TURNBERRY TOWER ARLINGTON

ARLINGTON, VIRGINIA

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Construction Management

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Thesis Proposal

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Executive Summary

This report will serve as my proposal for my research pertaining to my senior thesis work to be conducted in the spring. This semester was used to research the building for my thesis project and identify problems that have occurred on the jobsite. The theme for my proposal is to take some of the larger problems that have occurred during construction of Turnberry Tower Arlington and come up with alternative solutions or alternative ways tasks could have been performed. I will take this research and compare it to what was actually done during construction. The different analysis topics are as follows:

Analysis 1 – Attachment of the Window Wall to non Post Tension Concrete

Structural Breadth

This analysis will focus on problems that occurred on the jobsite with attaching the structural supports for the building's exterior window wall system to the post tension concrete decks. With lack of coordination between the design team and the contractors, drilling needed to occur in the post tension decks. Many tendons failed due to being struck during the drilling process. With this major tendon failure occurring halfway up the building, steps were immediately taken to remedy the installation process. The goal for this analysis is to take the same situation that occurred on this job (with lack of coordination between the design team and contractors) and compare the cost and schedule problems from failed post tension tendons to the same project if regular reinforced concrete had been used.

Analysis 2 – Use of the Sovent System

Mechanical Breadth & Critical Industry Issue

During some of the value engineering that occurred in the beginning phases of construction, one idea that was used on this project was the use of the Sovent System. This system helped to utilize one stack for drain, waste, and venting of waste products instead of the traditional two pipe system. I plan to investigate how much money this system saved and what impact it had on the LEED rating of the building. By saving materials that would have been needed in the two stack method and creating some of the system from recycled metal, it can have an impact on points obtained for the project. I will also look into similar systems that could have been used in the place of the Sovent System.

Analysis 3 – Site Logistics Plan

Turnberry Tower Arlington is surrounded on three sides by main roads. The country has put time restrictions on some of the roads so construction does not create more traffic during some parts of rush hour. With those restrictions, the site plan that was utilized throughout the project used one road for deliveries to the site. This one main passageway was also the place that concrete was delivered and where the material hoist was accessed. The goal of this analysis is to investigate the logic that was used to create the current site logistics plan and come up with an alternative solution. I would like to ease the amount of coordination needed for deliveries and make it easier for the subcontractors to get their materials on site.

I. Analysis 1 – Window Wall Attachment with Normal Reinforced Concrete

(Structural Breadth)

A. Problem Statement

Turnberry Tower Arlington's exterior skin is made up of both curtain wall and window wall. The curtain wall, located at the four corners of the building, was submitted and approved before concrete construction began. That made it possible to include embeds in the concrete pours that made it easy to attach the curtain wall to the building. The window wall was not approved until after the concrete construction had begun. In order to secure the window wall to the building, the supports had to be designed and installed to be attached after the post tension concrete decks had cured. The danger of drilling into post tension slabs is that you will hit a tendon and cause it to fail and that happened on this project. More than 20 tendons were hit and failed because of the window wall installation process.

B. Goal

I intend to redesign the post tension concrete decks and make them normal reinforced concrete decks. Once redesigned, a cost and schedule analysis will be performed to see which design would be better taking in to account all of the problems that occurred from the post tension tendon blow outs. I will also find out why post tension concrete was used on this building.

C. Research Steps

1. Investigate why post tension concrete was used by talking to the architect, structural engineer, and developer.
2. Use the direct design method and the CRSI handbook to design the use of normal reinforced concrete.
3. Consult with the scheduler to determine the correct durations for the use of normal reinforced concrete construction on this project
4. Price the project using normal concrete.
5. Compare both the schedule and cost for the two different structural systems
6. Analyze and summarize the results

D. Tools

1. CRSI Handbook
2. ACI Handbook
3. Direct Design Method
4. Architectural Engineering Professors, General Contractor, and Design Team

5. R.S. Means Cost Analysis
6. Primavera
7. Microsoft Excel

E. Expected Outcome

The way this project was designed and then given to the general contractor, certain subcontractors were not yet onboard, including the exterior skin subcontractor. By the time the package was picked up and all of the submittals were approved by the architect, there was not time to place an embed into the concrete decks that would support the window wall. This led to the problems of ruptured post tension tendons and having to x-ray all future window wall installations. All of these problems should show that the use of normal reinforced concrete would have been a better option.

II. Analysis 2 – Sovent System

(Mechanical Breadth + Critical Industry Issue)

A. Problem Statement

When the developer obtained the finished set of plans from the architect, they went right to the general contractor for any value engineering ideas they had. These ideas could also helped to obtain more points for the desired LEED Certified rating. The use of the Sovent System was one proposed idea that was used in the construction of this building. This system helped to remove eight stacks of pipe in the building by utilizing one stack for the drain, waste, and venting of waste products.

B. Goal

I intend to research how much of a cost difference the use of the Sovent System is compared to installing a normal two pipe drain, waste, and vent stack. I will also research other systems that could have been used in place of the Sovent System. This will lead to a direct comparison of the different systems with amount of space the systems take up, how much they cost, and the durations of installing each system. A LEED analysis will be performed to see how beneficial the Sovent System is and what impact it played on gaining points and obtaining the desired LEED rating. Lastly, I will investigate what could have been added or taken away from the different systems to gain a larger LEED rating or help with a more sustainable design to help the LEED rating and possible rebates for the owners.

