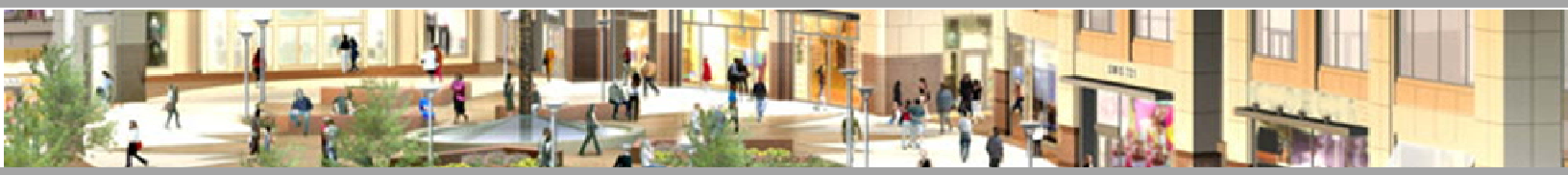
Wisconsin Place Residential

Chevy Chase, MD



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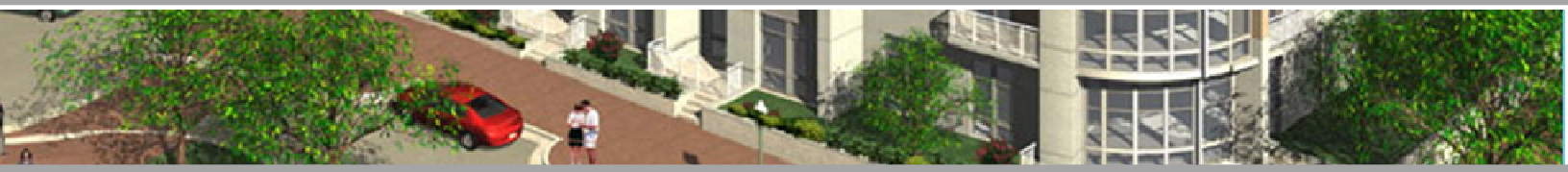

Technical Assignment #3
December 3, 2007

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Executive Summary

Technical Assignment 3 is an opportunity to define potential thesis topics for the spring semester. Four core areas are analyzed: research, alternative methods, value engineering, and schedule compression. This report looks at critical issues that the construction industry is faced with every day and proposes some solutions to these problems. In addition to this, several project-specific problems are pinpointed and briefly described. These could certainly be incorporated into thesis research as well. Finally, three analysis activities are selected as the focus of thesis research. These three topics to be explored next semester are slab coordination, building envelope, and acoustics. Slab coordination will involve constructability reviews made possible through the use of Revit software. Since Wisconsin Place is a post-tensioned structure, it becomes a huge coordination issue to fit every tendon, chair, conduit, and MEP box out into an 8 inch concrete slab. By detecting field clashes early in the design phase, this can save the owner a lot of time and money in change orders. The building facade consists of a variety of different materials including brick, glass, and cast stone. One value engineering idea would be to find one standard material or a couple of cladding materials that are compatible with one another to use as a substitute. Also, using the crane to pre-load the floors with masonry and finishing materials might be a way to eliminate one or two hoists, saving money and cutting down schedule time. City living always poses the problem of noise whether it is traffic or crowds of people or neighboring construction. Acoustical solutions will be investigated to make these 432 apartment units as sound proof as possible. A weight matrix has been completed to show which core areas will be incorporated into the spring thesis work. This will serve as a guideline for all work to follow the final thesis proposal.

A. Critical Industry Issues

The 2007 PACE Roundtable was a great success for students, faculty, and industry professionals alike. This forum presented a fantastic opportunity to discuss a few pressing industry issues. The three major themes that were touched upon were prefabrication, BIM, and labor shortages.

Prefabrication can greatly reduce schedule time and increase quality control of building elements. When something is constructed in a controlled environment there is less room for variability. Prefabricated items are also convenient when certain pieces of a building are repetitive or present in large quantities. A few downsides to prefabrication are the long lead times for items, transportation restrictions, and increased cost due to prefabrication and sometimes pre-installation. One final prefabrication issue is coordination with other trades. Who becomes responsible for the prefabricated item once it is delivered to site, and who controls the sequence of work following its installation? Field inaccuracies make it difficult to wholeheartedly accept prefabricated items on a job site. If every subcontractor could work together to build one master prefabricated unit, that would make everyone's life a little bit easier.

Building Information Modeling is becoming more of a household name than a cutting technology in this day and age. It was determined that the main barrier to BIM implementation within companies is that owners do not require it. They feel like it is still "too new" to force every contractor/architect to learn and live it. Compatibility is such a pressing issue when it comes to BIM software. Standardization would make for a seamless transition from program to program. One interesting observation is how people have entirely different perceptions of what "BIM" means. I think we need to clearly define this idea before riding forward on the BIM wave.

