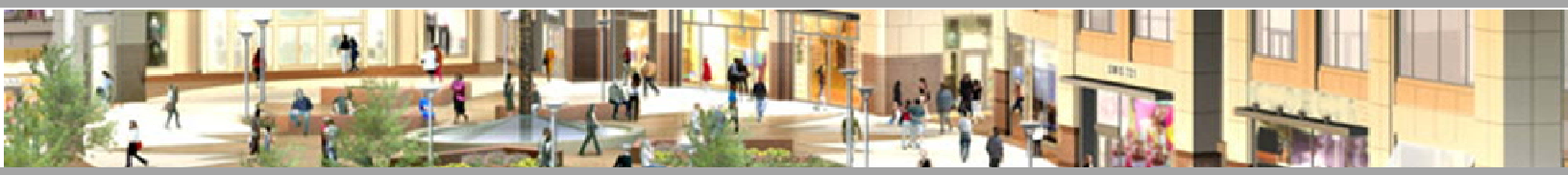
Wisconsin Place Residential

Chevy Chase, MD



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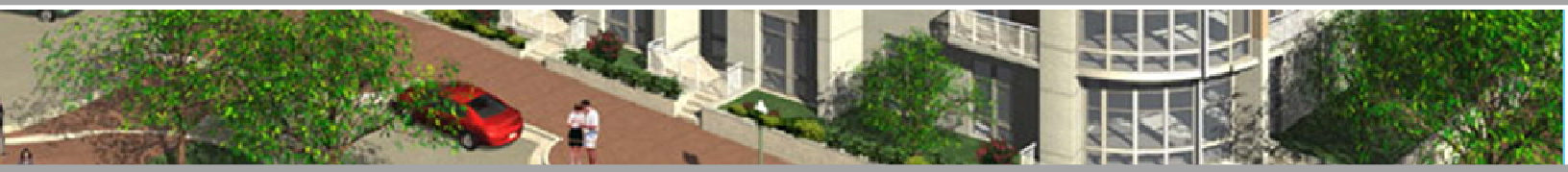
Construction Management



Thesis Proposal
December 17, 2007

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Executive Summary

This thesis proposal is an elaboration on Technical Assignment 3. After brainstorming some initial ideas, I have refined my research to a few key concepts. Some initial research was performed to determine the feasibility of my proposed solutions. The Analysis Descriptions will highlight 3 main topics for my thesis project.

Analysis 1 will look at slab coordination for the Wisconsin Place apartment tower. Since this is a post tensioned structure, much planning has gone into the placement of tendons, conduit, and mechanical box-outs in the 8 inch slab. There have already been a few instances where penetrations were placed at incorrect locations, and the remedy for this is costly and time consuming. One breadth stems from this issue and that is using building information modeling (BIM) to detect clashes in the field before it is actually constructed.

Analysis 2 will look at the building envelope and try to find ways to reduce cost by limiting the faced to one or two standard materials. A breadth will be embedded in this analysis to look at the acoustics of a typical apartment unit and determine ways to further reduce noise and vibration in this city location.

Analysis 3 will look at the punch list process and determine ways to expedite and simplify the tedious job of turning over units. Turner currently uses an Excel spreadsheet to track progress. I will research some computer programs that could be used to monitor the punch list process more effectively as well as speak to companies that are currently using such programs. BIM will also be used here as an easy way to tag incomplete or incorrect items within an apartment unit, making the jobs of the finishes trades a lot easier.

These three topics are supported by background research, potential solutions, steps to achieve my technical analysis, and my expected outcome. In addition, one critical issue research topic will also be explored, and that is prefabrication and the potential schedule and cost savings impacts it can have on a project. The goal of my research is to standardize common building elements to facilitate a faster construction schedule.

The weight matrix shows how much emphasis will be placed on the core areas of research, alternative methods, value engineering, and schedule compression. A detailed explanation of my breadth studies can be found in Appendix A. The purpose of the breadth is to show my proficiency in at least two option areas outside of construction.

