

TURNBERRY TOWER ARLINGTON

ARLINGTON, VIRGINIA



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Construction Management

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Thesis Proposal – Revision

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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 identifying problems that have occurred on the jobsite. The theme for my proposal is to take some of the bigger 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 Reinforced Concrete

Structural Breadth

This analysis will focus on the problems that occurred on the jobsite with attachment of 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 because of being struck through the drilling process. With this occurring halfway up the building, steps were immediately taken to remedy this process. The goal for this analysis is to go back to the preconstruction phase of the project and propose the use of reinforced concrete. This would help with all of the designs that were not yet in place and would reduce the risk of having to drill into post tension decks. I will compare the cost and schedule problems from failed post tension tendons to the same project if reinforced concrete had been used.

Analysis 2 – Supply Water System

Mechanical Breadth & Critical Industry Issue

During some of the value engineering that occurred in the beginning phases of construction, one idea that was utilized on this project was the use of the Sovent System which helped in sustainable construction for the waste piping. I will now look more closely at the supply water system and propose ways to make this system more sustainable while at the same time decreasing the cost and schedule for installation. Utilizing propress fittings and prefabrication, I plan to investigate to see if these construction methods would have been more beneficial for this project. I will then see if any of these construction methods could have helped to obtaining more LEED points for the project.

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 the day. 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 redesign the site logistics plan to utilize another part of the site for more deliveries that will reduce the amount of overtime the drywall subcontractor needed for this project. Cost savings would occur if the drywall subcontractor did not have to accept as many deliveries on the weekends.

I. Analysis 1 – Window Wall Attachment with Reinforced Concrete *(Structural Breadth)*

A. Problem Statement

Turnberry Tower Arlington's exterior skin is made up of both curtain wall and window wall. When the general contractor was given the contract documents during bidding, it was noted that neither exterior skin system had a design in place on connecting it to the structure of the building. Because the building structure is post tension concrete, not having a design for the connections made it very difficult for a connection to be designed in the existing conditions. Any connection design could have had a large impact on the structure design and may have caused a redesign of the post tension slabs. As a result of not having this important connection design, drilling into the cured post tension decks had to occur to attach the window and curtain wall. As a result, more than 20 tendons were hit and failed because of the window wall installation process.

The general contractor knew that there was no design to attach the exterior skin system to the building, so I will propose to go back to the preconstruction process and suggest that reinforced concrete decks be used for the building instead of the post tension concrete decks.

B. Goal

I intend to act as the general contractor during the preconstruction process and suggest that the post tension concrete decks be replaced with reinforced concrete decks to allow for more design flexibility in connecting the exterior skin to the building. 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 and ask if reinforced concrete could have been an option.
2. Use the direct design method and the CRSI handbook to design the building using normal concrete (structural breadth).
3. Consult with the scheduler to determine the correct durations for the use of reinforced concrete construction on this project and see what other activities this may impact.
4. Price the project using reinforced 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
5. General Contractor and Design Team
6. R.S. Means Cost Analysis
7. Primavera / Microsoft Project
8. 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 post tension 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 additional costs to the project should show that if the suggestion was made to use reinforced concrete instead of post tension concrete then time and money would have been saved.

II. Analysis 2 – Supply Water 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 that may help to reduce cost or 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.

All of these ideas were with the waste piping. I would like to see if any ideas could have been used on the supply piping that could have better saved time on the schedule, reduced the cost of the project, or helped to use fewer materials and make the project more sustainable.

B. Goal

I will start out the research by looking extensively at the existing system in the building which supplies the water to the different units which is a hybrid system that uses both copper and CPVC pipe. I will look at the methods of installing for both of the pipes and see what can be done to speed up the

installation process, lower the cost of installation, or both. I will look at an alternative way than soldering the copper pipes, especially with propress fittings, and see if prefabrication is an option for this project.

After the redesign of the system is proposed, I will check this new system to the existing system and see if there is any cost saving or schedule reduction. A LEED analysis will be performed to see how beneficial the new system may be, and what impact it played on gaining points and obtaining the desired LEED rating.