Labor shortages were the final topic for the PACE Roundtable discussion group. I never realized how American popular culture has altered the perception of careers for youths. For instance, storybooks tell children they can be doctors or lawyers, but never construction workers. It seems that people have a misconception about the construction industry that it is a static position as a laborer and there are never advancement opportunities. I agree that construction companies need to become more involved with recruiting labor for a project and explain to individuals the career paths they could choose. Better marketing to high school students via technical trade school or internships is one feasible solution to this.

I was fortunate enough to meet a few key contacts who are willing to help me with thesis ideas at the PACE conference. I met a senior project manager from Whiting Turner who is really encouraging and willing to offer advice on any thesis roadblocks that arise. I also spoke with an architect from Seattle, WA who might be able to lend his expertise on design issues. A project manager from Davis gave me some good advice about a software program that deals with punch list issues for building close out. I will speak to my Turner project team regarding this to see what type of coordination, if any, has been implemented to date. With 432 apartment units, standardization will be the key to moving quickly through he units and checking for quality and consistency.

I was surprised by the drastic shift in attitudes toward BIM. I attended CONVR last year and multiple industry members gave presentations on BIM that were not so widely accepted by the crowd. There was a lot of criticism and doubt. People didn't seem 100% on board with virtual modeling. This year, the focus was not on "will it work" but "how can we make it work." I think a lot of industry members have finally been swayed and realize that BIM will soon be a part of their everyday life, so they need to adjust now.

I was curious to see what opportunities were in store for intelligent models with regard to Design-Build-Operate-Maintain projects. This delivery method is growing in popularity, partly due to the push for building efficiency and sustainability. I was glad that facilities management was addressed. If a company is going to invest so much time and money into a BIM, they might as well utilize it for as long as possible, preferably for the life of the building. I would be interested to see the facilities management program that was mentioned. It would be advantageous to tag all of the major equipment within a BIM so that a notification pops up when an AHU is due for a filter change or a valve needs to be replaced.

Overall, PACE was a really positive experience and I think everyone took away some newfound knowledge about the industry.

B. Critical Issues Research Method

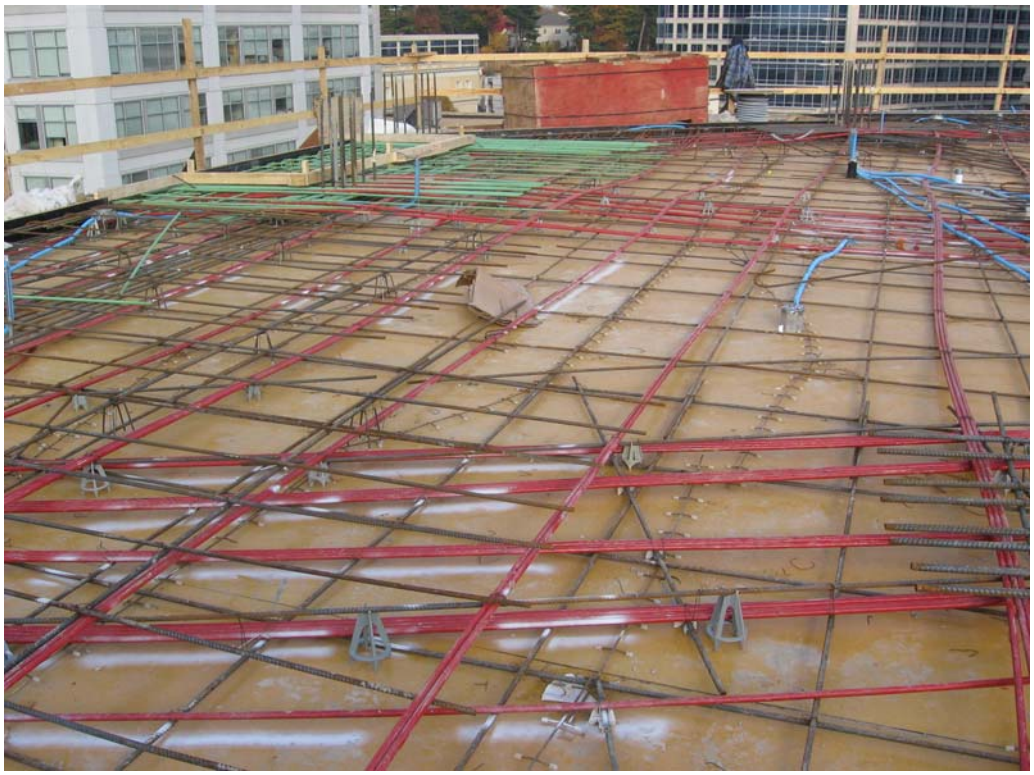
One critical issue that I wish to address in my thesis is prefabrication and the potential schedule and cost savings impacts it can have on a project. On Wisconsin Place Residential, prefabricated electrical outlets and switches are being installed to expedite the completion of all 432 units. This was 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.

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 such prefabricated elements, and conducting a literature review of the financial benefits to product standardization. Surveys are another possibility to gain information from industry members regarding prefabrication policies. 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.

