Towers Crescent Building B

Mike Synnott
Structural
Advisor - Parfitt

Thesis Proposal / Breadth Topics

Executive Summary:

Towers Crescent Building B is a 9 story, composite steel building located in Vienna, Virginia. The first level is comprised of retail stores, while the other 8 levels are for office use.

The current structural system in Building B is of a composite steel design. Each floor is comprised of two typical bays. The outside bays are 30’ x 40’, and the inside bays are 30’ x 30’. The floor itself consists of 2” metal decking, with a 3.25” thick concrete slab. Shear studs connect the floor to the steel frame in order to transfer the loads.

This thesis project will investigate and discuss a complete change to the entire structure of Building B. In place of the existing composite steel design, a flat slab with drop panels will be investigated and compared to the existing structure. Also, concrete shear walls will be used instead of the steel braced frame. Through in depth analysis, the proposed structure will be compared to the existing structure to check its feasibility.

The first breadth analysis investigated is an in depth cost analysis of the structure. RS – Means and possibly Primavera software will be used to acquire a precise cost of construction. This will then be compared to the original cost of construction.

The second breadth analysis is an investigation of the history of Towers Crescent building B. Building B was designed based off an existing building, designed by Phillip Johnson, which was built in the 1980’s. Also, how all the buildings in the site interconnect will be investigated.

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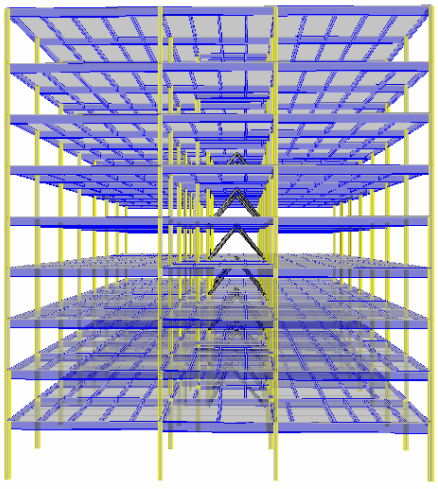
Background:

Towers Crescent Building B is a 9 story, 200,000 square foot building located in Vienna Virginia. The first floor is retail space while the other 8 floors house office space. The façade is comprised of a brick and glazed aluminum curtain wall. Large windows located near the roof and in a vertical line up the middle of the building add to the look of the building architecturally as well as provide much natural light to the interior of Building B. The picture on the right shows the North façade. Upon entering Building B, a two story main lobby welcomes visitors to the building. Elevators are located near the center of the building and act as the location for some of the braced frames. The picture on the left shows the lobby.

Figure 1 – Braced Frame resisting N-S lateral loads



The structure is comprised of a composite steel floor system to resist gravity loads and steel braced frames to resist lateral loads. Locations and elevations of the braced frames are found in figures 1, 2, and 3. Floor heights range from 13’4” to 15’, with the first floor height at 15’, floors 2-8 at 13’4”, and floor 9 at 14’5”. Each floor is comprised of two typical bays. The outside bays are 30’ x 40’, and the inside bays are 30’ x 30’.

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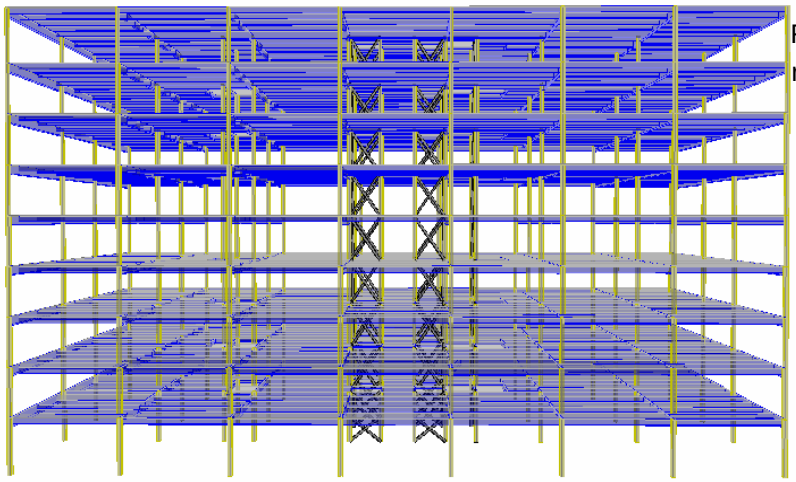
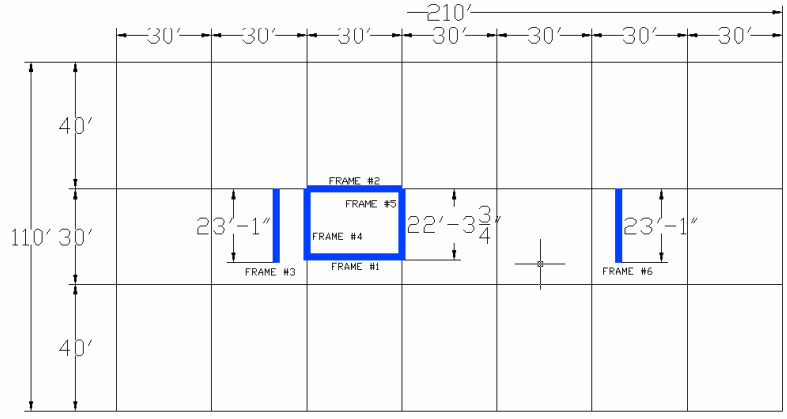
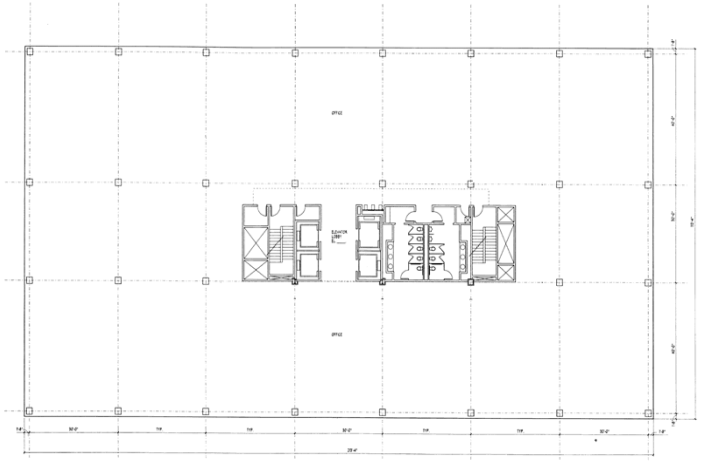


