87	1.17	**440.24**	**14.74**	**18.58**
385.52	12.67	38.62	1.17	**451.38**	**14.83**	**45.22**
417.33	12.69	16.25	1.17	**488.63**	**14.86**	**19.03**
425.97	12.71	20.64	1.17	**498.74**	**14.88**	**24.17**

23, 24, 25 — Repeat of columns 10, 11, 12
26 — Correction factor
27 — ACOL: Optimum column area = (col23) x (col26)
28 — AGIRD: Optimum girder area = (col24) x (col26)
29 — ABRAC: Optimum brace area = (col25) x (col26)

Appendix D

Braced Frame Drift Results

		WINDS1			WINDS2			WINDS3			WINDS4		
Level	Height (ft)	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux	Uy	H/?
41	460.00	11.40	6.46	484.14	11.01	6.45	501.35	11.37	-6.38	485.31	10.98	-6.39	502.61
40	437.58	10.82	6.05	485.29	10.42	6.04	503.80	10.79	-5.99	486.55	10.39	-6.00	505.16
39	422.58	10.42	5.76	486.73	10.01	5.76	506.44	10.39	-5.72	488.07	9.98	-5.72	507.89
38	412.17	10.10	5.56	489.56	9.70	5.56	509.95	10.08	-5.52	490.76	9.67	-5.53	511.25
37	401.75	9.77	5.36	493.30	9.37	5.36	514.38	9.75	-5.33	494.30	9.35	-5.33	515.47
36	391.33	9.43	5.15	497.98	9.03	5.15	519.76	9.42	-5.13	498.72	9.02	-5.13	520.57
35	380.92	9.08	4.94	503.65	8.69	4.94	526.15	9.07	-4.93	504.07	8.68	-4.93	526.61
34	370.50	8.71	4.72	510.38	8.33	4.73	533.64	8.71	-4.73	510.41	8.33	-4.72	533.68
33	360.08	8.34	4.51	518.14	7.97	4.51	542.18	8.35	-4.52	517.68	7.98	-4.52	541.70
32	349.67	7.98	4.30	525.59	7.62	4.31	550.37	8.00	-4.33	524.56	7.64	-4.32	549.24
31	339.25	7.63	4.10	533.86	7.28	4.10	559.40	7.65	-4.14	532.16	7.30	-4.13	557.53
30	328.83	7.27	3.89	543.05	6.93	3.90	569.41	7.30	-3.95	540.58	6.96	-3.94	566.68
29	318.42	6.91	3.69	553.17	6.58	3.70	580.40	6.95	-3.76	549.81	6.63	-3.75	576.70
28	308.00	6.55	3.49	564.17	6.24	3.50	592.35	6.60	-3.57	559.81	6.29	-3.56	587.54
27	297.58	6.20	3.29	575.99	5.90	3.30	605.20	6.26	-3.38	570.48	5.96	-3.37	599.14
26	287.17	5.86	3.09	588.46	5.57	3.11	618.85	5.92	-3.20	581.69	5.64	-3.18	611.37
25	276.75	5.52	2.90	601.22	5.25	2.92	632.96	5.60	-3.02	593.05	5.32	-3.00	623.91
24	266.33	5.21	2.72	613.00	4.95	2.74	646.22	5.30	-2.85	603.28	5.03	-2.83	635.42
23	255.92	4.92	2.54	624.58	4.66	2.56	659.61	5.01	-2.68	613.17	4.75	-2.66	646.89
22	245.50	4.63	2.37	635.86	4.38	2.39	673.03	4.73	-2.51	622.74	4.47	-2.49	658.35
21	235.08	4.35	2.20	648.03	4.10	2.22	687.33	4.45	-2.34	634.57	4.20	-2.32	672.19
20	224.67	4.07	2.04	662.64	3.83	2.06	703.99	4.15	-2.18	648.92	3.92	-2.16	688.55
19	214.25	3.78	1.88	679.94	3.55	1.90	723.37	3.86	-2.01	665.91	3.63	-1.99	707.50
18	203.83	3.49	1.73	700.18	3.28	1.75	745.66	3.57	-1.86	685.75	3.35	-1.84	729.30
17	193.42	3.21	1.58	723.37	3.01	1.60	770.84	3.28	-1.70	708.47	3.08	-1.69	753.94
16	183.00	2.94	1.45	747.57	2.76	1.47	796.89	3.00	-1.56	732.34	2.82	-1.54	779.58
15	172.58	2.67	1.32	774.99	2.51	1.33	826.25	2.73	-1.42	759.39	2.56	-1.41	808.57
14	162.17	2.41	1.19	806.80	2.26	1.21	860.11	2.46	-1.29	790.93	2.31	-1.27	842.10
13	151.75	2.16	1.07	844.03	2.02	1.09	899.44	2.20	-1.16	827.92	2.07	-1.14	881.16
12	141.33	1.91	0.96	887.96	1.79	0.97	945.48	1.95	-1.03	871.62	1.83	-1.02	926.98
11	130.92	1.67	0.85	940.21	1.57	0.86	999.88	1.70	-0.91	923.79	1.60	-0.90	981.26
10	120.50	1.44	0.74	1003.26	1.36	0.75	1064.88	1.47	-0.79	986.83	1.38	-0.78	1046.39
9	110.08	1.22	0.64	1079.07	1.16	0.65	1142.14	1.24	-0.69	1062.75	1.18	-0.68	1123.96
8	99.67	1.03	0.55	1162.75	0.98	0.56	1225.79	1.04	-0.59	1146.92	0.99	-0.58	1208.21
7	89.25	0.85	0.47	1265.96	0.81	0.48	1327.47	0.86	-0.50	1250.58	0.82	-0.49	1310.57
6	78.83	0.68	0.39	1399.61	0.65	0.40	1456.50	0.68	-0.42	1384.25	0.66	-0.41	1439.87
5	68.42	0.52	0.32	1579.46	0.50	0.33	1626.39	0.53	-0.34	1562.63	0.51	-0.33	1608.55
4	58.00	0.38	0.26	1813.92	0.38	0.26	1844.20	0.39	-0.27	1794.28	0.38	-0.26	1823.90
3	26.00	0.13	0.09	2335.33	0.13	0.09	2352.94	0.13	-0.09	2326.62	0.13	-0.09	2344.10
2	16.00	0.07	0.05	2570.28	0.07	0.05	2584.12	0.07	-0.05	2566.84	0.07	-0.05	2580.65

			WINDS5			WINDS6			WINDS7			WINDS8	
Level	Height (ft)	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux	Uy	H/?
41	460.00	-10.98	6.39	502.61	-11.37	6.38	485.31	-11.01	-6.45	501.35	-11.40	-6.46	484.14
40	437.58	-10.39	6.00	505.16	-10.79	5.99	486.55	-10.42	-6.04	503.80	-10.82	-6.05	485.29
39	422.58	-9.98	5.72	507.89	-10.39	5.72	488.07	-10.01	-5.76	506.44	-10.42	-5.76	486.73
38	412.17	-9.67	5.53	511.25	-10.08	5.52	490.76	-9.70	-5.56	509.95	-10.10	-5.56	489.56
37	401.75	-9.35	5.33	515.47	-9.75	5.33	494.30	-9.37	-5.36	514.38	-9.77	-5.36	493.30
36	391.33	-9.02	5.13	520.57	-9.42	5.13	498.72	-9.03	-5.15	519.76	-9.43	-5.15	497.98
35	380.92	-8.68	4.93	526.61	-9.07	4.93	504.07	-8.69	-4.94	526.15	-9.08	-4.94	503.65
34	370.50	-8.33	4.72	533.68	-8.71	4.73	510.41	-8.33	-4.73	533.64	-8.71	-4.72	510.38
33	360.08	-7.98	4.52	541.70	-8.35	4.52	517.68	-7.97	-4.51	542.18	-8.34	-4.51	518.14
32	349.67	-7.64	4.32	549.24	-8.00	4.33	524.56	-7.62	-4.31	550.37	-7.98	-4.30	525.59
31	339.25	-7.30	4.13	557.53	-7.65	4.14	532.16	-7.28	-4.10	559.40	-7.63	-4.10	533.86
30	328.83	-6.96	3.94	566.68	-7.30	3.95	540.58	-6.93	-3.90	569.41	-7.27	-3.89	543.05
29	318.42	-6.63	3.75	576.70	-6.95	3.76	549.81	-6.58	-3.70	580.40	-6.91	-3.69	553.17
28	308.00	-6.29	3.56	587.54	-6.60	3.57	559.81	-6.24	-3.50	592.35	-6.55	-3.49	564.17
27	297.58	-5.96	3.37	599.14	-6.26	3.38	570.48	-5.90	-3.30	605.20	-6.20	-3.29	575.99
26	287.17	-5.64	3.18	611.37	-5.92	3.20	581.69	-5.57	-3.11	618.85	-5.86	-3.09	588.46
25	276.75	-5.32	3.00	623.91	-5.60	3.02	593.05	-5.25	-2.92	632.96	-5.52	-2.90	601.22
24	266.33	-5.03	2.83	635.42	-5.30	2.85	603.28	-4.95	-2.74	646.22	-5.21	-2.72	613.00
23	255.92	-4.75	2.66	646.89	-5.01	2.68	613.17	-4.66	-2.56	659.61	-4.92	-2.54	624.58
22	245.50	-4.47	2.49	658.35	-4.73	2.51	622.74	-4.38	-2.39	673.03	-4.63	-2.37	635.86
21	235.08	-4.20	2.32	672.19	-4.45	2.34	634.57	-4.10	-2.22	687.33	-4.35	-2.20	648.03
20	224.67	-3.92	2.16	688.55	-4.15	2.18	648.92	-3.83	-2.06	703.99	-4.07	-2.04	662.64
19	214.25	-3.63	1.99	707.50	-3.86	2.01	665.91	-3.55	-1.90	723.37	-3.78	-1.88	679.94
18	203.83	-3.35	1.84	729.30	-3.57	1.86	685.75	-3.28	-1.75	745.66	-3.49	-1.73	700.18
17	193.42	-3.08	1.69	753.94	-3.28	1.70	708.47	-3.01	-1.60	770.84	-3.21	-1.58	723.37
16	183.00	-2.82	1.54	779.58	-3.00	1.56	732.34	-2.76	-1.47	796.89	-2.94	-1.45	747.57
15	172.58	-2.56	1.41	808.57	-2.73	1.42	759.39	-2.51	-1.33	826.25	-2.67	-1.32	774.99
14	162.17	-2.31	1.27	842.10	-2.46	1.29	790.93	-2.26	-1.21	860.11	-2.41	-1.19	806.80
13	151.75	-2.07	1.14	881.16	-2.20	1.16	827.92	-2.02	-1.09	899.44	-2.16	-1.07	844.03
12	141.33	-1.83	1.02	926.98	-1.95	1.03	871.62	-1.79	-0.97	945.48	-1.91	-0.96	887.96
11	130.92	-1.60	0.90	981.26	-1.70	0.91	923.79	-1.57	-0.86	999.88	-1.67	-0.85	940.21
10	120.50	-1.38	0.78	1046.39	-1.47	0.79	986.83	-1.36	-0.75	1064.88	-1.44	-0.74	1003.26
9	110.08	-1.18	0.68	1123.96	-1.24	0.69	1062.75	-1.16	-0.65	1142.14	-1.22	-0.64	1079.07
8	99.67	-0.99	0.58	1208.21	-1.04	0.59	1146.92	-0.98	-0.56	1225.79	-1.03	-0.55	1162.75
7	89.25	-0.82	0.49	1310.57	-0.86	0.50	1250.58	-0.81	-0.48	1327.47	-0.85	-0.47	1265.96
6	78.83	-0.66	0.41	1439.87	-0.68	0.42	1384.25	-0.65	-0.40	1456.50	-0.68	-0.39	1399.61
5	68.42	-0.51	0.33	1608.55	-0.53	0.34	1562.63	-0.50	-0.33	1626.39	-0.52	-0.32	1579.46
4	58.00	-0.38	0.26	1823.90	-0.39	0.27	1794.28	-0.38	-0.26	1844.20	-0.38	-0.26	1813.92
3	26.00	-0.13	0.09	2344.10	-0.13	0.09	2326.62	-0.13	-0.09	2352.94	-0.13	-0.09	2335.33
2	16.00	-0.07	0.05	2580.65	-0.07	0.05	2566.84	-0.07	-0.05	2584.12	-0.07	-0.05	2570.28

		WINDS9			WINDS10			WINDS11			WINDS12		
Level	Height (ft)	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux	Uy	H/?
41	460.00	7.54	12.87	428.98	7.07	12.86	429.34	-7.01	12.82	430.49	-7.48	12.81	430.86
40	437.58	7.16	12.06	435.45	6.68	12.06	435.55	-6.63	12.03	436.62	-7.11	12.02	436.73
39	422.58	6.90	11.50	441.12	6.42	11.49	441.19	-6.36	11.47	442.20	-6.85	11.47	442.27
38	412.17	6.69	11.10	445.56	6.21	11.10	445.60	-6.16	11.08	446.54	-6.65	11.08	446.58
37	401.75	6.48	10.70	450.65	6.00	10.70	450.65	-5.96	10.68	451.48	-6.44	10.68	451.48
36	391.33	6.25	10.29	456.49	5.77	10.29	456.43	-5.75	10.27	457.12	-6.22	10.27	457.06
35	380.92	6.01	9.87	463.13	5.55	9.87	462.99	-5.53	9.86	463.50	-6.00	9.86	463.37
34	370.50	5.77	9.45	470.66	5.31	9.45	470.43	-5.31	9.45	470.71	-5.77	9.45	470.49
33	360.08	5.52	9.02	479.05	5.07	9.03	478.71	-5.09	9.03	478.71	-5.53	9.03	478.38
32	349.67	5.28	8.62	486.85	4.85	8.63	486.39	-4.88	8.63	486.06	-5.31	8.64	485.60
31	339.25	5.04	8.22	495.36	4.62	8.23	494.76	-4.67	8.24	494.05	-5.08	8.25	493.45
30	328.83	4.79	7.82	504.71	4.39	7.83	503.94	-4.46	7.85	502.80	-4.86	7.86	502.03
29	318.42	4.55	7.42	514.93	4.16	7.43	513.96	-4.25	7.46	512.32	-4.63	7.47	511.37
28	308.00	4.31	7.03	526.07	3.94	7.04	524.89	-4.04	7.07	522.68	-4.41	7.09	521.52
27	297.58	4.07	6.64	538.18	3.71	6.65	536.76	-3.83	6.69	533.92	-4.19	6.71	532.52
26	287.17	3.84	6.25	551.30	3.49	6.27	549.60	-3.63	6.31	546.08	-3.98	6.33	544.42
25	276.75	3.62	5.87	565.36	3.28	5.89	563.37	-3.44	5.94	559.11	-3.77	5.96	557.15
24	266.33	3.41	5.52	579.18	3.08	5.54	576.87	-3.25	5.59	571.86	-3.57	5.61	569.62
23	255.92	3.21	5.17	594.20	2.89	5.19	591.57	-3.08	5.24	585.76	-3.39	5.27	583.19
22	245.50	3.02	4.82	610.58	2.71	4.85	607.61	-2.90	4.90	600.98	-3.21	4.93	598.10
21	235.08	2.84	4.49	628.40	2.54	4.51	625.08	-2.72	4.57	617.66	-3.02	4.59	614.46
20	224.67	2.65	4.16	647.75	2.37	4.19	644.10	-2.54	4.24	635.95	-2.82	4.26	632.42
19	214.25	2.47	3.84	668.75	2.19	3.87	664.75	-2.35	3.92	655.97	-2.63	3.94	652.11
18	203.83	2.28	3.54	691.55	2.02	3.56	687.19	-2.17	3.61	677.84	-2.43	3.63	673.68
17	193.42	2.09	3.24	715.96	1.86	3.26	711.29	-1.99	3.31	701.46	-2.23	3.33	696.98
16	183.00	1.92	2.97	739.82	1.70	2.99	734.84	-1.82	3.03	724.70	-2.04	3.05	719.93
15	172.58	1.75	2.70	766.16	1.55	2.72	760.84	-1.66	2.76	750.44	-1.86	2.78	745.36
14	162.17	1.58	2.45	795.55	1.40	2.46	789.90	-1.49	2.50	779.31	-1.67	2.51	773.88
13	151.75	1.41	2.20	828.52	1.25	2.21	822.46	-1.34	2.24	811.75	-1.49	2.26	805.93
12	141.33	1.25	1.96	865.66	1.11	1.97	859.12	-1.18	2.00	848.38	-1.32	2.01	842.15
11	130.92	1.09	1.73	907.68	0.97	1.74	900.65	-1.03	1.77	890.04	-1.15	1.78	883.23
10	120.50	0.94	1.51	955.65	0.84	1.53	947.95	-0.89	1.54	937.68	-0.99	1.55	930.26
9	110.08	0.80	1.31	1009.55	0.72	1.32	1001.06	-0.76	1.33	991.37	-0.84	1.34	983.18
8	99.67	0.67	1.13	1060.76	0.61	1.14	1051.43	-0.64	1.15	1042.81	-0.70	1.16	1033.80
7	89.25	0.55	0.96	1117.49	0.51	0.97	1107.09	-0.53	0.97	1100.15	-0.57	0.98	1090.08
6	78.83	0.44	0.80	1181.90	0.41	0.81	1170.06	-0.42	0.81	1165.31	-0.46	0.82	1153.79
5	68.42	0.34	0.65	1255.17	0.32	0.66	1241.31	-0.33	0.66	1239.63	-0.35	0.67	1225.93
4	58.00	0.25	0.52	1341.04	0.24	0.53	1323.70	-0.25	0.52	1326.47	-0.26	0.53	1309.50
3	26.00	0.09	0.19	1666.67	0.09	0.19	1657.81	-0.09	0.19	1664.89	-0.09	0.19	1656.93
2	16.00	0.05	0.11	1789.38	0.05	0.11	1782.73	-0.05	0.11	1794.39	-0.05	0.11	1789.38