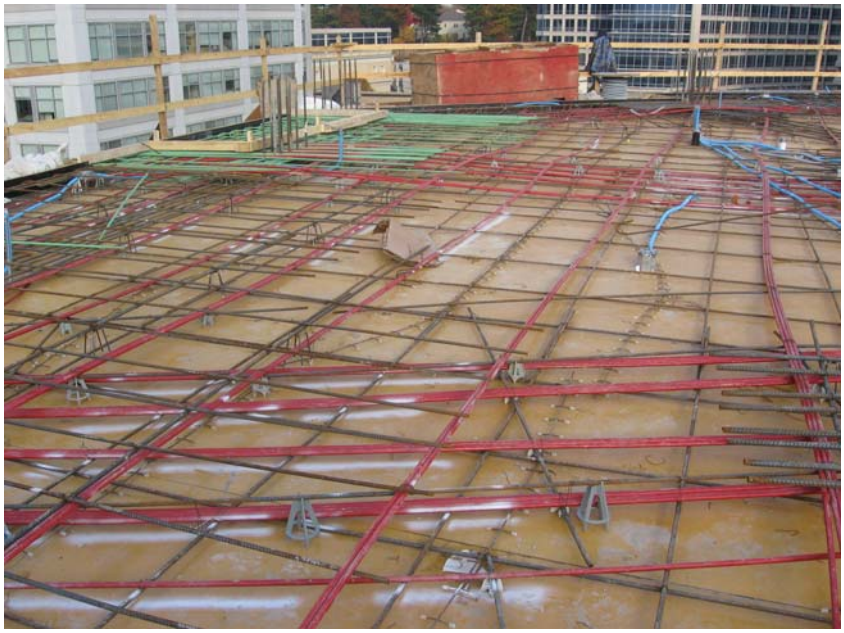
Through executing my technical assignments this semester, receiving feedback from professors, attending conferences, and speaking with the Turner team on Wisconsin Place, I feel I have chosen topics that both interest me and could provide some positive solutions for the WPR project. I look forward to what the next semester brings.

Analysis 1: Slab Coordination

Breadth 1: BIM for Slab Coordination

Problem Statement

Currently at Wisconsin Place the slabs are poured using a pump truck while the columns use a crane and bucket. I feel that the crane and bucket method is time consuming and could be accomplished more efficiently if a second pump truck were brought to the site every other day or so. Turner's resistance to this option is due to the high cost of pump trucks.



Unbonded tendons in the ninth floor slab of WPR.

Research Goals

I will analyze the cost and schedule impact that could result from using two concrete pumps a day – one to pour slabs and one to pour columns. This change would free up the tower cranes for other site activities and potentially eliminate the need for the third tower crane. I will perform a cost comparison between the two methods to see which is more cost effective.

Research Steps

1. Request Turner team fill out a brief survey regarding concrete productivity.
2. Request Turner fill out a matrix showing how each of three tower cranes spends its time each day, i.e. what activities each serves.
3. Create a schedule of tower crane activity for a typical day.

4. See if eliminating crane and bucket pours is enough of a reduction to also eliminate one tower crane from the project.
5. Call several pump truck companies to compare prices.
6. Compare the cost savings of eliminating a tower crane to the added cost of a second pump truck.

Data Collection Tools

This matrix is to be filled out based upon the percentage of a typical day that is spent on each of the following activities. This will help me see areas where a tower crane is inefficiently used.

Activity	Tower Crane 1	Tower Crane 2	Tower Crane 3
Erect/Strip Formwork			
Pour Columns			
Pick/Place Material			

Survey Questions

1. Have you met your projected concrete production schedule to date?
2. What do you see as the main roadblocks to meeting this schedule?
3. Approximately how long does it take to pour one column using the crane and bucket method?
4. Have you ever used a pump to place column concrete? If so, how long did that take?
5. How many workers does it take to pump concrete?
6. How many workers does it take to crane and bucket concrete?

Expected Outcome

I would like to optimize crane efficiency and potentially eliminate one of the three Turner cranes onsite. Eliminating the crane and bucket pours might be enough of a reduction to get rid of the third crane, and this huge contractor savings could offset the cost of an additional pump truck.

Analysis 2: Building Envelope

Breadth 2: Acoustical Analysis

Problem Statement

As a value engineering idea I will condense the types of façade materials for the outside of the building. Currently, the façade consists of different materials including brick, glass, and cast stone. I might replace these materials with a different color brick or some type of EIFS. This could also tie into my research topic of prefabrication. The congested WPR site could benefit from large portions of the façade being prefabricated in a warehouse and delivered to the site just in time to be picked and placed from the truck bed. Pre-loading the floors with masonry could also save time and possibly eliminate the rental cost associated with use of a hoist.

Research Goals

My research for this topic will include a cost comparison between various alternative cladding systems as well as an updated construction schedule that shows any time savings. I will also investigate the possibility of prefabricating large panels of the façade offsite and determine the cost and schedule impact of that alternative.

Expected Outcome

I think that by standardizing the building façade materials, or at least the process of assembling the exterior, a lot of time can be saved on the project. This will also reduce the amount of field clashes when it comes to tying different materials together and keeping the connections watertight.

Façade material mock-up for WPR.

Analysis 3: Punch List

Breadth 3: BIM for Punch List Coordination

Problem Statement

Turner currently uses a detailed Excel spreadsheet to handle punch list items on their project. I intend to acquire a copy of this spreadsheet and modify it to be a more useful tool for them in dealing with punch list quality control and assurance. I will also research computerized punch list programs that could make the final crunch time run a lot smoother and keep the entire project team involved and updated.

Research Goals

I would like to research some existing punch list software and receive feedback from construction companies who have used any if these on their projects. I found one company that makes E-Z punch list software, a palm pilot that organizes notes by trade. I would like to analyze the effects of implementing a computerized software system to assist the punch list process. I am curious to learn about the learning curve associated with this newer technology, as well as how it can be coordinated between all of the finish trades.