C. Research Steps

1. Research the existing system by interviewing the MEP Engineer, general contractor, and the owner's representatives. I will also look at construction progress photos to learn as much as possible.
2. Speak with other members of the construction and design community to learn about what products could be used to help speed up and/or reduce project cost.
3. Redesign the system using these new products and possible prefabrication options (Mechanical Breadth & Critical Industry Issue).
4. Compare the two systems in a cost and schedule analysis.
5. Learn what impact the redesigned system would have on obtaining LEED points.

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
7. MEP Engineer, General Contractor, and Owner's Representatives

E. Expected Outcome

I expect that by using materials such as the propress fittings, and utilizing construction techniques such as prefabrication, the schedule should accelerate for installation of the supply water system. I do think that the initial cost will increase because the propress fittings will be more expensive, but I believe that the cost for the fittings will be offset by the labor cost for installation. I hope that these results will show that this redesigned system could have obtained more LEED points and would have helped to accelerate the installation process.

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 for this project utilizes one road on the north side of the site for most of the site deliveries, as well as the access road for all of the concrete trucks to stage. During certain times of the week while deliveries and trucks are trying to move around, traffic around the site was slowed down which caused law enforcement in the area to get involved. Stop work orders by the county were threatened a few times.

One material that always had a problem with deliveries was drywall. The drywall deliveries would always need to be planned to occur around the concrete deliveries, and because there was so much drywall on this project many of the deliveries had to occur outside the normal work day which caused overtime to have to be paid to the workers that were forced to work during night and weekend deliveries.

B. Goal

I want to research why the site logistics plan was created the way it was and explore other options that would allow for drywall to deliveries to occur simultaneously while concrete is being delivered. Utilizing the other parts of the site should allow for this to be possible.

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 and see if another loading dock would be allowed.
3. Propose another site plan that would help deliveries for the drywall subcontractor.
4. Talk to project managers and superintendents at the project site and compare my site logistics plan with the one used.
5. Compile the research and compare the new site plan to the existing site plan and see if it would help to reduce overtime costs.

D. Tools

1. General Contractor Personnel
2. Drywall Subcontractor
3. Arlington County Code Officials
4. Microsoft Powerpoint
5. Adobe Fireworks

E. Expected Outcome

After working on the project site for two summers and seeing how congested the delivery lane was because of all the deliveries, I believe re-evaluating the site logistics plan would increase material delivery during the normal work day. Utilizing the other main road that surrounds the site, another site logistics plan can be developed that allows for more deliveries including the drywall, which would then reduce the need for deliveries on the weekends and reduce the cost of overtime.

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 Reinforced Concrete (Structural Breadth)	10%	5%	25%		40%
Analysis 2 – Supply Water 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. Milestone Dates for Turnberry Tower Arlington Thesis:

January 26th- Alternate Slab Design Complete

February 9th - Analysis 1 is complete (Concrete Redesign)

February 23rd - Alternate materials for supply water system have been researched and priced and are ready to be compared to the use of the currently installed materials

March 16th- Analysis 2 is complete (Alternate Materials for Supply Water to Units)

April 13th - Final Presentation

April 17th- Final Report is due

Appendix 1 – Breadth Studies

Analysis 1 – Using Reinforced Concrete in the place of Post Tension Concrete

Structural Breadth

When this project was handed over to the general contractor, there were many systems that were not yet designed and some of these systems needed to be connected to the post tension concrete slabs. During construction many tendons were hit as a result of the lack of design and coordination. I plan to go back to the beginning of the preconstruction process and propose to use reinforced concrete to assure we would not have any tendon busts from the lack of design, especially from the window wall brackets. I will learn how to use the CRSI handbook to approximate the 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 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 use of the Sovent System in this building was a great step in sustainable construction because of the amount of pipe that the system saved compared to using a normal drain, waste, vent system. I plan to get one step further and analyze the supply water system and come up with other sustainable ways of construction including prefabrication and the use of propress fittings. I will attempt to utilize these methods of construction into the design and then see what the impact would be on the cost and schedule compared to the systems that are currently being installed on the project. I will also see if the use of either of these methods would lead to anymore obtainable points on the LEED rating or rebates for the owner.