Level	Height (ft)	WINDS13			WINDS14			WINDS15			WINDS16		
		Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux	Uy	H/?
41	460.00	7.48	-12.81	430.86	7.01	-12.82	430.49	-7.07	-12.86	429.34	-7.54	-12.87	428.98
40	437.58	7.11	-12.02	436.73	6.63	-12.03	436.62	-6.68	-12.06	435.55	-7.16	-12.06	435.45
39	422.58	6.85	-11.47	442.27	6.36	-11.47	442.20	-6.42	-11.49	441.19	-6.90	-11.50	441.12
38	412.17	6.65	-11.08	446.58	6.16	-11.08	446.54	-6.21	-11.10	445.60	-6.69	-11.10	445.56
37	401.75	6.44	-10.68	451.48	5.96	-10.68	451.48	-6.00	-10.70	450.65	-6.48	-10.70	450.65
36	391.33	6.22	-10.27	457.06	5.75	-10.27	457.12	-5.77	-10.29	456.43	-6.25	-10.29	456.49
35	380.92	6.00	-9.86	463.37	5.53	-9.86	463.50	-5.55	-9.87	462.99	-6.01	-9.87	463.13
34	370.50	5.77	-9.45	470.49	5.31	-9.45	470.71	-5.31	-9.45	470.43	-5.77	-9.45	470.66
33	360.08	5.53	-9.03	478.38	5.09	-9.03	478.71	-5.07	-9.03	478.71	-5.52	-9.02	479.05
32	349.67	5.31	-8.64	485.60	4.88	-8.63	486.06	-4.85	-8.63	486.39	-5.28	-8.62	486.85
31	339.25	5.08	-8.25	493.45	4.67	-8.24	494.05	-4.62	-8.23	494.76	-5.04	-8.22	495.36
30	328.83	4.86	-7.86	502.03	4.46	-7.85	502.80	-4.39	-7.83	503.94	-4.79	-7.82	504.71
29	318.42	4.63	-7.47	511.37	4.25	-7.46	512.32	-4.16	-7.43	513.96	-4.55	-7.42	514.93
28	308.00	4.41	-7.09	521.52	4.04	-7.07	522.68	-3.94	-7.04	524.89	-4.31	-7.03	526.07
27	297.58	4.19	-6.71	532.52	3.83	-6.69	533.92	-3.71	-6.65	536.76	-4.07	-6.64	538.18
26	287.17	3.98	-6.33	544.42	3.63	-6.31	546.08	-3.49	-6.27	549.60	-3.84	-6.25	551.30
25	276.75	3.77	-5.96	557.15	3.44	-5.94	559.11	-3.28	-5.89	563.37	-3.62	-5.87	565.36
24	266.33	3.57	-5.61	569.62	3.25	-5.59	571.86	-3.08	-5.54	576.87	-3.41	-5.52	579.18
23	255.92	3.39	-5.27	583.19	3.08	-5.24	585.76	-2.89	-5.19	591.57	-3.21	-5.17	594.20
22	245.50	3.21	-4.93	598.10	2.90	-4.90	600.98	-2.71	-4.85	607.61	-3.02	-4.82	610.58
21	235.08	3.02	-4.59	614.46	2.72	-4.57	617.66	-2.54	-4.51	625.08	-2.84	-4.49	628.40
20	224.67	2.82	-4.26	632.42	2.54	-4.24	635.95	-2.37	-4.19	644.10	-2.65	-4.16	647.75
19	214.25	2.63	-3.94	652.11	2.35	-3.92	655.97	-2.19	-3.87	664.75	-2.47	-3.84	668.75
18	203.83	2.43	-3.63	673.68	2.17	-3.61	677.84	-2.02	-3.56	687.19	-2.28	-3.54	691.55
17	193.42	2.23	-3.33	696.98	1.99	-3.31	701.46	-1.86	-3.26	711.29	-2.09	-3.24	715.96
16	183.00	2.04	-3.05	719.93	1.82	-3.03	724.70	-1.70	-2.99	734.84	-1.92	-2.97	739.82
15	172.58	1.86	-2.78	745.36	1.66	-2.76	750.44	-1.55	-2.72	760.84	-1.75	-2.70	766.16
14	162.17	1.67	-2.51	773.88	1.49	-2.50	779.31	-1.40	-2.46	789.90	-1.58	-2.45	795.55
13	151.75	1.49	-2.26	805.93	1.34	-2.24	811.75	-1.25	-2.21	822.46	-1.41	-2.20	828.52
12	141.33	1.32	-2.01	842.15	1.18	-2.00	848.38	-1.11	-1.97	859.12	-1.25	-1.96	865.66
11	130.92	1.15	-1.78	883.23	1.03	-1.77	890.04	-0.97	-1.74	900.65	-1.09	-1.73	907.68
10	120.50	0.99	-1.55	930.26	0.89	-1.54	937.68	-0.84	-1.53	947.95	-0.94	-1.51	955.65
9	110.08	0.84	-1.34	983.18	0.76	-1.33	991.37	-0.72	-1.32	1001.06	-0.80	-1.31	1009.55
8	99.67	0.70	-1.16	1033.80	0.64	-1.15	1042.81	-0.61	-1.14	1051.43	-0.67	-1.13	1060.76
7	89.25	0.57	-0.98	1090.08	0.53	-0.97	1100.15	-0.51	-0.97	1107.09	-0.55	-0.96	1117.49
6	78.83	0.46	-0.82	1153.79	0.42	-0.81	1165.31	-0.41	-0.81	1170.06	-0.44	-0.80	1181.90
5	68.42	0.35	-0.67	1225.93	0.33	-0.66	1239.63	-0.32	-0.66	1241.31	-0.34	-0.65	1255.17
4	58.00	0.26	-0.53	1309.50	0.25	-0.52	1326.47	-0.24	-0.53	1323.70	-0.25	-0.52	1341.04
3	26.00	0.09	-0.19	1656.93	0.09	-0.19	1664.89	-0.09	-0.19	1657.81	-0.09	-0.19	1666.67
2	16.00	0.05	-0.11	1789.38	0.05	-0.11	1794.39	-0.05	-0.11	1782.73	-0.05	-0.11	1789.38

		WINDS17			WINDS18			WINDS19			WINDS20		
Level	Height (ft)	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux (in)	Uy (in)	H/?	Ux	Uy	H/?
41	460.00	7.52	6.45	733.70	7.50	-6.39	736.39	-7.50	6.39	736.39	-7.52	-6.45	733.70
40	437.58	7.15	6.04	734.66	7.12	-6.00	737.56	-7.12	6.00	737.56	-7.15	-6.04	734.66
39	422.58	6.89	5.76	736.15	6.86	-5.73	739.21	-6.86	5.73	739.21	-6.89	-5.76	736.15
38	412.17	6.68	5.56	740.15	6.66	-5.53	742.90	-6.66	5.53	742.90	-6.68	-5.56	740.15
37	401.75	6.47	5.35	745.59	6.45	-5.33	747.88	-6.45	5.33	747.88	-6.47	-5.35	745.59
36	391.33	6.24	5.15	752.48	6.23	-5.13	754.17	-6.23	5.13	754.17	-6.24	-5.15	752.48
35	380.92	6.01	4.94	760.90	6.00	-4.93	761.86	-6.00	4.93	761.86	-6.01	-4.94	760.90
34	370.50	5.77	4.72	770.96	5.77	-4.73	771.03	-5.77	4.73	771.03	-5.77	-4.72	770.96
33	360.08	5.52	4.51	782.63	5.53	-4.52	781.60	-5.53	4.52	781.60	-5.52	-4.51	782.63
32	349.67	5.29	4.30	793.90	5.30	-4.33	791.55	-5.30	4.33	791.55	-5.29	-4.30	793.90
31	339.25	5.05	4.10	806.44	5.07	-4.13	802.56	-5.07	4.13	802.56	-5.05	-4.10	806.44
30	328.83	4.81	3.90	820.42	4.84	-3.94	814.78	-4.84	3.94	814.78	-4.81	-3.90	820.42
29	318.42	4.57	3.70	835.81	4.61	-3.75	828.17	-4.61	3.75	828.17	-4.57	-3.70	835.81
28	308.00	4.34	3.50	852.60	4.39	-3.56	842.66	-4.39	3.56	842.66	-4.34	-3.50	852.60
27	297.58	4.10	3.30	870.59	4.16	-3.37	858.10	-4.16	3.37	858.10	-4.10	-3.30	870.59
26	287.17	3.87	3.11	889.61	3.94	-3.18	874.24	-3.94	3.18	874.24	-3.87	-3.11	889.61
25	276.75	3.65	2.92	909.04	3.73	-3.00	890.49	-3.73	3.00	890.49	-3.65	-2.92	909.04
24	266.33	3.45	2.74	926.91	3.53	-2.83	904.89	-3.53	2.83	904.89	-3.45	-2.74	926.91
23	255.92	3.25	2.56	944.40	3.34	-2.66	918.55	-3.34	2.66	918.55	-3.25	-2.56	944.40
22	245.50	3.06	2.39	961.24	3.16	-2.49	931.57	-3.16	2.49	931.57	-3.06	-2.39	961.24
21	235.08	2.88	2.22	978.90	2.97	-2.32	948.49	-2.97	2.32	948.49	-2.88	-2.22	978.90
20	224.67	2.70	2.06	1000.26	2.78	-2.16	969.37	-2.78	2.16	969.37	-2.70	-2.06	1000.26
19	214.25	2.51	1.90	1025.81	2.59	-2.00	994.20	-2.59	2.00	994.20	-2.51	-1.90	1025.81
18	203.83	2.32	1.75	1055.95	2.39	-1.84	1023.47	-2.39	1.84	1023.47	-2.32	-1.75	1055.95
17	193.42	2.13	1.60	1090.65	2.20	-1.69	1057.12	-2.20	1.69	1057.12	-2.13	-1.60	1090.65
16	183.00	1.95	1.46	1126.96	2.01	-1.55	1092.65	-2.01	1.55	1092.65	-1.95	-1.46	1126.96
15	172.58	1.77	1.33	1168.07	1.83	-1.41	1132.99	-1.83	1.41	1132.99	-1.77	-1.33	1168.07
14	162.17	1.60	1.21	1215.87	1.65	-1.27	1180.18	-1.65	1.27	1180.18	-1.60	-1.21	1215.87
13	151.75	1.43	1.08	1272.00	1.47	-1.15	1235.75	-1.47	1.15	1235.75	-1.43	-1.08	1272.00
12	141.33	1.27	0.97	1338.38	1.30	-1.02	1301.61	-1.30	1.02	1301.61	-1.27	-0.97	1338.38
11	130.92	1.11	0.85	1417.49	1.14	-0.90	1380.50	-1.14	0.90	1380.50	-1.11	-0.85	1417.49
10	120.50	0.96	0.75	1513.34	0.98	-0.79	1476.11	-0.98	0.79	1476.11	-0.96	-0.75	1513.34
9	110.08	0.81	0.65	1628.85	0.83	-0.68	1591.95	-0.83	0.68	1591.95	-0.81	-0.65	1628.85
8	99.67	0.68	0.56	1757.02	0.69	-0.59	1721.36	-0.69	0.59	1721.36	-0.68	-0.56	1757.02
7	89.25	0.56	0.47	1916.26	0.57	-0.50	1881.59	-0.57	0.50	1881.59	-0.56	-0.47	1916.26
6	78.83	0.45	0.40	2124.40	0.45	-0.41	2089.21	-0.45	0.41	2089.21	-0.45	-0.40	2124.40
5	68.42	0.34	0.32	2407.64	0.35	-0.34	2368.74	-0.35	0.34	2368.74	-0.34	-0.32	2407.64
4	58.00	0.25	0.26	2779.55	0.25	-0.27	2733.70	-0.25	0.27	2733.70	-0.25	-0.26	2779.55
3	26.00	0.09	0.09	3586.21	0.09	-0.09	3565.71	-0.09	0.09	3565.71	-0.09	-0.09	3586.21
2	16.00	0.05	0.05	3942.51	0.05	-0.05	3942.51	-0.05	0.05	3942.51	-0.05	-0.05	3942.51

		EQX		EQXE1		EQXE2		EQY		EQYE1		EQYE2	
Level	Height (ft)	Ux (in)	Uy (in)	Ux (in)	Uy (in)	Ux (in)	Uy (in)	Ux (in)	Uy (in)	Ux (in)	Uy (in)	Ux (in)	Uy (in)
41	460.00	5.22	0.02	5.15	0.02	5.30	0.02	0.02	4.36	0.09	4.36	-0.06	4.35
40	437.58	4.94	0.02	4.86	0.02	5.02	0.02	0.02	4.08	0.09	4.08	-0.06	4.08
39	422.58	4.75	0.02	4.67	0.01	4.82	0.02	0.02	3.88	0.09	3.88	-0.06	3.88
38	412.17	4.59	0.01	4.52	0.01	4.67	0.01	0.02	3.74	0.09	3.74	-0.06	3.74
37	401.75	4.44	0.01	4.36	0.01	4.51	0.01	0.01	3.60	0.09	3.60	-0.06	3.60
36	391.33	4.27	0.01	4.19	0.01	4.35	0.01	0.01	3.46	0.09	3.46	-0.06	3.46
35	380.92	4.10	0.01	4.03	0.01	4.17	0.01	0.01	3.31	0.08	3.31	-0.07	3.31
34	370.50	3.93	0.00	3.85	0.00	4.00	0.00	0.01	3.17	0.08	3.17	-0.07	3.17
33	360.08	3.75	0.00	3.68	0.00	3.82	0.00	0.00	3.02	0.07	3.02	-0.07	3.02
32	349.67	3.58	0.00	3.51	0.00	3.65	0.00	0.00	2.88	0.07	2.88	-0.07	2.88
31	339.25	3.41	0.00	3.35	0.00	3.48	-0.01	0.00	2.74	0.06	2.74	-0.07	2.74
30	328.83	3.24	-0.01	3.18	-0.01	3.30	-0.01	-0.01	2.60	0.06	2.60	-0.07	2.60
29	318.42	3.07	-0.01	3.01	-0.01	3.13	-0.01	-0.01	2.46	0.05	2.46	-0.07	2.47
28	308.00	2.91	-0.01	2.85	-0.01	2.96	-0.02	-0.01	2.33	0.04	2.33	-0.07	2.33
27	297.58	2.74	-0.02	2.69	-0.01	2.80	-0.02	-0.02	2.19	0.04	2.19	-0.07	2.20
26	287.17	2.58	-0.02	2.53	-0.02	2.63	-0.02	-0.02	2.06	0.03	2.06	-0.07	2.07
25	276.75	2.43	-0.02	2.38	-0.02	2.48	-0.02	-0.02	1.94	0.03	1.93	-0.07	1.94
24	266.33	2.29	-0.02	2.24	-0.02	2.33	-0.03	-0.02	1.81	0.02	1.81	-0.07	1.82
23	255.92	2.15	-0.02	2.10	-0.02	2.19	-0.03	-0.03	1.70	0.02	1.69	-0.07	1.70
22	245.50	2.02	-0.03	1.97	-0.02	2.06	-0.03	-0.03	1.58	0.02	1.58	-0.07	1.58
21	235.08	1.89	-0.03	1.84	-0.02	1.93	-0.03	-0.03	1.47	0.02	1.46	-0.07	1.47
20	224.67	1.76	-0.03	1.72	-0.02	1.80	-0.03	-0.03	1.36	0.02	1.35	-0.07	1.36
19	214.25	1.63	-0.02	1.59	-0.02	1.67	-0.03	-0.02	1.25	0.02	1.25	-0.06	1.25
18	203.83	1.50	-0.02	1.46	-0.02	1.54	-0.03	-0.02	1.15	0.02	1.14	-0.06	1.15
17	193.42	1.37	-0.02	1.34	-0.02	1.41	-0.03	-0.02	1.05	0.01	1.04	-0.05	1.05
16	183.00	1.25	-0.02	1.22	-0.02	1.28	-0.02	-0.02	0.96	0.01	0.95	-0.05	0.96
15	172.58	1.13	-0.02	1.10	-0.02	1.16	-0.02	-0.02	0.87	0.01	0.86	-0.04	0.87
14	162.17	1.02	-0.02	0.99	-0.01	1.05	-0.02	-0.01	0.78	0.01	0.78	-0.04	0.78
13	151.75	0.91	-0.01	0.89	-0.01	0.93	-0.02	-0.01	0.70	0.01	0.70	-0.04	0.70
12	141.33	0.80	-0.01	0.78	-0.01	0.82	-0.02	-0.01	0.62	0.01	0.62	-0.03	0.62
11	130.92	0.70	-0.01	0.68	-0.01	0.72	-0.01	-0.01	0.55	0.01	0.54	-0.03	0.55
10	120.50	0.60	-0.01	0.59	-0.01	0.61	-0.01	-0.01	0.48	0.01	0.47	-0.02	0.48
9	110.08	0.51	-0.01	0.50	-0.01	0.52	-0.01	-0.01	0.41	0.01	0.41	-0.02	0.41
8	99.67	0.43	-0.01	0.42	0.00	0.43	-0.01	0.00	0.35	0.01	0.35	-0.01	0.35
7	89.25	0.35	0.00	0.34	0.00	0.36	-0.01	0.00	0.30	0.00	0.30	-0.01	0.30
6	78.83	0.28	0.00	0.27	0.00	0.28	0.00	0.00	0.25	0.00	0.25	-0.01	0.25
5	68.42	0.21	0.00	0.21	0.00	0.22	0.00	0.00	0.20	0.00	0.20	0.00	0.20
4	58.00	0.16	0.00	0.16	0.00	0.16	0.00	0.00	0.16	0.00	0.16	0.00	0.16
3	26.00	0.05	0.00	0.05	0.00	0.05	0.00	0.00	0.06	0.00	0.06	0.00	0.06
2	16.00	0.03	0.00	0.03	0.00	0.03	0.00	0.00	0.03	0.00	0.03	0.00	0.03