C. Problem Identification

Coordination is paramount on the Wisconsin Place Residential site primarily because Turner shares the stage with three other construction managers. In addition to overall site coordination, many painstaking steps have been taken to ensure the proper placement of MEP penetrations within the post-tensioned concrete floor slabs for this 15 story building. Between conduit, tendons, and cables, there is little room for mistakes when it comes to punching holes in the slab as evidenced by the picture below. Cutting penetrations after the slab has been poured can become very time-consuming, expensive, and dangerous. If the contractor needs to make a cut after a floor slab is cured, the slab must be X-rayed to ensure they are not puncturing any stressed tendons. If someone accidentally ruptures one of the highly stressed bands, the results could be fatal. Careful planning ensures that every cable, conduit, and penetration is in the correct location. An independent structural consultant remains on site 100% of the time to verify the location and placement of each cable, which alleviates some of the workload form the project engineers.



Site logistics becomes of high importance when you are faced with the limited amount of space that Turner has to work with on WPR. Material storage, trailers, and waste must all be incorporated so that trucks can still make their way through the site for deliveries. Vertical storage could be one option to avoid a cluttered site as well as preloading floors with materials like masonry, doors, and windows. Strategic placement of items like toilets and dumpsters can make a world of difference of a congested site like Wisconsin Place.

Timely material delivery is the key to steady production on site. One subcontractor Turner has kept a watchful eye on is the cast stone fabricator/vendor. Since the supplier is a smaller company, Turner is concerned that they will not be able to keep up with the demand of the job site. To avoid this potential problem, Turner sends representatives to the cast stone manufacturing plant to verify they are producing as many pieces as they say they are in the contract and submittals. The masons recently began fastening the cast stone pieces to the façade of the building, so any delay in deliveries will surely delay the progress of the exterior skin of the building.

The buyout for WPR was a complicated issue that forced the Turner team to change the window system as a motivating factor for the bidders. The problem with bidding out the glass and masonry work is that there is so much work for these subcontractors in the Washington, D.C. area that they had no incentive to bid the project. In fact, there were no bidders for the glass and masonry at first. After tweaking the design of the window system, a few subcontractors were willing to bid on the project. By changing the window system to slab to slab windows, Turner saved Archstone-Smith $2 million, so this turned out to be a win-win situation for everyone.

D. Technical Analysis Methods

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 look into using Revit Systems and Revit Structures to draft plans that can then be used to detect any interference between the MEP and structural work.

Site Logistics

As each phase of construction is completed, I believe the site logistics plan should change to accommodate the new setting. I might look at a few critical stages of construction on WPR, i.e. superstructure, enclosure, and finishes, and design three respective site layout plans for each. I am also thinking about developing a short interval production schedule (SIPS) for some repetitive project tasks like pouring concrete or running tendons through the slab.

Punch List Process

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 might also research some web-based programs that could make the final crunch time run a lot smoother and keep the entire project team involved and updated.

Building Envelope

As a value engineering idea I might consider limiting the types of façade materials for the outside of the building. Since cast stone is not the most reliable of resources, I might try to replace it with a different color brick or some type of EIFS. I may also try to re-sequence the façade construction. Pre-loading the floors with masonry could also save time and possibly eliminate the rental cost associated with use of a hoist.

LEED Analysis

Archstone-Smith could benefit immensely from implementing green design elements into their urban residential tower. The use of recycled materials is one way to gain LEED points on a jobsite. In addition, I will investigate energy efficient windows since they do make up such a large percentage of the façade. All apartment windows were value engineered to span the floor to ceiling height, and the atrium is essentially a glass curtain wall in a metal framing system. The environment could also be spared if the equipment used on the jobsite ran on cleaner fuels like natural gas or hydrogen, as opposed to diesel.

Acoustical Analysis

Since it is located in a populated city, noise will definitely be an issue for Wisconsin Place. Also, the fact that this tower is being constructed amidst an office, major retailers and restaurants will be enough reason to focus on traffic and sound attenuation. I might 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.

Concrete Pours

While I was visiting the site recently, I noticed that a crane and bucket is used to pour the columns of WPR while a pump is used to pour the large sections of floor slab. It seems like productivity would increase if a pump were used for both, especially since they pour several columns in a given day. I realize this may be a costly alternative, but I would like to analyze the cost and schedule impact that would result from using two pumps a day as opposed to one. This would also free up the tower cranes for other activities. This then leads to one final idea of optimizing crane efficiency and potentially eliminating one of the three Turner cranes that is onsite. If two tower cranes can satisfactorily service all areas of the building, I don't se why a third is needed to supplement the other two. Eliminating the crane and bucket pours might be enough of a reduction to get rid of the third crane, and this would result in huge contractor savings.

E. Weight Matrix

The following is a table 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	10%	10%	60%	20%	100%
Analysis 2 - Building Envelope	20%	40%	10%	30%	100%
Analysis 3 - Acoustical Analysis	50%	30%	10%	10%	100%
Critical Issue - Prefabrication	20%	20%	20%	40%	100%
Total	100%	100%	100%	100%	