C. Research Steps

1. Find the person who suggested the use of the Sovent System and where they learned about it.
2. Speak with other members of the construction and design community to learn about other systems that may be similar to the Sovent System.
3. Price the original two pipe drain, waste, and vent system.

4. Compare the systems in a cost and schedule analysis.
5. Learn what impact the Sovent System had on obtaining LEED points and what other systems would have done.

D. Tools

1. LEED Point Checklist
2. R.S. Means Cost Analysis
3. Microsoft Excel
4. Websites & Engineering Journals
5. Arlington Country tax rebate information
6. National Plumbing Code

E. Expected Outcome

I expect to find that using the Sovent System saved money because of the amount of pipe that it saved. There are eight stacks in the building that each travel about 260 feet in the air. Saving that amount of pipe should offset the cost for using this system. Additionally, I believe research will show there are other systems that are comparable to the Sovent System and could have been used on this project. I do believe that all of these systems will have an impact on the LEED rating of the building by not having to use pipe and safely venting the waste air away from the units more efficiently.

III. Analysis 3 – Site Logistics Plan

A. Problem Statement

Every construction project requires a site logistics plan that enables the building to be built. The site logistics plan utilizes one road on the north side of the site for most of the site deliveries as well as access road for all of the concrete trucks to stage. During certain times of the week during deliveries and trucks trying to move around, traffic around the site was slowed down which caused law enforcement in the area to get involved. Stop work orders could have been ordered.

B. Goal

I want to research why the site logistics plan was created the way it was and explore other options that might be able to increase site productivity and allow for more deliveries to the site at the same time while at the same time not affect public vehicular and pedestrian traffic around the site.

C. Research Steps

1. Speak to the superintendent who created the site logistics plan and learn about their logic.
2. Talk to Arlington County in Virginia and learn about local ordinances and requirements for construction sites.
3. Explore other options for the site logistics plan
4. Talk to project managers and superintendents at the project site and compare my site logistics plan with the one used.

D. Tools

1. General Contractor Personnel
2. Microsoft Powerpoint

E. Expected Outcome

After working on the project site for two summers and seeing how congested the one area was because of all the deliveries, I believe by re-evaluating the site logistics plan and utilizing the other main road that surrounds the site, another site logistics plan can be developed that allows for more flow. By allowing easier flow of traffic on site and more deliveries at once it can play a part in easing the need to use the one loading dock on site.

IV. Weight Matrix

The following matrix will help to define the areas I will use for my thesis:

Analysis Topic	Research	Value Engineering	Constructability	Schedule Acceleration	Total
Analysis 1 - Use of Normal Reinforced Concrete **(Structural Breadth)**	10%	5%	25%		40%
Analysis 2 - Use of the Sovent System **(Mechanical Breadth & Critical Industry Issue)**	15%	10%	5%	5%	35%
Analysis 3 - Site Logistics Plan	5%			20%	25%
Total	30%	15%	30%	25%	100%

V. Time Table for Thesis Research:

January						
S	M	T	W	Th	F	S
				1	2	3
4	5	6	7	8	9	10
			WINTER BREAK			
11	12	13	14	15	16	17
	Research Direct Design Method →					
18	19	20	21	22	23	24
	Redesign Concrete and Complete Analysis 1 →					
25	26	27	28	29	30	31
→						

February						
S	M	T	W	Th	F	S
1	2	3	4	5	6	7
→						
8	9	10	11	12	13	14
	Find information on Sovent System from MEP Engineer and Project Mangers. Find out about similar systems					
15	16	17	18	19	20	21
	Complete Analysis 2 →					
22	23	24	25	26	27	28
→						

March						
S	M	T	W	Th	F	S
1	2	3	4	5	6	7
→					→	
8	9	10	11	12	13	14
			SPRING BREAK			
15	16	17	18	19	20	21
	Site Visit and Research Existing Site Logistics Plan					
22	23	24	25	26	27	28
→						→
29	30	31				
→		→				

April						
S	M	T	W	Th	F	S
			1 →	2	3	4 →
5	6	7	8	9	10	11
Finalize Report and Presentation →						
12	13	14	15	16	17	18
		FINAL THESIS PRESENTATIONS				
19	20	21	22	23	24	25
26	27	28	29	30		

Appendix 1 – Breadth Studies

Analysis 1 – Window Wall Attachment with Normal Reinforced Concrete
Structural Breadth

To complete the analysis of attaching the window wall to the concrete decks, I will need to redesign the post tension concrete slabs to normal reinforced concrete slabs. I will learn how to use the CRSI handbook to the approximate rebar layouts and then use the direct design method along with the ACI handbook to come up with the slab thickness. I have come up with "typical bays" in the building that I can use to complete this research. All of this structural analysis will lead to a conclusion whether using normal reinforced concrete would have been a better idea, with cost and schedule, than using the post tension concrete.

Analysis 2 – Sovent System
Mechanical Breadth & Critical Industry Issue

The analysis of the how beneficial the Sovent System is compared to a normal two stack drain, waste, and vent system will need to be performed by designing the two stack system. I will learn how to size the pipe based on mechanical and plumbing codes for the Arlington County, Virginia area. I will also research other systems that could have been used in place of the Sovent System. This will lead to the direct comparison to the different systems with amount of space the systems take up, how much they cost, and the durations of installing each system. A LEED analysis will be performed to see how beneficial the Sovent System is and what impact it played on gaining points and obtaining the desired LEED rating. Lastly, I will investigate what could have been added or taken away from the different systems to gain a larger LEED rating or help with a more sustainable design to help the LEED rating and possible rebates for the owners.