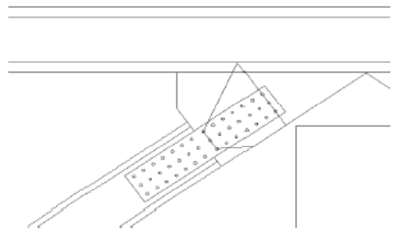
Appendix E

Braced Frame Connection Calculations

Project	AE482
Date	4/8/2008
Engineer	Steve Reichwein

Brace to Girder Connection - LRFD

Fy,beam	50	ksi	Bolt Dia.	0.75	in	Lweld	12	in
Fu,beam	65	ksi	#Rows of Bolts	2		tweld	5	1/16 in
Fy,plate	36	ksi	#Bolts/Row	5		θ	37.5	Deg
Fu,plate	58	ksi	Plate t (ea)	0.5	in	Whitmore Section Length	18	in
Brace	W12X53		Plate w	9	in			
Girder	W14X145		Gusset Plate t	0.5	in			
						ΦRn	206.68	kips



Brace Limit States

Tension Yielding ΦRn = 0.9 Fy Ag

ΦRn 702.0 kips

Tension Rupture ΦRn = .75 Fu (Ag - Abolts)

ΦRn 232.9396875 kips

Block Shear ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 242.19 kips Anv 6.98625
Ant 0.77625
Agv 9.315

Bolt Limit States

Bolt Shear/Row
Φrn 79.6 kips

Bearing on Beam/Row
Φrn 60.5475 kips

Bearing on Plates/Row
Φrn 156.6 kips

Tearout on Beam/Row
Edge Bm Φrn 44.14921875 kips
Other Bm Φrn 88.2984375 kips

Tearout on Plates/Row
Edge Plate Φrn 127.96875 kips
Other Plate Φrn 228.375 kips

ΦRn Beam 286.3392188 kips
ΦRn Plate 398 kips

Plate Limit States

Tension Yielding ΦRn = 0.9 Fy Ag

ΦRn 291.6 kips

Tension Rupture ΦRn = .75 Fu (Ag - Abolts)

ΦRn 315.375 kips

Block Shear ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 242.5 kips Anv 10.125
Ant 0.546875
Agv 13.5

Gusset Plate Limit States

Tension Yielding ΦRn = 0.9 Fy Ag

ΦRn 291.6 kips

Tension Rupture ΦRn = .75 Fu (Ag - Abolts)

ΦRn 353.4375 kips

Block Shear ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 485.0 kips Anv 20.25
Ant 1.09375
Agv 27

Weld Limit States

Base Metal ΦRn = .75 x .6 x Fu x t x Lweld

ΦRn 765.18 kips

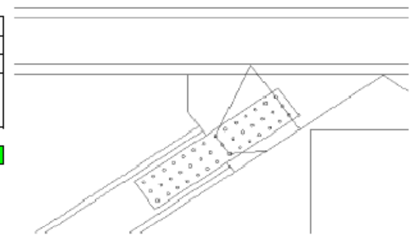
Weld Rupture ΦRn = 1.392 x Lweld x tweld(1/16") x (1 + .5 (sin θ)^1.5)

ΦRn 206.68 kips

Project	AE482
Date	4/8/2008
Engineer	Steve Reichwein

Brace to Girder Connection - LRFD

Fy,beam	50	ksi	Bolt Dia.	0.75	in	Lweld	24	in
Fu,beam	65	ksi	#Rows of Bolts	2		tweld	5	1/16 in
Fy,plate	36	ksi	#Bolts/Row	6		θ	37.5	Deg
Fu,plate	58	ksi	Plate t (ea)	0.75	in	Whitmore		
Brace	W12X87		Plate w	9	in	Section		
Girder	W14X145		Gusset Plate t	1.5	in	Length	18	in



ΦRn	413.37	kips

Brace Limit States

Tension Yielding — ΦRn = 0.9 Fy Ag

ΦRn 1152.0 kips

Tension Rupture — ΦRn = .75 Fu (Ag - Abolts)

ΦRn 598.7840625 kips

Block Shear — ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 429.316875 kips
Anv 12.74625
Ant 1.15875
Agv 16.995

Bolt Limit States

Bolt Shear/Row
Φrn 79.6 kips

Bearing on Beam/Row
Φrn 90.3825 kips

Bearing on Plates/Row
Φrn 234.9 kips

Tearout on Beam/Row
Edge Bm Φrn 65.90390625 kips
Other Bm Φrn 131.8078125 kips

Tearout on Plates/Row
Edge Plate Φrn 191.953125 kips
Other Plate Φrn 342.5625 kips

ΦRn Beam 463.9039063 kips
ΦRn Plate 477.6 kips

Plate Limit States

Tension Yielding — ΦRn = 0.9 Fy Ag

ΦRn 437.4 kips

Tension Rupture — ΦRn = .75 Fu (Ag - Abolts)

ΦRn 473.0625 kips

Block Shear — ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 472.3 kips
Anv 18.5625
Ant 1.640625
Agv 24.75

Gusset Plate Limit States

Tension Yielding — ΦRn = 0.9 Fy Ag

ΦRn 874.8 kips

Tension Rupture — ΦRn = .75 Fu (Ag - Abolts)

ΦRn 1060.3125 kips

Block Shear — ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 472.3 kips
Anv 18.5625
Ant 1.640625
Agv 24.75

Weld Limit States

Base Metal — ΦRn = .75 x .6 x Fu x t x Lweld

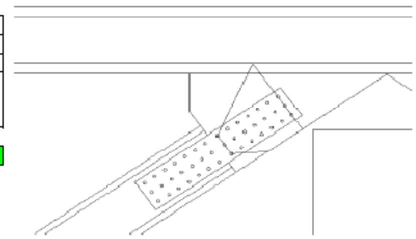
ΦRn 1530.36 kips

Weld Rupture — ΦRn = 1.392 x Lweld x tweld(1/16") x (1 + .5 (sin θ)^1.5)

ΦRn 413.37 kips

Project	AE482
Date	4/8/2008
Engineer	Steve Reichwein

Brace to Girder Connection - LRFD



Fy,beam	50	ksi	Bolt Dia.	0.75	in	Lweld	22	in
Fu,beam	65	ksi	#Rows of Bolts	2		tweld	8	1/16 in
Fy,plate	36	ksi	#Bolts/Row	8		θ	37.5	Deg
Fu,plate	58	ksi	Plate t (ea)	1.25	in	Whitmore Section Length	18	in
Brace	W12X106		Plate w	9	in			
Girder	W14X145		Gusset Plate t	1.5	in			

ΦRn	606.27	kips

Brace Limit States

Tension Yielding   ΦRn = 0.9 Fy Ag

ΦRn   1404.0 kips

Tension Rupture   ΦRn = .75 Fu (Ag - Abolts)

ΦRn   875.769375 kips

Block Shear   ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn   669.09375 kips   Anv 20.5875
Ant 1.3725
Agv 27.45

Bolt Limit States

Bolt Shear/Row
Φrn   79.6 kips

Bearing on Beam/Row
Φrn   107.055 kips

Bearing on Plates/Row
Φrn   391.5 kips

Tearout on Beam/Row
Edge Bm   Φrn   78.0609375 kips
Other Bm   Φrn   156.121875 kips

Tearout on Plates/Row
Edge Plate   Φrn   319.921875 kips
Other Plate   Φrn   570.9375 kips

ΦRn Beam   635.2609375 kips
ΦRn Plate   636.8 kips

Plate Limit States

Tension Yielding   ΦRn = 0.9 Fy Ag

ΦRn   729 kips

Tension Rupture   ΦRn = .75 Fu (Ag - Abolts)

ΦRn   788.4375 kips

Block Shear   ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn   1160.6 kips   Anv 42.1875
Ant 1.367188
Agv 112.5

Gusset Plate Limit States

Tension Yielding   ΦRn = 0.9 Fy Ag

ΦRn   874.8 kips

Tension Rupture   ΦRn = .75 Fu (Ag - Abolts)

ΦRn   1060.3125 kips

Block Shear   ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn   618.1 kips   Anv 25.3125
Ant 1.640625
Agv 33.75

Weld Limit States

Base Metal   ΦRn = .75 x .6 x Fu x t x Lweld

ΦRn   1402.83 kips

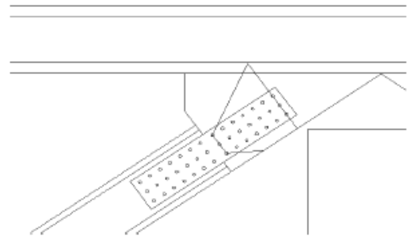
Weld Rupture   ΦRn = 1.392 x Lweld x tweld(1/16") x (1 + .5 (sin θ)^1.5)

ΦRn   606.27 kips

Project	AE482
Date	4/8/2008
Engineer	Steve Reichwein

Brace to Girder Connection - LRFD

Fy,beam	50	ksi	Bolt Dia.	0.75	in	Lweld	30	in
Fu,beam	65	ksi	#Rows of Bolts	3		tweld	8	1/16 in
Fy,plate	36	ksi	#Bolts/Row	7		θ	37.5	Deg
Fu,plate	58	ksi	Plate t (ea)	2	in	Whitmore		
Brace	W12X136		Plate w	9	in	Section		
Girder	W14X145		Gusset Plate t	2.5	in	Length	18	in



ΦRn	826.74	kips

Brace Limit States

Tension Yielding — ΦRn = 0.9 Fy Ag

ΦRn 1795.5 kips

Tension Rupture — ΦRn = .75 Fu (Ag - Abolts)

ΦRn 1435.553438 kips

Block Shear — ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 844.3865625 kips — Anv 23.1075; Ant 3.45625; Agv 30.81

Bolt Limit States

Bolt Shear/Row
Φrn 119.4 kips

Bearing on Beam/Row
Φrn 207.9675 kips

Bearing on Plates/Row
Φrn 939.6 kips

Tearout on Beam/Row
Edge Bm Φrn 151.6429688 kips
Other Bm Φrn 303.2859375 kips

Tearout on Plates/Row
Edge Plate Φrn 767.8125 kips
Other Plate Φrn 1370.25 kips

ΦRn Beam 835.8 kips
ΦRn Plate 835.8 kips

Plate Limit States

Tension Yielding — ΦRn = 0.9 Fy Ag

ΦRn 1166.4 kips

Tension Rupture — ΦRn = .75 Fu (Ag - Abolts)

ΦRn 1109.25 kips

Block Shear — ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 1698.4 kips — Anv 73.125; Ant 2.734375; Agv 97.5

Gusset Plate Limit States

Tension Yielding — ΦRn = 0.9 Fy Ag

ΦRn 1458 kips

Tension Rupture — ΦRn = .75 Fu (Ag - Abolts)

ΦRn 1672.03125 kips

Block Shear — ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 908.7 kips — Anv 36.5625; Ant 2.734375; Agv 48.75

Weld Limit States

Base Metal — ΦRn = .75 x .6 x Fu x t x Lweld

ΦRn 1912.95 kips

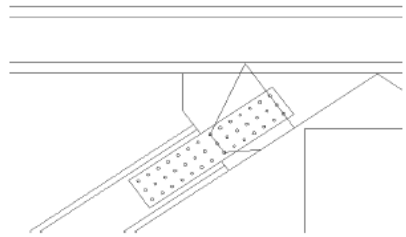
Weld Rupture — ΦRn = 1.392 x Lweld x tweld(1/16") x (1 + .5 (sin θ)^1.5)

ΦRn 826.74 kips

Project	AE482
Date	4/8/2008
Engineer	Steve Reichwein

Brace to Girder Connection - LRFD

Fy,beam	50	ksi	Bolt Dia.	0.75	in	Lweld	38	in
Fu,beam	65	ksi	#Rows of Bolts	4		tweld	8	1/16 in
Fy,plate	36	ksi	#Bolts/Row	7		θ	37.5	Deg
Fu,plate	58	ksi	Plate t (ea)	2.25	in	Whitmore Section Length	18	in
Brace	W12X170		Plate w	9	in			
Girder	W14X145		Gusset Plate t	3	in			



BoE ΦRn 1047.20 kips

Brace Limit States

Tension Yielding ΦRn = 0.9 Fy Ag

ΦRn 2250.0 kips

Tension Rupture ΦRn = .75 Fu (Ag - Abolts)

ΦRn 2176.2 kips

Block Shear ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 1125.54 kips

Anv	28.08
Ant	6.24
Agv	37.44

Bolt Limit States

Bolt Shear/Row
Φrn 159.2 kips

Bearing on Beam/Row
Φrn 336.96 kips

Bearing on Plates/Row
Φrn 1409.4 kips

Tearout on Beam/Row
Edge Bm Φrn 245.7 kips
Other Bm Φrn 491.4 kips

Tearout on Plates/Row
Edge Plate Φrn 1151.71875 kips
Other Plate Φrn 2055.375 kips

ΦRn Beam 1114.4 kips
ΦRn Plate 1114.4 kips

Plate Limit States

Tension Yielding ΦRn = 0.9 Fy Ag

ΦRn 1312.2 kips

Tension Rupture ΦRn = .75 Fu (Ag - Abolts)

ΦRn 1076.625 kips

Block Shear ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 1635.7 kips

Anv	65.8125
Ant	4.921875
Agv	87.75

Gusset Plate Limit States

Tension Yielding ΦRn = 0.9 Fy Ag

ΦRn 1749.6 kips

Tension Rupture ΦRn = .75 Fu (Ag - Abolts)

ΦRn 1892.25 kips

Block Shear ΦRn = .75 (.6 x Fu x Anv + Fu x Ant) ≤ .75 (.6 x Fy x Agv + Fu x Ant)