Figure 2 – Braced frame resisting E-W lateral loads

Figure 3 – Location of braced frames



The floor system is made up of two typical bays; the outside bays are 30’ x 40’ and the inside bays are 30’ x 30’. All stairwells and elevator shafts are located near the center of the building and provide the main means of egress. Below is a typical floor plan, which lays out the elevators, stairwells, and bathrooms. These components typically make up the buildings core as it creates a central location for comfort as well as the safety of all occupants in the building.



7E BUILDING B TYPICAL LEVEL PLAN

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Problem Statement:

Towers Crescent Building B is one of six buildings in the master plan of the site in Vienna Virginia. Its design is based off an existing building designed by Phillip Johnson in the late 1980's. This includes the structural system and façade materials.

The floor systems were designed with the use of BOCA – 97 and ASCE 7-98. Dead and live loads of 65 psf and 100 psf, respectively, were used in the in the design. Because this structure was designed in Virginia in the late 1990's, seismic loads were not considered in the design of the lateral resistance.

The overall height of the building is 123' tall, 153' tall including the mechanical penthouse located on the roof of the structure. Also, the average story height is 13' – 4". This includes the thickness of the floor and space needed for the mechanical and HVAC systems. The average floor to ceiling height for each story is 10'.This means that 3' – 4" is dedicated to the mechanical and floor systems.

Proposed Solution / Method:

A drastic change in the design of Building B is proposed for the topic of this thesis. A flat slab with drop panels will replace the existing composite steel system and will be investigated for feasibility and constructability. No changes will be made to the column layout at first, though, depending on the thickness and size of the slab and drop panels, alterations may be made to the column layout.

A possible advantage to the flat slab and drop panel system is reduction in the ceiling to floor heights, which would in turn increase the floor to ceiling heights. This would open each floor spatially and aide in creating a more open, welcome feel to each floor.

The lateral load resisting system will also change from a steel braced frame to concrete shear walls. The walls will first be designed in the same locations as the braced frames, and, if necessary, more walls will be added or existing walls will be moved in order to produce the best design.

Through the investigation of lateral loads in technical assignment three, seismic loads controlled over wind loads for a majority of the structure. Therefore, seismic loads will be used for the investigation of the lateral resistance system in order to assume a worst case scenario.

The use of structural design software, in which a specific program has yet to be chosen, along with hand calculations will be used in the investigation of the structural changes in Building B. The results will then be compared to the results

found in previous technical assignments in order to decide which system is better for the design.

Breadth Analysis Topics:

The first breadth analysis investigated is an in depth cost analysis of the structure. RS – Means and possibly Primavera software will be used to acquire a precise cost of construction. This will then be compared to the original cost of construction.

The second breadth analysis is an investigation of the history of Towers Crescent building B. Building B was designed based off an existing building, designed by Phillip Johnson, which was built in the 1980's. Also, how all the buildings in the site interconnect will be investigated.

Tasks and Tools:

Data collected and calculated for the existing structure in previous technical assignments will be used to compare the redesign to the existing structure. Also, the preliminary design for the flat slab with drop panels studied in technical assignment two will be used as a basis for the more in depth study of the redesign.

The use of ETABS will be employed in order to save time in designing the new concrete flat slab system. Hand calculations will also be used in order to check the output data ETABS produces. The CRSI manual, Along with ACI – 318 – 05 will be used for the hand calculations.

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Time Table:

Task	1/09 - 1/15	1/16 - 1/22	1/23 - 1/29	1/30 - 2/05	2/06 - 2/12	2/13 - 2/19	2/20 - 2/26
Check calculations on loads and existing structure	X	X					
Check architecturally layout for columns		X					
Determine gravity loads on structure			X				
Design Floor System for same Column Layout				X			
Design system for new column layout					X		
Design of proposed lateral resistance system					X	X	
Breadth Analysis Research						X	X
	2/27 - 3/05	3/06 - 3/12	3/13 - 3/19	3/20 - 3/26	3/27 - 4/02	4/03 - 4/09	4/10 - 4/16
Breadth Analysis Discussion and summary	X	Spring Break					
Comparison between existing and proposed systems	X	Spring Break	X				
Final Written Report		Spring Break		X	X		
Presentation preparation		Spring Break			X	X	
Presentation Given (4/12/06 at 10:40 am)		Spring Break					X