Research Steps

1. Search for punch list software online.
2. Contact several construction companies and find out if they have ever used computer automated equipment to track punch list items.
3. Ask the companies who have experience on the topic to complete a brief survey.
4. Talk to finish contractors to see how the computerized punch list affects their job.

Survey Questions – Construction Companies

1. Have you ever used computer automated devices to track punch list items on a project? What was the name of the software?
2. How much training did the implementation process require?
3. Who managed the software? The CM? An independent party?
4. Did the trades have to purchase their own palm pilots or did you provide them?
5. How did this new technology affect the timeline of the punch list process?
6. Would you recommend using automated punch list software to another company?
7. What were some of the benefits/drawbacks?
8. About how much did this system cost?

9. How did the trades perceive this new device? Did it improve communication or confuse things even more?

10. Did the software accelerate your schedule at all? If so, by how much?

Survey Questions – Finish Trades

1. Have you ever used computer automated devices to track punch list items on a project? What was the name of the software?

2. How much training did the implementation process require?

3. Describe the learning curve for your employees.

4. How was this new system received by your employees? Favorably?

5. Did this tool improve communication or make things cloudier?

6. Did this tool make your job easier or more complex?

7. Would you ever consider purchasing and managing a system on your own?

8. What were some of the benefits/drawbacks?

Expected Outcome

I hope to find that automated punch list software improves the overall turnover process by keeping information organized and concise. I would not be surprised if the system also shows reductions in schedule time due to a rapid learning curve that could justify investing in a computerized system.

Critical Issue: Prefabrication

One critical issue that I wish to address in my thesis is prefabrication and the potential schedule and cost savings impacts it can have on a project. On Wisconsin Place Residential, prefabricated electrical outlets and switches are being installed to expedite the completion of all 432 units. This was a wise decision to make, considering the large amount of electrical power required for just one apartment these days. Some other options for prefabricated components could be preassembled pipe, vanity units in bathrooms, and rebar cages for cast in place concrete columns. As mentioned earlier, I am also interested to see the cost and schedule impacts of pre-assembling portions of the brick façade offsite and employing a just-in-time delivery method to fasten them to the building skeleton. This would conserve space on site and expedite the building enclosure.

The goal of my research is to standardize common building elements to facilitate a faster construction schedule. Now that there are so many amenities to offer in apartment units, it is important to maintain core components that can be readily available in bulk quantities. Most tenants prefer to customize their apartment to match their personal style, but many prefabricated elements can be hidden beneath the surface like the electrical outlet option.

In order to measure the affects of standardizing parts for the construction of WPR, I will be consulting with the Turner team on site, researching similar projects that have employed prefabricated elements, and conducting a literature review of the financial benefits to product standardization. Surveys are another way to gain information from industry members regarding prefabrication. I will also determine which scenarios could best benefit from utilizing standardized components, i.e. the building size and function that would optimize price based upon the use of prefabrication.

Site congestion could be reduced by utilizing prefabricated materials.

Weight Matrix

The following is a weight matrix that shows the level of emphasis to be placed on each of the four areas of research for my senior thesis.

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Analysis 1 - Slab Coordination	5%	0%	15%	5%	25%
Analysis 2 - Building Envelope	5%	20%	0%	0%	25%
Analysis 3 - Punchlist Process	10%	0%	10%	5%	25%
Critical Issue - Prefabrication	10%	0%	5%	10%	25%
Total	30%	20%	30%	20%	100%

Appendix A: Breadth Studies

Breadth 1: BIM for Slab Coordination

The benefits to using a post-tensioned concrete structure are many. Fewer interior columns allow for a more open floor plan, and the unbonded tendons can be de-stressed before attempting repair work on the slab. But guaranteeing the location of every penetration in the slab before it is poured is a difficult task. I will use Revit Systems and Revit Structures to draft plans that can then be used to detect any interference between the MEP and structural work.

Breadth 2: BIM for Punch List Coordination

One problem with performing a quality control walk-through in a building is being able to pinpoint the exact areas that need to be fixed. Finish trades sometimes search for hours trying to find a knick in the drywall or the missing piece of trim in an apartment unit. By creating a building information model of a typical apartment unit the CM can easily tag the exact location of mistakes that need to be fixed. The subcontractor can carry around a palm pilot or pocket PC that displays this model so that he can quickly find the mistakes and correct them. This model is also a good tool for tracking punch list progress. A master file will be used so that the project team can see how many units are being turned over a day. This can also be a way to track where the most inconsistencies are located.

Breadth 3: Acoustical Analysis

Since it is located in city environment, noise will definitely be an issue for Wisconsin Place. The fact that this tower is being constructed amidst an office, major retailers and restaurants will be another reason to focus on traffic and sound attenuation. I will research some acoustical ceiling tiles or decorative baffles that will reduce the amount of noise and vibration for tenants without detracting from the overall look of the interior space. Additionally, I will provide the cost and schedule impact associated with installing sound-reducing accessories.