ΦRn 1090.4 kips

Anv	43.875
Ant	3.28125
Agv	58.5

Weld Limit States

Base Metal ΦRn = .75 x .6 x Fu x t x Lweld

ΦRn 2423.07 kips

Weld Rupture ΦRn = 1.392 x Lweld x tweld(1/16") x (1 + .5 (sin θ)^1.5)

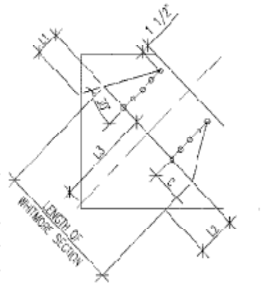
ΦRn 1047.20 kips

Project: AE 482
Date: 4/8/2008
Engineer: STEVE REICHWEIN

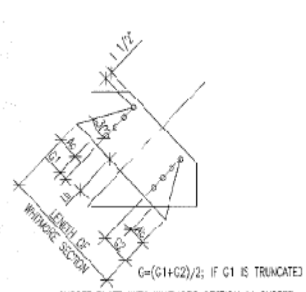
GUSSET PLATE CAPACITY (LRFD)

Fy =	36	ksi
Bolt Diameter =	0.75	in
# of Rows of Bolts=	1	
G =	6	In
Lb =	18	in

Gusset pl (in)	Brace Size	φRn PL (k)	φRn yld (k)	φ Rn rpt (k)	φ Rn b.s. (k)	φ Pn (k)
	W14	**427.3**	607.5	757.85	664.11	427.29
0.625	W12	**313.3**	445.5	540.35	446.61	313.34
	W10	**284.9**	405	485.98	392.24	284.86
	W14	**448.9**	583.2	713.67	601.19	448.85
0.75	W12	**411.4**	534.6	648.42	535.94	411.45
	W10	**374.0**	486	583.17	470.69	374.04
	W14	**654.5**	777.6	951.56	801.58	654.53
1	W12	**600.0**	712.8	864.56	714.58	599.99
	W10	**545.4**	648	777.56	627.58	545.44
	W14	**852.8**	972	1189.45	1001.98	852.79
1.25	W12	**781.7**	891	1080.70	893.23	781.72
	W10	**710.7**	810	971.95	784.48	710.66
	W14	**1046.6**	1166.4	1427.34	1202.37	1046.65
1.5	W12	**959.4**	1069.2	1296.84	1071.87	959.43
	W10	**872.2**	972	1166.34	941.37	872.21
	W14	**1237.8**	1360.8	1665.23	1402.77	1237.78
1.75	W12	**1134.6**	1247.4	1512.98	1250.52	1134.63
	W10	**1031.5**	1134	1360.73	1098.27	1031.48
	W14	**1427.1**	1555.2	1903.13	1603.16	1427.13
2	W12	**1308.2**	1425.6	1729.13	1429.16	1308.20
	W10	**1189.3**	1296	1555.13	1255.16	1189.27
	W14	**1615.2**	1749.6	2141.02	1803.56	1615.24
2.25	W12	**1480.6**	1603.8	1945.27	1607.81	1480.64
	W10	**1346.0**	1458	1749.52	1412.06	1346.04
	W14	**1802.5**	1944	2378.91	2003.95	1802.49
2.5	W12	**1652.3**	1782	2161.41	1786.45	1652.28
	W10	**1502.1**	1620	1943.91	1568.95	1502.07
	W14	**1989.1**	2138.4	2616.80	2204.35	1989.09
2.75	W12	**1823.3**	1960.2	2377.55	1965.10	1823.33
	W10	**1657.6**	1782	2138.30	1725.85	1657.57
	W14	**2175.2**	2332.8	2854.69	2404.74	2175.19
3	W12	**1993.9**	2138.4	2593.69	2143.74	1993.93
	W10	**1812.7**	1944	2332.69	1882.74	1812.66



GUSSET PLATE WITH WHITMORE SECTION IN GUSSET



GUSSET PLATE WITH WHITMORE SECTION IN GUSSET AND FRAMING MEMBER

Lb,UNBRACED LENGTH FOR BUCKLING CHECK = (L1+L2+L3)/3, CONSERVATIVELY USE L3 FOR SIMPLICITY.
Ac = AREA OF WHITMORE SECTION THAT IS INTO THE COLUMN.
Ab = AREA OF WHITMORE SECTION THAT IS INTO THE BEAM.
FOR DESIGN CHECKS OF THE WHITMORE SECTION, THE AREA OF THE BEAM AND COLUMN CAN BE UTILIZED, AS WELL AS THE YIELD STRESS OF THE BEAM OF COLUMN, I.E.. φPn=.9[Ac(FYc)-Ab(FYb)+Apl(FYpl)]. WHERE THE COLUMN IS ORIENTED WEAK AXIS TO THE CONNECTION(COLUMN WEB PERPENDICULAR TO GUSSET). THE WHITMORE SECTION MUST BE TRUNCATED, Ac=0.

Project:	AE 482
Date:	4/8/2008
Engineer:	STEVE REICHWEIN

CLAW ANGLECAPACITY (LRFD)

Fy =	36	ksi
Bolt Diameter =	0.75	in
# Angles per Conn =	4	

ϕ Rn Angle Group (k)						
# of Bolts / Angle	3	4	5	6	7	8
L3X3X1/2	356.4	356.4	356.4	356.4	356.4	356.4
L3X3X7/16	314.9	314.9	314.9	314.9	314.9	314.9
L3X3X3/8	273.5	273.5	273.5	273.5	273.5	273.5
L3X3X5/16	230.7	230.7	230.7	230.7	230.7	230.7
L3X3X1/4	186.6	186.6	186.6	186.6	186.6	186.6
L3X3X3/16	141.3	141.3	141.3	141.3	141.3	141.3
L3 1/2x3 1/2x1/2	401.2	423.8	423.8	423.8	423.8	423.8
L3 1/2x3 1/2x7/16	351.1	374.5	374.5	374.5	374.5	374.5
L3 1/2x3 1/2x3/8	300.9	324.0	324.0	324.0	324.0	324.0
L3 1/2x3 1/2x5/16	250.8	272.2	272.2	272.2	272.2	272.2
L3 1/2x3 1/2x1/4	200.6	220.3	220.3	220.3	220.3	220.3
L4X4X3/4	601.8	703.7	703.7	703.7	703.7	703.7
L4X4X5/8	501.5	597.5	597.5	597.5	597.5	597.5
L4X4X1/2	401.2	486.0	486.0	486.0	486.0	486.0
L4X4X7/16	351.1	427.7	427.7	427.7	427.7	427.7
L4X4X3/8	300.9	370.7	370.7	370.7	370.7	370.7
L4X4X5/16	250.8	311.0	311.0	311.0	311.0	311.0
L4X4X1/4	200.6	250.1	250.1	250.1	250.1	250.1
L5X5X7/8	702.1	976.2	1039.4	1039.4	1039.4	1039.4
L5X5X3/4	601.8	836.7	904.6	904.6	904.6	904.6
L5X5X5/8	501.5	697.3	764.6	764.6	764.6	764.6
L5X5X1/2	401.2	557.8	620.8	620.8	620.8	620.8
L5X5X7/16	351.1	488.1	546.9	546.9	546.9	546.9
L5X5X3/8	300.9	418.4	473.0	473.0	473.0	473.0
L5X5X5/16	250.8	348.6	397.9	397.9	397.9	397.9

Appendix F

Parametric RMS Acceleration Calculations

CONCRETE SHEAR WALL CORE PARAMETRIC RMS ACCELERATION

Project AE 482
Date 4/8/2008
Engr Steve Reichwein

Tall Building Acceleration (Serviceability Limit States Under Wind Load, Griffis)

Equations

$$A_L(Z) = C_L(Z)\frac{U_H^{3.54}}{K_L^{0.77} \times \zeta^{0.5} \times M_L^{0.23}}$$

$$A_D(Z) = C_D(Z)\frac{U_H^{2.74}}{K_D^{0.37} \times \zeta^{0.5} \times M_D^{0.3}}$$

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{1.88}}{K_\theta^{-0.06} \times \zeta^{0.5} \times M_\theta^{1.06}}\frac{N_\theta B}{U_H} \leq 0.25$$

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{1.88}}{K_\theta^{-0.06} \times \zeta^{0.5} \times M_\theta^{1.06}}, \frac{N_\theta B}{U_H} \leq 0.25$$

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{2.76}}{K_\theta^{0.38} \times \zeta^{0.5} \times M_\theta^{0.62}}, \frac{N_\theta B}{U_H} > 0.25$$

$$C_D(Z) = 0.0116 \times B^{0.26} \times Z$$

$$C_L(Z) = 0.0263 \times B^{-0.54} \times Z$$

$$C_\theta(Z) = 0.00341 \times B^{2.12} \times Z, \frac{N_\theta B}{U_H} \leq 0.25$$

$$C_\theta(Z) = 0.00510 \times B^{1.24} \times Z, \frac{N_\theta B}{U_H} > 0.25$$

$$A_R = (A_D^2 + A_L^2 + (B/\sqrt{2} \times A_\theta)^2)^{0.5}$$

$$K = (2\Pi N)^2 \times M$$

Parameters

50 Year Wind Speed		114	mph			
10 Year	U_H	84.36	mph	37.717965	m/s	
ETABS	T_θ	1.77	s			
ETABS	T_{TRANS}	3.13	s			
	K_θ	61916501414	N/m			
	K_{TRANS}	65242338.61	N/m			
	ζ (Damping)	0.02				
	M	1110058.97	lb-sec^2/ft	16206861	kg	
	MMI	4918511077.50	kg-m^2			
	B	140	ft	42.672	m	
	C_D	4.08				
	C_L	0.46				
	C_θ	71.00				
	A_D	0.022	0.00227	g	2.27	μg
	A_L	0.026	0.00267	g	2.67	μg
	A_θ	0.001	0.00009	g	0.09	μg
	A_R	**4.416**	**μg**			
	Design Target	**4.500**	**μg**			

Notes: 10 year wind is equivalent to 0.74 x 50 year wind speed
If accelerations exceed design limit, tuned mass damper may be required
However, calculations are only an approximation and a wind tunnel test will be required to verify

STEEL BRACED FRAME CORE PARAMETRIC RMS ACCELERATION

Project	AE 482
Date	4/8/2008
Engr	Steve Reichwein

Tall Building Acceleration (Serviceability Limit States Under Wind Load, Griffis)

Equations

$$A_L(Z) = C_L(Z)\frac{U_H^{3.54}}{K_L^{0.77} \times \zeta^{0.5} \times M_L^{0.23}}$$

$$A_D(Z) = C_D(Z)\frac{U_H^{2.74}}{K_D^{0.37} \times \zeta^{0.5} \times M_D^{0.3}}$$

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{1.88}}{K_\theta^{-0.06} \times \zeta^{0.5} \times M_\theta^{1.06}}\frac{N_\theta B}{U_H} \le 0.25$$

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{1.88}}{K_\theta^{-0.06} \times \zeta^{0.5} \times M_\theta^{1.06}}, \frac{N_\theta B}{U_H} \le 0.25$$

$$A_\theta(Z) = C_\theta(Z)\frac{U_H^{2.76}}{K_\theta^{0.38} \times \zeta^{0.5} \times M_\theta^{0.62}}, \frac{N_\theta B}{U_H} > 0.25$$

$$C_D(Z) = 0.0116 \times B^{0.26} \times Z$$

$$C_L(Z) = 0.0263 \times B^{-0.54} \times Z$$

$$C_\theta(Z) = 0.00341 \times B^{2.12} \times Z, \frac{N_\theta B}{U_H} \le 0.25$$

$$C_\theta(Z) = 0.00510 \times B^{1.24} \times Z, \frac{N_\theta B}{U_H} > 0.25$$

$$A_R = (A_D^2 + A_L^2 + (B/\sqrt{2} \times A_\theta)^2)^{0.5}$$

$$K = (2\Pi N)^2 \times M$$

Parameters

50 Year Wind Speed		114	mph			
10 Year	U_H	84.36	mph	37.717965	m/s	
ETABS	T_θ	2.9	s			
ETABS	T_{TRANS}	4.3	s			
	K_θ	16977955619	N/m			
	K_{TRANS}	25445426.36	N/m			
	ζ (Damping)	0.02				
	M	817098.66	lb-sec^2/ft	11929640	kg	
	MMI	3620446234.00	kg-m^2			
	B	140	ft	42.672	m	
	C_D	4.32				
	C_L	0.49				
	C_θ	75.11				
	A_D	0.040	0.00412	g	4.12	μg
	A_L	0.061	0.00625	g	6.25	μg
	A_θ	0.002	0.00019	g	0.19	μg
	A_R	**9.369**	**μg**			
	Design Limit	**4.800**	**μg**			

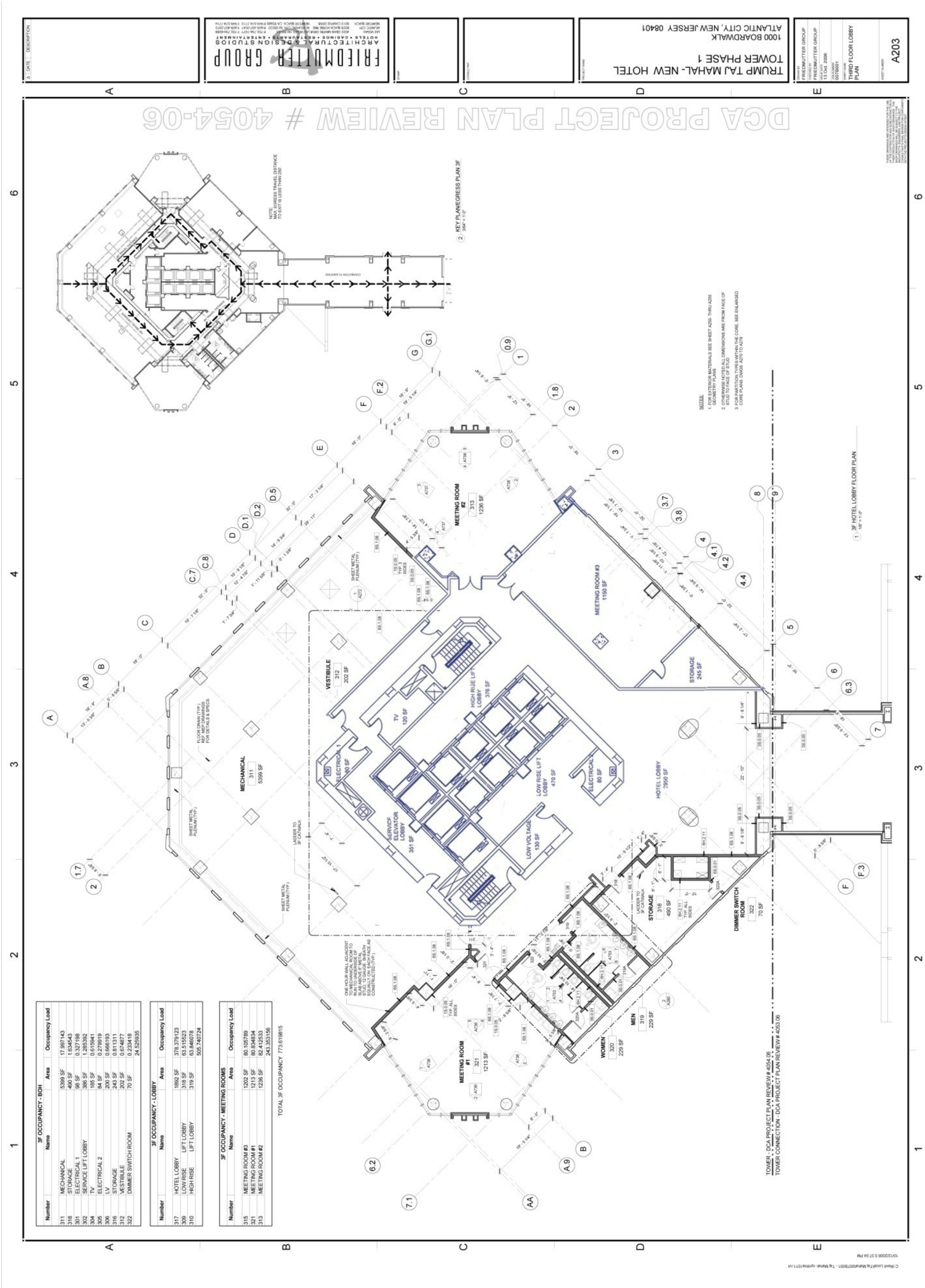
Notes: 10 year wind is equivalent to 0.74 × 50 year wind speed

If accelerations exceed design limit, tuned mass damper may be required

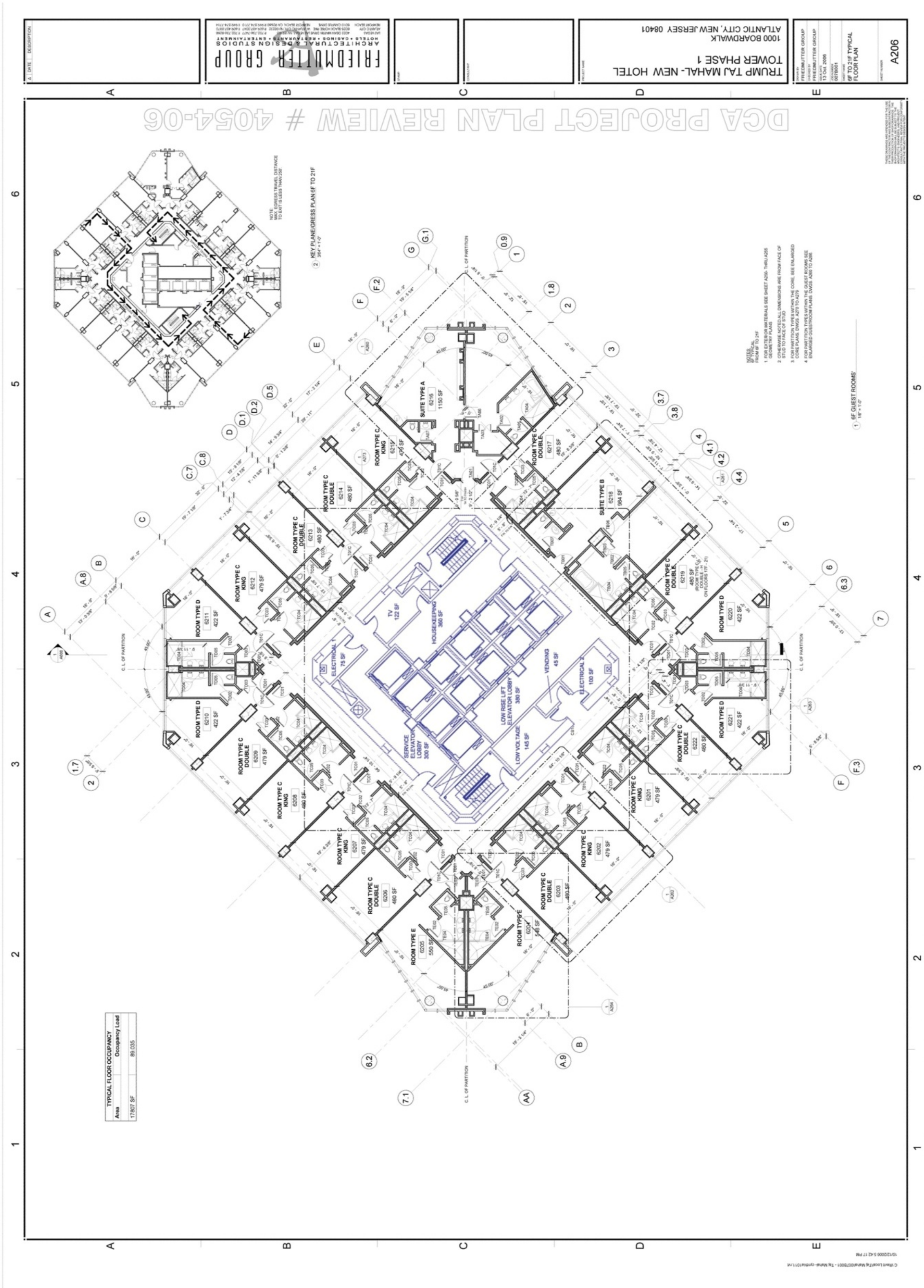
However, calculations are only an approximation and a wind tunnel test will be required to verify

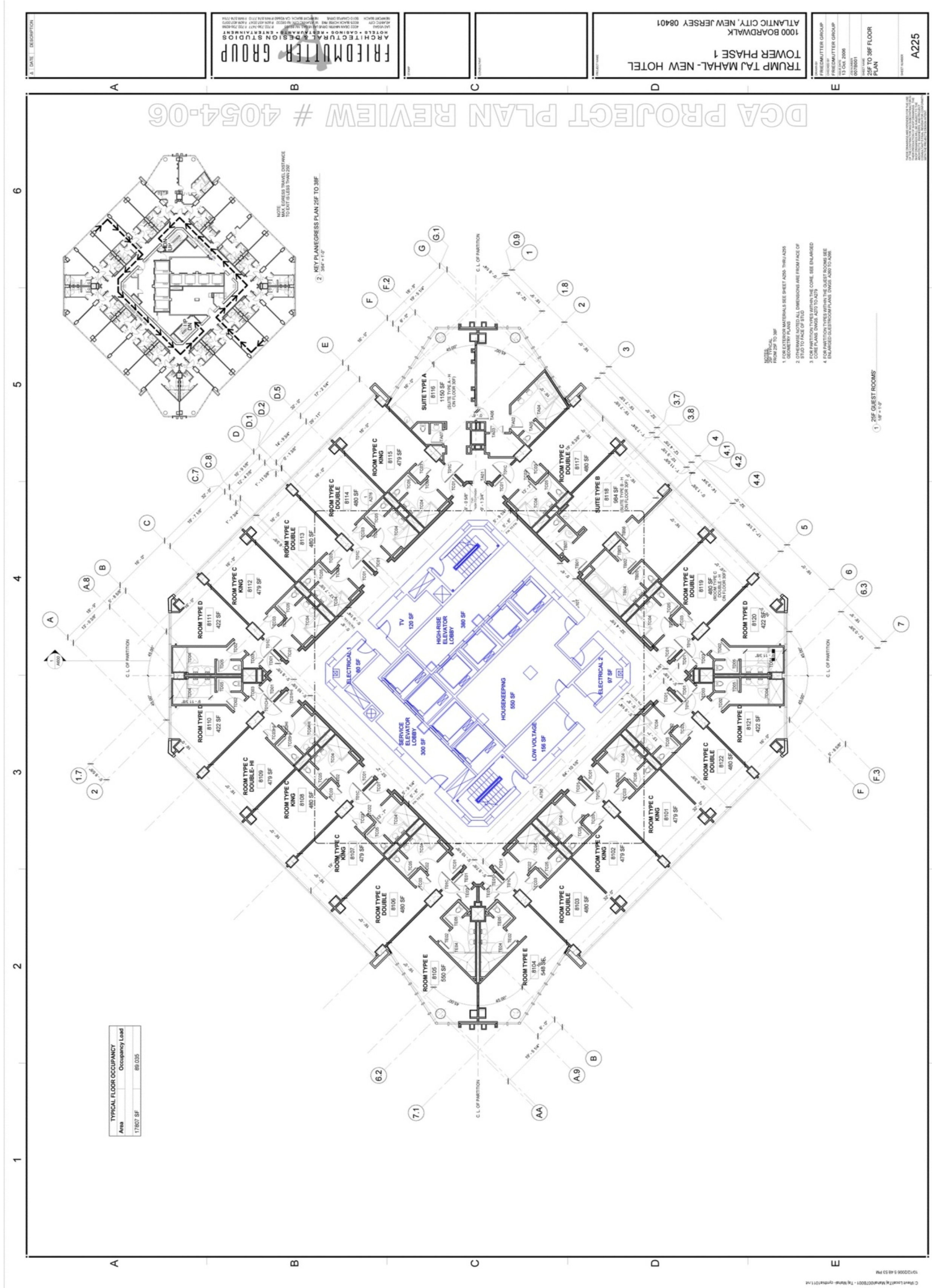
Appendix G

Architectural Breadth Studies



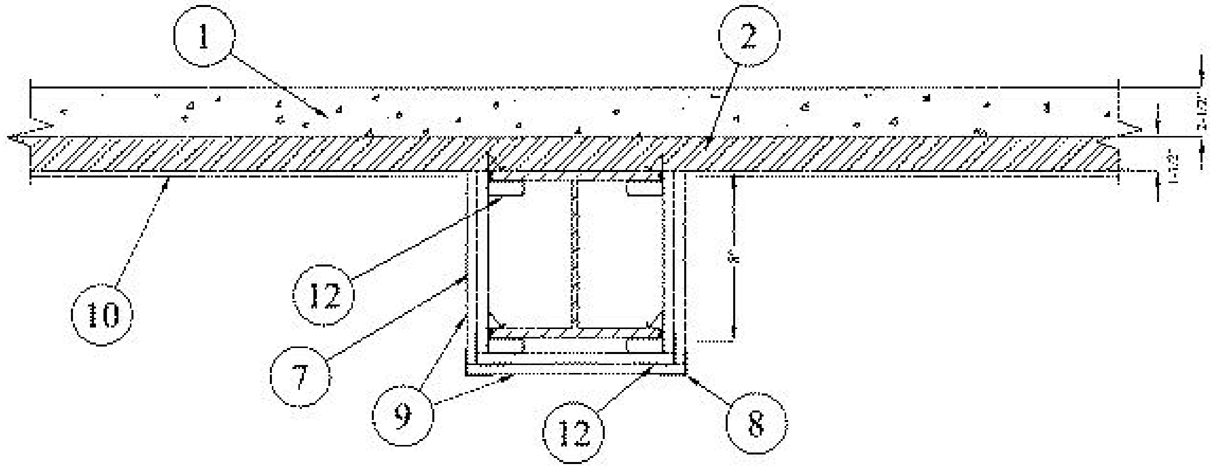
TRUMP TAJ MAHAL- NEW HOTEL
TOWER PHASE 1
1000 BOARDWALK
ATLANTIC CITY, NEW JERSEY 08401
FRIEDMUTTER GROUP
ARCHITECTURAL DESIGN STUDIOS
THIRD FLOOR LOBBY PLAN
A203
DCA PROJECT PLAN REVIEW # 4054-06
KEY PLAN/EGRESS PLAN 3F
3F HOTEL LOBBY FLOOR PLAN
MECHANICAL
311
5399 SF
HOTEL LOBBY
7950 SF
MEETING ROOM #3
1150 SF
MEETING ROOM #1
321
1213 SF
MEETING ROOM #2
313
1236 SF


TRUMP TAJ MAHAL- NEW HOTEL
TOWER PHASE 1
1000 BOARDWALK
ATLANTIC CITY, NEW JERSEY 08401
FRIEDMUTTER GROUP
A206
DCA PROJECT PLAN REVIEW # 4054-06


TRUMP TAJ MAHAL- NEW HOTEL
TOWER PHASE 1
1000 BOARDWALK
ATLANTIC CITY, NEW JERSEY 08401
A225
DCA PROJECT PLAN REVIEW # 4054-06

Fire Resistance Ratings - ANSI/UL 263

Design No. N501



Steel Beam — Min size, a W8X24 with outside dimensions of 7-7/8x6-1/2 in. with a flange thickness of 3/8 in., a web thickness of 1/4 in., and a cross-sectional area of 7.06 sq in.

1. **Normal Weight Concrete** — 148 pcf.
2. **Steel Floor and Form Units*** — 1-1/2 in. fluted type, welded to beam.
3. **Drill Screw** — No. 8-18 by 1/2-in. long Phillips panhead drill screws, self-drilling and self-tapping, made of case-hardened steel.
4. **Runner Angle** — 24 MSG galv steel with 1 and 2-in. legs. Fastened to steel deck 12 in. O.C. with Item 3.
5. **Channel Bracket** — Fabricated from 25 MSG galv steel, 1-11/16 in. deep with 1-in. legs and spaced 24 in. O.C. Fastened to the runner angles with Item 3.
6. **Corner Angle** — same material as Item 4, fastened to channel brackets with Item 3.
7. **Gypsum Board*** — 5/8 in. thick. First layer fastened with 1-1/4 in. long, 0.150 in. diam screws spaced 16 in. O.C. Second layer attached with 1-3/4 in. long, 0.150 in. diam screws spaced 8 in. O.C. Screws are self-drilling and self-tapping Phillips head made of case-hardened steel.
8. **Corner Bead** — Fabricated from 20 MSG galv steel to form an angle with 1-1/4 in. legs. Legs perforated with 1/4 in. diam holes approx 1 in. OC. Attached to wallboard with special crimping tool approx 6 in. OC. As an alternate, the bead may be nailed to the wallboard.
9. **Joint Compound** — 1/32 in. thick on bottom and sides of wallboard from corner beads and feathered out. Paper tape embedded in joint compound over joints with edges of compound feathered out.
10. **Protective Material — Spray-Applied Fire Resistive Materials*** — Spray applied to the underside of the steel floor units, filling the flutes of the units and providing a smooth ceiling which was 1/4 in. thick as measured from the bottom plane of the floor units.

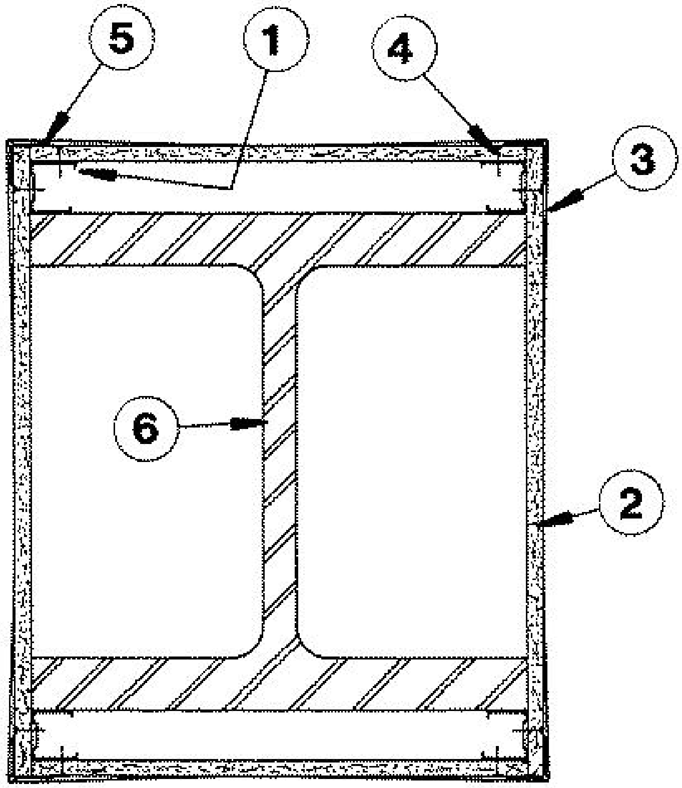
See Spray-Applied Fire Resistive Materials (CHPX) category for names of manufacturers.

11. **Alternate Joint System —** (Not Shown) — For lath only. A 1/16 in. thickness of gypsum plaster applied to entire exposed surface over either paper tape on joints embedded in cementitious compound or 2 1/2 in. wide glass fiber tape stapled 8 in. OC on joints.

12. **Alternate Construction - Steel Framing Members* —** As an alternate to Items 3, 4, 5 and 6 steel clips attached to both sides of beam flanges 2 ft OC and at ends of beam. First layer of gypsum board fastened to steel clips with 1-1/4 in. long Type S drywall screws. 2 in. by 2 in. 25 MSG angle fastened to clips on bottom portion of assembly with 2 in. long Type S drywall screws. Second layer of gypsum board fastened to angle and steel clips with 2 in. long Type S drywall screws, spaced 2 ft OC. Screws are self-drilling and self-tapping Phillips head made of case-hardened steel.

Fire Resistance Ratings - ANSI/UL 263

Design No. X521



1. **Steel Studs** — 1-5/8 in. wide with leg dimensions of 1-5/16 and 1-7/16 in. with a 1/4 in. folded flange in legs fabricated from 25 MSG galv steel. Steel stud cut 1/2 in. less in length than assembly height.

2. **Gypsum Board*** — 1/2 in. thick, one layer.
3. **Joint Compound** — Applied at corners to cover corner beads. As an option, nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard.

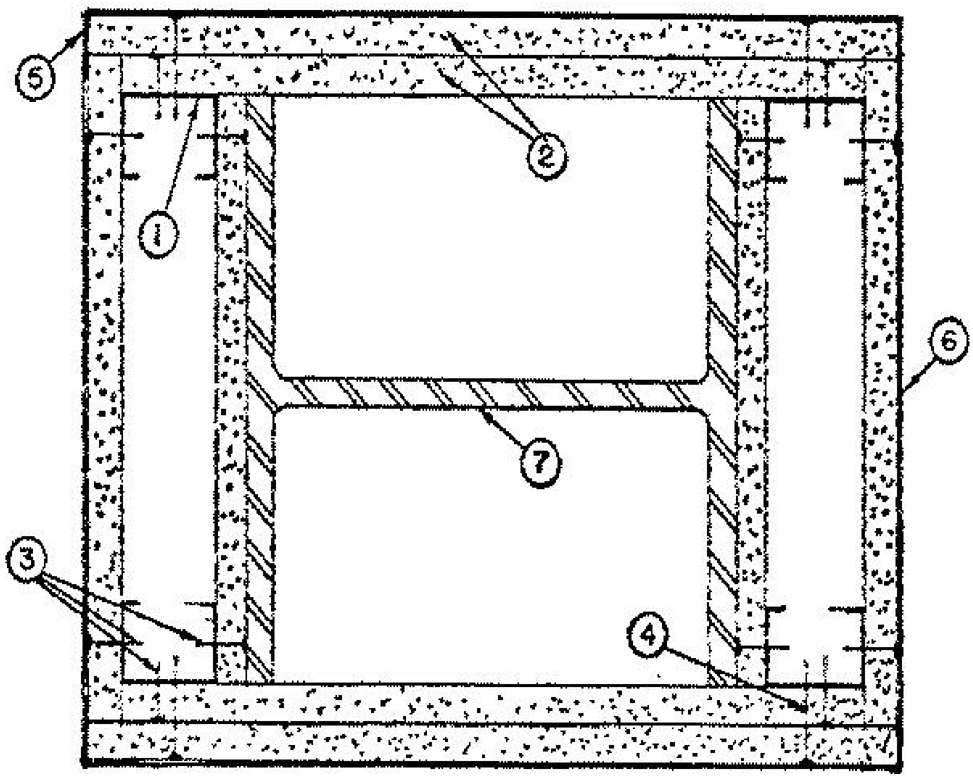
4. **Screws** — 1 in. long self-drilling, self-tapping steel screws, spaced vertically 12 in. OC.

5. **Corner Beads** — 26 MSG galv steel, 1-1/4 in. legs attached to wallboard by crimping spaced 6 in. O.C.

6. **Steel Column** — Min. size of column W14 x 228, with outside dimensions of 16 by 15-7/8 in. with flange thickness of 1-11/16 in., a web thickness of 1-1/16 in., and a cross-sectional area of 67.06 sq in.

Fire Resistance Ratings - ANSI/UL 263

Design No. X518



1. **Steel Studs —** 1-5/8 in. wide with leg dimensions of 1-5/16 and 1-7/16 in. with a 1/4 in. folded flange in legs, fabricated from 25 MSG galv steel. Steel stud cut 1/2 in. less in length than assembly height.

2. **Gypsum Board* —** Two layers of 1/2 in. thick wallboard.

3. **Screws —** 1 in. long self-drilling, self-tapping screws, spaced vertically 24 in. on centers, except on the outer layer of wallboard on the flanges, which are spaced on 12 in. centers.

4. **Screws —** 1-5/8 in. long self-drilling, self-tapping screws spaced vertically 12 in. OC.

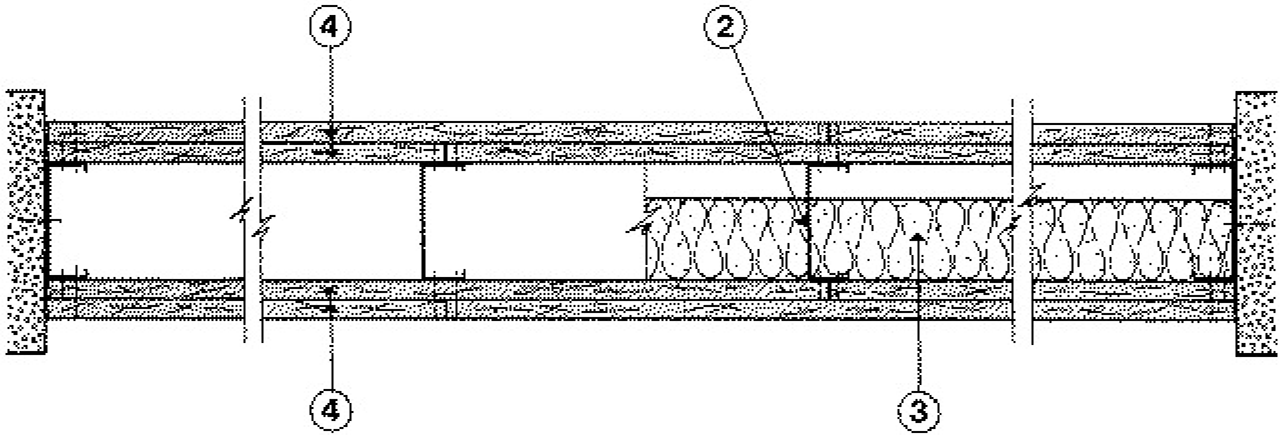
5. **Corner Beads —** No. 28 MSG galv steel, 1-1/8 in. legs. Attached to wallboard with 4d by 1-3/8 in. nails spaced 12 in. OC at each leg.

6. **Joint Compound —** 1/16 in. thick. As an option, nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard.

7. **Steel Column —** Min size of column, W10 x 49, with outside dimensions of 10 x 10 in. with a flange thickness of 9/16 in., a web thickness of 5/16 in., and a cross-sectional area of 14.4 sq in.

Fire Resistance Ratings - ANSI/UL 263

Design No. U411



1. **Floor and Ceiling Runner —** (Not Shown) — Min. 25 MSG galv steel 1 in. high, return legs 2-1/2 in. wide (min), attached to floor and ceiling with fasteners 24 in. OC.

2. **Steel Studs —** Min 2-1/2 in. wide, 1-1/4 in. legs, 3/8 in. return, formed of min 25 MSG galv steel max stud spacing 24 in. OC. Studs to be cut 3/4 in. less than assembly height.

3. **Batts and Blankets* —** (Optional) — Mineral wool or glass fiber batts partially or completely filling stud cavity. Fasten each batt to wallboard base layer with a min 9/16 in. long staple. Use five staples for each 4 ft piece. Drive one staple in the center of each piece and a staple at each corner, approx 3 in. from edges.

See Batts and Blankets (BZJZ) category for names of manufacturers.

3A. **Fiber, Sprayed* —** As an alternate to Batts and Blankets (Item 3) — Spray applied cellulose material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Nominal dry density of 3.0 lb/ft^3. Alternate application method: The fiber is applied with U.S. Greenfiber LLC Type AD100 hot melt adhesive at a nominal ratio of one part adhesive to 6.6 parts fiber to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Nominal dry density of 2.5 lb/ft^3.

3B. **Fiber, Sprayed* —** As an alternate to Batts and Blankets (Item 3) and Item 3A - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft.

4. **Gypsum Board* —** 5/8 in. thick, outer layer paper or vinyl surfaced. (Laminated System) Wallboard applied vertically in two layers. Inner layer attached to studs with 1 in. long Type S steel screws spaced 8 in. OC along vertical edges, and 12 in. OC in the field and outer layer laminated to inner layer with joint compound, applied with a notched spreader producing continuous beads of compound about 3/8 in. in diameter, spaced not greater than 2 in. OC. Joints of laminated outer layer offset 12 in. from inner layer

joints Outer layer wallboard attached to floor and ceiling runner track with 1-5/8 in. long Type S steel screws spaced 12 in. OC.

Optional, (Direct Attached System), Inner layer attached to studs with 1 in. long Type S steel screws spaced 16 in. OC in the field and along the vertical edges. Outer layer attached to the studs over the inner layer with 1-5/8 in. long Type S steel screws spaced 16 in. OC in the field and along the vertical edges and 12 in. OC to the floor and ceiling runners. Joints of screw-attached outer layer offset from inner layer joints. Joints of outer layer may be taped or untaped.

Nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard. Joints reinforced.

4A. **Gypsum Board* —** (As an alternate to Item 4) — Nom 3/4 in. thick, installed as described in Item 4 with 1-1/4 in. long Type S screws for inner layer and 2-1/4 in. long Type S screws for outer layer.

Appendix H

Construction Management Breadth Studies

BIGGE CRANE and RIGGING CO.

TEREX | COMEDIL

TOWER CRANE SALES • RENTAL

Tel: (888) 337-BIGGE or (510) 638-8100 • Web: www.biggetowercrane.com

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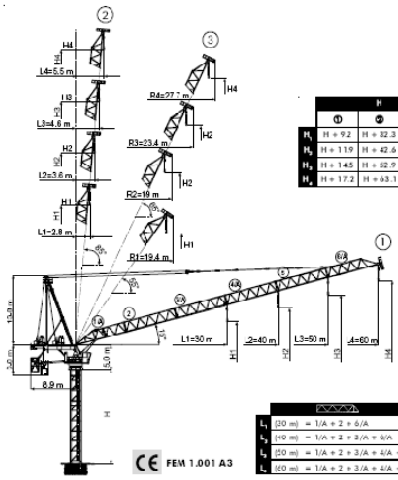
CTL 630-32 HD23



	①	②	③
H_1	H + 9.2	H + 32.3	H + 26.7
H_2	H + 11.9	H + 42.6	H + 38.9
H_3	H + 14.5	H + 52.9	H + 48.2
H_4	H + 17.2	H + 63.1	H + 57.5

L_1	(30 m) = 1/A + 2 + 6/A
L_2	(40 m) = 1/A + 2 + 3/A + 6/A
L_3	(50 m) = 1/A + 2 + 3/A + 4/A + 6/A
L_4	(60 m) = 1/A + 2 + 3/A + 4/A + 5 + 6/A

CE FEM 1.001 A3

Données techniques seulement indicatives
Modifications réservées sans préavis

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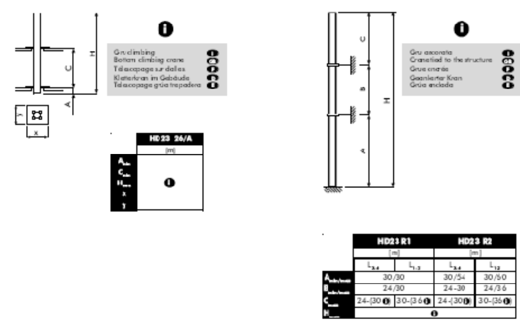
TEREX | COMEDIL

CTL 630-32

Diagramma di portata (I) · Load Diagram (GB) · Courbes de charges (F) · Lastkurven (D) · Curvas de cargas (E)

CTL 630-32	m	20	22	25	27	30	35	40	45	50	55	60
16 t - 35 m	t	16,00	16,00	16,00	16,00	16,00	16,00	13,90	12,27	10,96	9,89	9,00
16 t - 41,9 m	t	16,00	16,00	16,00	16,00	16,00	16,00	16,00	14,82	13,20		
32 t - 21,8 m	t	32,00	31,78	27,80	25,64	22,93	19,46	16,85	14,82	13,20		
16 t - 40 m	t	16,00	16,00	16,00	16,00	16,00	16,00	16,00				
32 t - 22,6 m	t	32,00	32,00	28,84	26,60	23,80	20,20	17,50				
16 t - 30 m	t	16,00	16,00	16,00	16,00	16,00						
32 t - 22,8 m	t	32,00	32,00	29,08	26,82	24,00						

Altre installazioni (I) · Other configurations (GB) · Autres implantations (F) · Aufstellmöglichkeiten (D) · Otras implantaciones (E)



This information is for reference use only. Operators manual should be consulted and adhered to. Please contact Bigge Crane and Rigging Co. at 888-337-BIGGE or email towers@bigge.com for further information.

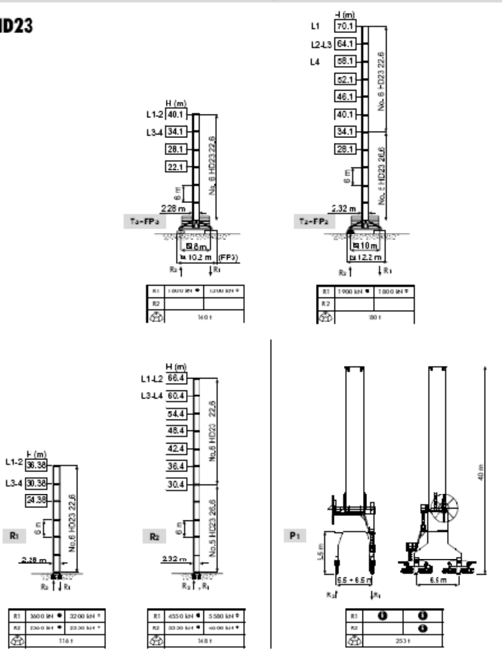
Bigge Tel: (888) 337-BIGGE or (510) 638-8100 • Fax: (510) 639-4053 • Email: towers@bigge.com www.biggetowercrane.com

TEREX | COMEDIL

CTL 630-32

Torre (I) · Tower (GB) · Tour (F) · Turm (D) · Torre (E)

HD23



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TEREX | COMEDIL

CTL 630-32

Meccanismi (I) · Mechanisms (GB) · Mécanismes (F) · Antriebe (D) · Mecanismos (E)

SRWB 102 160/5	301 * kVA	400 V - 50 Hz	2000/14/CE
SRWB 122 160/5	325 * kVA	460 V - 60 Hz	
110 AWL 160	297 * kVA	400 V - 50 Hz / 460 V - 60 Hz	

* Gru senza traslazione / Crane without travelling equipment / Grue sans translation / Krane ohne Schienenfahren / Grúa sin traslación

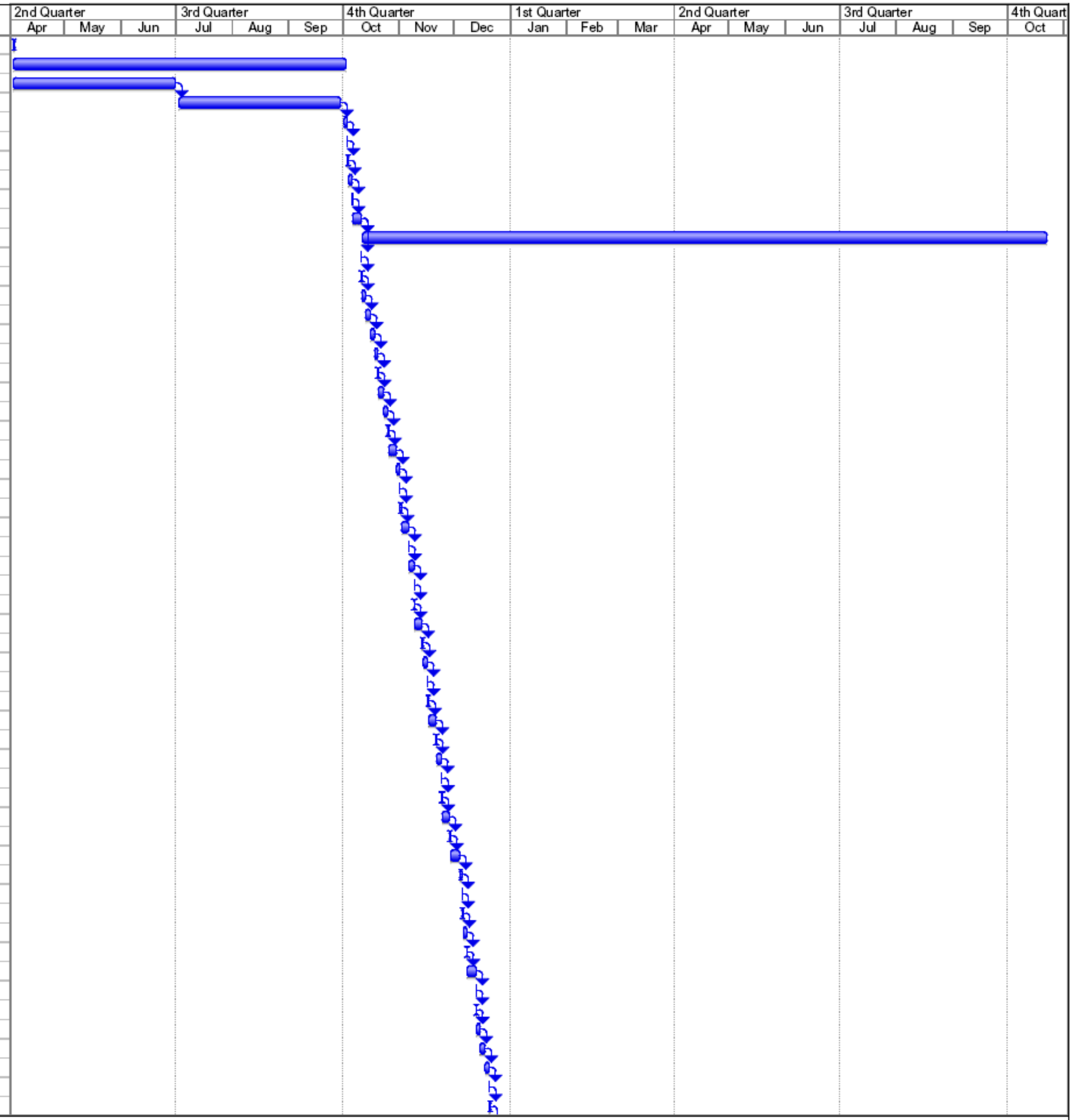
		m/min	t	kW	
SRWB 102 160/5 50 Hz	2 falls	0 → 32	16	102	600 m
		0 → 50	10		
		0 → 80	6		
		0 → 125	3.5		
	4 falls	0 → 16	32		
		0 → 25	20		
		0 → 40	12		
		0 → 63	7		
SRWB 122 160/5 60 Hz	2 falls	0 → 38	16	112	600 m
		0 → 60	10		
		0 → 96	6		
		0 → 150	3.5		
	4 falls	0 → 19	32		
		0 → 30	20		
		0 → 48	12		
		0 → 76	7		
110 AWL 160 LC	2 falls	0 → 26	16	110	340 m
		0 → 36	11.3		
		0 → 50	8.1		
		0 → 60	5.6		
		0 → 80	0.8		
	4 falls	0 → 13	32		
		0 → 18	22.6		
		0 → 25	16.2		
		0 → 35	11.2		
		0 → 40	1.6		

Luffing	LWL 11000	2.8 min	110 kW
Slewing	SCC 2 1 132 L	0 → 0.65 rpm	2 × 14 kW
Travelling	n TVF 2RT 4M11	0 → 24 m/min	4 × 11 kW
	t TSR 4RG 4M8	12 → 24 m/min	4 × 80 Nm
	g TVF 4RT 8M11	0 → 24 m/min	8 × 11 kW

	n	t	g
	Max H [m]		
T_1	28.1	40.1	40.1
T_2	40.1	70.1	70.1
P_1	-	40	40

This information is for reference use only. Operators manual should be consulted and adhered to. Please contact Bigge Crane and Rigging Co. at 888-337-BIGGE or email towers@bigge.com for further information.

ID	Task Name
1	Contract Award
2	Structural Steel and Precast Plank Procurement
3	Concrete Lead Time
4	Excavate and Pour Mat Foundation
5	Erect Columns - Levels 1 thru 3
6	Erect BF Girders - Level 2
7	Erect Braces - Level 2
8	Erect Floor Framing - Level 2
9	Plumb and Bolt Steel - Level 2
10	Erect Precast Planks - Level 2
11	Grout and Weld Planks; Place Topping Slab - Level 2 thru Roof
12	Erect BF Girders - Level 3
13	Erect Braces - Level 3
14	Erect Floor Framing - Level 3
15	Plumb and Bolt Steel - Level 3
16	Erect Precast Planks - Level 3
17	Erect Columns - Level 4
18	Erect BF Girders - Level 4
19	Erect Braces - Level 4
20	Erect Floor Framing - Level 4
21	Plumb and Bolt Steel - Level 4
22	Erect Precast Planks - Level 4
23	Erect Columns - Levels 5 thru 8
24	Erect BF Girders - Level 5
25	Erect Braces - Level 5
26	Erect Floor Framing - Level 5
27	Plumb and Bolt Steel - Level 5
28	Erect Precast Planks - Level 5
29	Erect BF Girders - Level 6
30	Erect Braces - Level 6
31	Erect Floor Framing - Level 6
32	Plumb and Bolt Steel - Level 6
33	Erect Precast Planks - Level 6
34	Erect BF Girders - Level 7
35	Erect Braces - Level 7
36	Erect Floor Framing - Level 7
37	Plumb and Bolt Steel - Level 7
38	Erect Precast Planks - Level 7
39	Erect BF Girders - Level 8
40	Erect Braces - Level 8
41	Erect Floor Framing - Level 8
42	Plumb and Bolt Steel - Level 8
43	Erect Precast Planks - Level 8
44	Erect Columns - Levels 9 thru 12
45	Erect BF Girders - Level 9
46	Erect Braces - Level 9
47	Erect Floor Framing - Level 9
48	Plumb and Bolt Steel - Level 9
49	Erect Precast Planks - Level 9
50	Erect BF Girders - Level 10
51	Erect Braces - Level 10
52	Erect Floor Framing - Level 10
53	Plumb and Bolt Steel - Level 10
54	Erect Precast Planks - Level 10
55	Erect BF Girders - Level 11
56	Erect Braces - Level 11

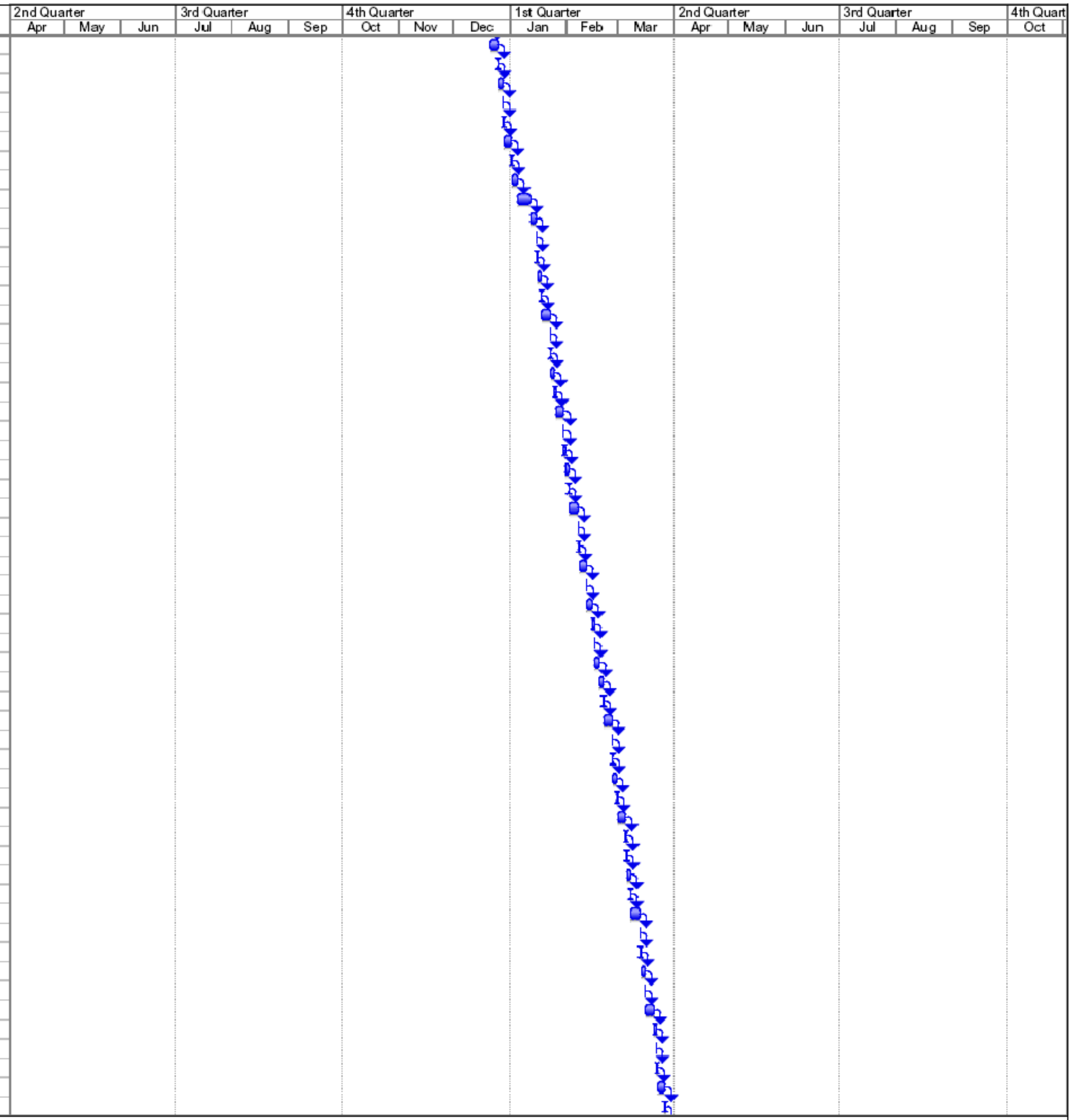


Project: Trump Taj Mahal Hotel - Steel
Date: Tue 4/8/08

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Page 1

ID	Task Name
57	Erect Floor Framing - Level 11
58	Plumb and Bolt Steel - Level 11
59	Erect Precast Planks - Level 11
60	Erect BF Girders - Level 12
61	Erect Braces - Level 12
62	Erect Floor Framing - Level 12
63	Plumb and Bolt Steel - Level 12
64	Erect Precast Planks - Level 12
65	Tower Crane Jump
66	Erect Columns - Levels 13 thru 16
67	Erect BF Girders - Level 13
68	Erect Braces - Level 13
69	Erect Floor Framing - Level 13
70	Plumb and Bolt Steel - Level 13
71	Erect Precast Planks - Level 13
72	Erect BF Girders - Level 14
73	Erect Braces - Level 14
74	Erect Floor Framing - Level 14
75	Plumb and Bolt Steel - Level 14
76	Erect Precast Planks - Level 14
77	Erect BF Girders - Level 15
78	Erect Braces - Level 15
79	Erect Floor Framing - Level 15
80	Plumb and Bolt Steel - Level 15
81	Erect Precast Planks - Level 15
82	Erect BF Girders - Level 16
83	Erect Braces - Level 16
84	Erect Floor Framing - Level 16
85	Plumb and Bolt Steel - Level 16
86	Erect Precast Planks - Level 16
87	Erect Columns - Levels 17 thru 20
88	Erect BF Girders - Level 17
89	Erect Braces - Level 17
90	Erect Floor Framing - Level 17
91	Plumb and Bolt Steel - Level 17
92	Erect Precast Planks - Level 17
93	Erect BF Girders - Level 18
94	Erect Braces - Level 18
95	Erect Floor Framing - Level 18
96	Plumb and Bolt Steel - Level 18
97	Erect Precast Planks - Level 18
98	Erect BF Girders - Level 19
99	Erect Braces - Level 19
100	Erect Floor Framing - Level 19
101	Plumb and Bolt Steel - Level 19
102	Erect Precast Planks - Level 19
103	Erect BF Girders - Level 20
104	Erect Braces - Level 20
105	Erect Floor Framing - Level 20
106	Plumb and Bolt Steel - Level 20
107	Erect Precast Planks - Level 20
108	Erect Columns - Levels 21 thru 24
109	Erect BF Girders - Level 21
110	Erect Braces - Level 21
111	Erect Floor Framing - Level 21
112	Plumb and Bolt Steel - Level 21

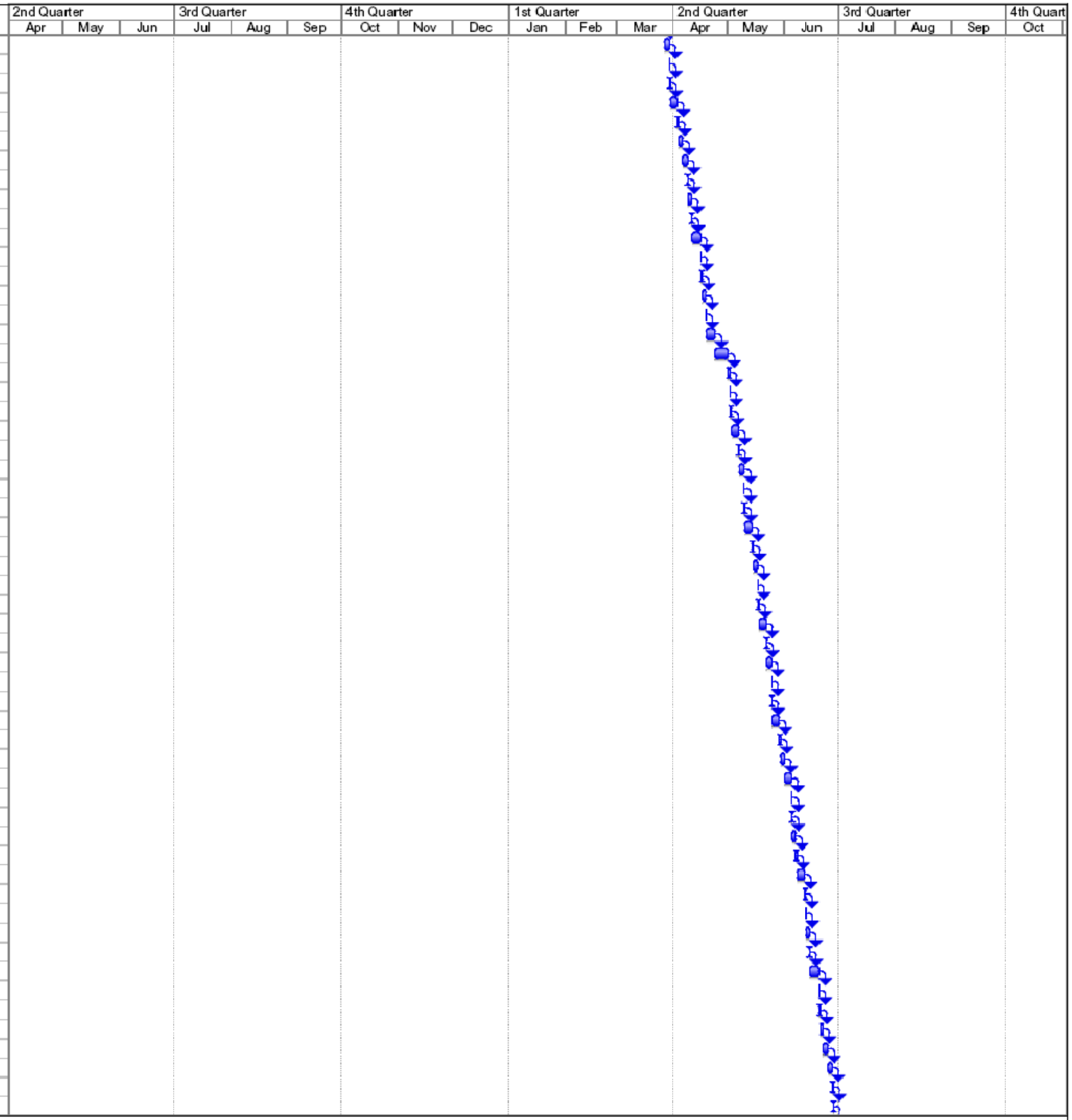


Project: Trump Taj Mahal Hotel - Steel
Date: Tue 4/8/08

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Page 2

ID	Task Name
113	Erect Precast Planks - Level 21
114	Erect BF Girders - Level 22
115	Erect Braces - Level 22
116	Erect Floor Framing - Level 22
117	Plumb and Bolt Steel - Level 22
118	Erect Precast Planks - Level 22
119	Erect BF Girders - Level 23
120	Erect Braces - Level 23
121	Erect Floor Framing - Level 23
122	Plumb and Bolt Steel - Level 23
123	Erect Precast Planks - Level 23
124	Erect BF Girders - Level 24
125	Erect Braces - Level 24
126	Erect Floor Framing - Level 24
127	Plumb and Bolt Steel - Level 24
128	Erect Precast Planks - Level 24
129	Tower Crane Jump
130	Erect Columns - Levels 25 thru 28
131	Erect BF Girders - Level 25
132	Erect Braces - Level 25
133	Erect Floor Framing - Level 25
134	Plumb and Bolt Steel - Level 25
135	Erect Precast Planks - Level 25
136	Erect BF Girders - Level 26
137	Erect Braces - Level 26
138	Erect Floor Framing - Level 26
139	Plumb and Bolt Steel - Level 26
140	Erect Precast Planks - Level 26
141	Erect BF Girders - Level 27
142	Erect Braces - Level 27
143	Erect Floor Framing - Level 27
144	Plumb and Bolt Steel - Level 27
145	Erect Precast Planks - Level 27
146	Erect BF Girders - Level 28
147	Erect Braces - Level 28
148	Erect Floor Framing - Level 28
149	Plumb and Bolt Steel - Level 28
150	Erect Precast Planks - Level 28
151	Erect Columns - Levels 29 thru 32
152	Erect BF Girders - Level 29
153	Erect Braces - Level 29
154	Erect Floor Framing - Level 29
155	Plumb and Bolt Steel - Level 29
156	Erect Precast Planks - Level 29
157	Erect BF Girders - Level 30
158	Erect Braces - Level 30
159	Erect Floor Framing - Level 30
160	Plumb and Bolt Steel - Level 30
161	Erect Precast Planks - Level 30
162	Erect BF Girders - Level 31
163	Erect Braces - Level 31
164	Erect Floor Framing - Level 31
165	Plumb and Bolt Steel - Level 31
166	Erect Precast Planks - Level 31
167	Erect BF Girders - Level 32
168	Erect Braces - Level 32

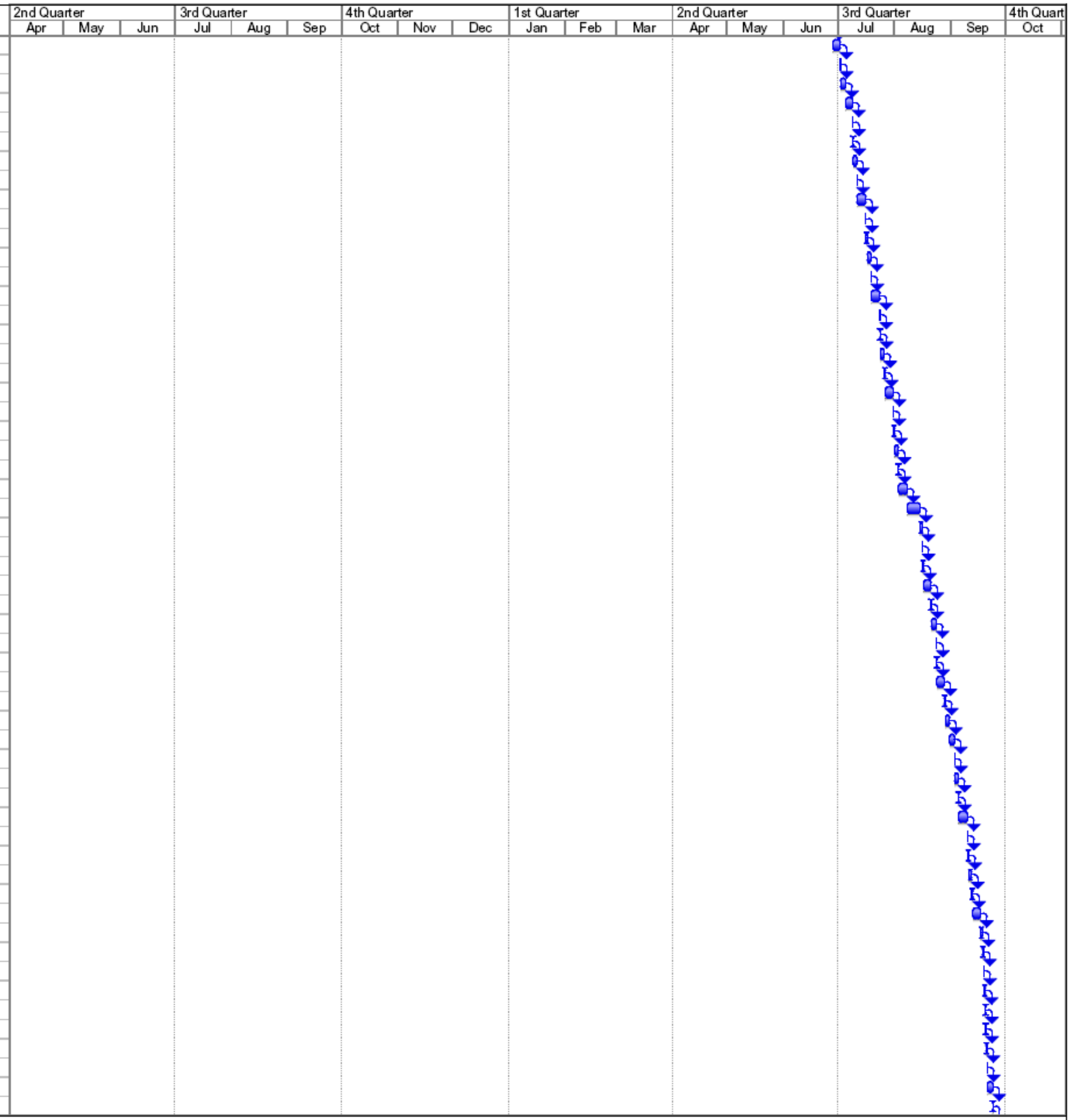


Project: Trump Taj Mahal Hotel - Steel
Date: Tue 4/8/08

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Page 3

ID	Task Name
169	Erect Floor Framing - Level 32
170	Plumb and Bolt Steel - Level 32
171	Erect Precast Planks - Level 32
172	Erect Columns - Levels 33 thru 36
173	Erect BF Girders - Level 33
174	Erect Braces - Level 33
175	Erect Floor Framing - Level 33
176	Plumb and Bolt Steel - Level 33
177	Erect Precast Planks - Level 33
178	Erect BF Girders - Level 34
179	Erect Braces - Level 34
180	Erect Floor Framing - Level 34
181	Plumb and Bolt Steel - Level 34
182	Erect Precast Planks - Level 34
183	Erect BF Girders - Level 35
184	Erect Braces - Level 35
185	Erect Floor Framing - Level 35
186	Plumb and Bolt Steel - Level 35
187	Erect Precast Planks - Level 35
188	Erect BF Girders - Level 36
189	Erect Braces - Level 36
190	Erect Floor Framing - Level 36
191	Plumb and Bolt Steel - Level 36
192	Erect Precast Planks - Level 36
193	Tower Crane Jump
194	Erect Columns - Levels 37 thru 40
195	Erect BF Girders - Level 37
196	Erect Braces - Level 37
197	Erect Floor Framing - Level 37
198	Plumb and Bolt Steel - Level 37
199	Erect Precast Planks - Level 37
200	Erect BF Girders - Level 38
201	Erect Braces - Level 38
202	Erect Floor Framing - Level 38
203	Plumb and Bolt Steel - Level 38
204	Erect Precast Planks - Level 38
205	Erect BF Girders - Level 39
206	Erect Braces - Level 39
207	Erect Floor Framing - Level 39
208	Plumb and Bolt Steel - Level 39
209	Erect Precast Planks - Level 39
210	Erect BF Girders - Level 40
211	Erect Braces - Level 40
212	Erect Floor Framing - Level 40
213	Plumb and Bolt Steel - Level 40
214	Erect Precast Planks - Level 40
215	Erect Columns - Levels 41 thru Roof
216	Erect BF Girders - Level 41
217	Erect Braces - Level 41
218	Erect Floor Framing - Level 41
219	Plumb and Bolt Steel - Level 41
220	Erect Precast Planks - Level 41
221	Erect BF Girders - Level 42
222	Erect Braces - Level 42
223	Erect Floor Framing - Level 42
224	Plumb and Bolt Steel - Level 42



Project: Trump Taj Mahal Hotel - Steel
Date: Tue 4/8/08

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Page 4

STEEL BEAM DESIGN TAKEOFF:

Floor Type: ROOF
Story Level 43
Steel Grade: 50

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W12X19	17	340.98	6463
W14X22	1	28.43	628
W18X35	6	137.92	4834
W24X55	12	345.37	19156
W24X68	2	58.50	4001
W36X182	1	58.50	10670
	39		**45751**

Total Number of Studs = **0**

Floor Type: FLR 41 M
Story Level 42
Steel Grade: 50

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	7	58.41	588
W12X19	7	108.50	2056
W16X26	1	21.25	555
W16X31	1	20.00	621
W18X35	2	27.75	973
W21X44	2	40.00	1769
W24X55	2	38.50	2135
	-----		-------------
	22		**8699**

Total Number of Studs = **0**

Floor Type: FLR 40 M
Story Level 41
Steel Grade: 50

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	13	128.08	1290
W10X12	1	19.75	238
W12X14	1	9.25	131
W8X18	2	49.52	886

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W12X19	5	108.60	2058
W14X22	5	94.52	2087
W12X26	2	80.00	2083
W16X26	3	58.03	1517
W16X31	4	117.49	3650
W18X35	14	274.43	9619
W16X36	1	32.00	1154
W18X40	2	50.50	2028
W21X44	3	56.33	2492
W18X46	1	32.00	1470
W21X48	2	50.75	2435
W24X55	9	176.93	9813
W24X68	1	37.25	2548
W27X84	8	150.00	12658
	-----		-------------
	77		**58157**

Total Number of Studs = **0**

Floor Type: FLR 24 TO 39
Story Levels 25 to 40
Steel Grade: 50

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	14	142.33	1434
W10X12	1	19.75	238
W12X16	4	75.00	1202
W12X19	21	376.00	7127
W14X22	7	133.50	2948
W16X26	4	76.77	2006
W18X35	12	268.06	9395
W21X44	4	83.26	3683
W18X50	2	58.60	2931
W24X76	8	288.00	21952
	-----		-------------
	77		**52916**

Total Number of Studs = **0**

Floor Type: FLR 4 TO 23
Story Levels 5 to 24
Steel Grade: 50

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	16	193.16	1946
W10X12	1	16.00	193
W12X14	1	9.25	131
W12X16	3	56.25	902
W8X18	1	29.17	522
W12X19	23	416.00	7885
W14X22	6	114.75	2534
W16X26	4	76.77	2006
W18X35	11	230.81	8089
W21X44	4	83.26	3683
W18X50	2	58.60	2931
W24X62	1	32.00	1993
W24X76	7	256.00	19513
	-----		-------------
	80		**52327**

Total Number of Studs = **0**

Floor Type: FLR 3
Story Level 2
Steel Grade: 50

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	15	181.16	1825
W12X14	2	37.25	527
W12X16	1	19.75	317
W12X19	5	87.52	1659
W14X22	2	37.00	817
W16X26	4	77.00	2012
W18X35	11	234.72	8227
W18X40	3	56.04	2250
W21X44	14	255.37	11296
W21X48	8	288.00	13818
W21X50	2	45.25	2264
W24X55	13	247.63	13735
	-----		-------------
	80		**58746**

Total Number of Studs = **0**

Floor Type: FLR 2
Story Level 1
Steel Grade: 50

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	15	181.16	1825
W12X14	2	37.25	527
W12X16	1	19.75	317
W8X18	1	19.62	351
W12X19	5	87.52	1659
W14X22	2	37.00	817
W16X26	4	77.00	2012
W16X31	1	18.21	566
W18X35	9	196.89	6901
W14X38	2	64.00	2439
W18X40	5	136.04	5462
W21X44	14	255.37	11296
W21X48	4	144.00	6909
W21X50	2	45.25	2264
W24X55	13	247.63	13735
	-----		-------------
	80		**57079**

Total Number of Studs = **0**

TOTAL STRUCTURE GRAVITY BEAM TAKEOFF

Steel Grade: 50

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	594	6689.23	67375
W8X18	23	652.47	11678
W10X12	37	655.75	7899
W12X14	25	268.75	3804
W12X16	126	2364.50	37896
W12X19	835	15069.13	285612
W12X26	2	80.00	2083
W14X22	242	4627.95	102204
W14X38	2	64.00	2439
W16X26	156	2996.99	78321
W16X31	6	155.70	4837
W16X36	1	32.00	1154
W18X35	454	9776.68	342659
W18X40	10	242.58	9740
W18X50	72	2109.65	105526
W18X46	1	32.00	1470
W21X48	14	482.75	23162
W21X44	177	3604.49	159449
W21X50	4	90.51	4527

Gravity Beam Design Takeoff

RAM Steel v11.2 | Page 5/5
DataBase: Takeoff Model - PLANKS | 04/08/08 04:28:46
Building Code: IBC | Steel Code: AISC LRFD

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W24X55	49	1056.05	58574
W24X62	20	640.00	39853
W24X68	3	95.75	6549
W24X76	268	9728.00	741490
W27X84	8	150.00	12658
W36X182	1	58.50	10670
	-----		-------------
	3130		**2121632**

Total Number of Studs = **0**

ETABS TAKEOFF			
ElementType	Material	TotalWeight	NumPieces
Column	STEEL	2945.134	516
Beam	STEEL	813.933	344
Brace	STEEL	1317.75	684
Brace	36KSI	172.47	172

Gravity Column Design TakeOff

RAM Steel v11.2
DataBase: Takeoff Model - PLANKS 04/08/08 06:09:34
Building Code: IBC Steel Code: AISC LRFD

Steel Grade: 50

I section

Size	#	Length (ft)	Weight (lbs)
W10X33	51	1883.7	62239
W10X39	5	92.0	3600
W12X40	13	486.2	19356
W14X43	57	1828.2	78386
W12X45	2	83.3	3715
W14X48	8	211.7	10156
W12X50	1	41.7	2070
W12X53	3	109.8	5826
W14X53	10	310.0	16456
W12X58	1	41.7	2410
W14X61	27	1098.4	66901
W12X65	1	41.7	2708
W10X68	4	105.7	7191
W14X68	11	458.3	31193
W14X74	7	291.7	21637
W12X79	1	26.4	2085
W14X82	17	708.4	57849
W10X88	4	128.0	11281
W14X90	25	1041.7	93934
W12X96	1	32.0	3071
W14X99	19	791.7	78394
W14X109	16	651.4	70934
W14X120	15	625.0	75076
W14X132	10	401.4	53000
W14X145	21	814.0	118277
W12X152	1	32.0	4867
W14X159	16	565.5	89866
W14X176	10	416.7	73446
W14X193	10	372.4	71982
W14X211	16	567.0	119624
W14X233	8	294.7	68685
W14X257	12	439.0	112936
W14X283	10	353.1	100084
W14X311	3	79.3	24648
W14X342	4	166.7	57282
W14X370	4	128.0	47476
W14X398	4	105.7	42069
W14X426	4	128.0	54445
W14X550	4	128.0	70560
	436		1835714

Project AE 482
Date 4/8/2008
Enginee Steve Reichwein

Cost and Schedule Takeoff

Structure

Description	Quantity	Unit	Daily Output	Labor Hours	Material	Labor	Equipment	Total	Total 15% O&P	Total Hours	10 hr Days	Total Cost
4000psi Topping Slab	682570	S.F.						$3.25	$3.75			$2,559,637.50
10" Precast Hollowcore Planks	682570	S.F.	3600	0.002	$11.05	$1.21	$0.75	$13.01	$14.97	1517	152	$10,215,759.75
Structural Steel - Beams	1608	Tons			$892.17	$1,982.61	$429.57	$3,304.35	$3,300.00			$6,108,959.23
Structural Steel - Columns	2629	Tons			$892.17	$1,982.61	$429.57	$3,304.35	$3,300.00			$9,991,972.32
Structural Steel - Braces	819.621	Tons			$892.17	$1,982.61	$429.57	$3,304.35	$3,300.00			$3,114,559.80
Structural Steel - Labor Output	5007	Each	40	0.25						1252	125	
Additional for Beam Connections	$6,108,959.23	Cost							7.00%			$427,627.15
Additional for Column Splices	$9,991,972.32	Cost							10.00%			$999,197.23
Additional for Brace Connections	$3,114,559.80	Cost							20.00%			$622,911.96
Shear Studs	16000	Each						$5.00	$5.75			$92,000.00
Tower Crane Jumps	3									120	15	
Plumbing and Bolting										120	15	
									Total	**3009**	**308**	**$34,132,624.93**

Note: Shear studs taken at one stud per foot for transfer of lateral forces from diaphragm to braced frame.

Cost/SF	**$47.47**

Additional

Description	Quantity	Unit	Material	Labor	Misc	Total	Total O&P	Total Cost
Curtain Wall	15600	SF					$85.00	$1,326,000.00
Elevators	1.06	% Incr.				$4,500,000.00		$258,620.69
MEP Increase	1.06	% Incr.						$1,300,000.00
Fire Rated Gypsum Board Partitions								
ANSI/UL 263 Design No. U411	186667	SF	$1.35	$3.04		$4.49	$5.16	$963,200.00
Additional Shaft Wall Assembly	16667	SF	$1.18	$2.77		$3.95	$4.54	$75,708.33
Gypsum Board Soffit - Beams ANSI/UL 263 Design No. N501	213750.00	SF	$1.16	$3.60		$4.76	$5.47	$1,170,122.24
Gypsum Board Soffit - Columns ANSI/UL 263 Design No. X518 ANSI/UL 263 Design No. X521	82800	SF	$1.16	$3.60		$4.76	$5.71	$472,953.60
Fire Resistant Drop Ceiling ANSI/UL 263 Design No. D502	90800	SF	$1.12	$1.36	.	$2.48	$3.36	$305,088.00
								$5,871,692.86

Cost Breakdown	
Structural	$34,132,624.93
Additional	$5,871,692.86
Total	**$40,004,317.80**