West Village Commons
Towson University
Towson, Maryland

Thesis Proposal
December 11, 2009

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-Executive Summary-

The past three months have been spent analyzing all aspects of West Village Commons in preparation for research next semester. This report will highlight 4 analysis topics that will be researched and related to this project. In addition to the topics below, I will also be exploring two breadths; a structural and a mechanical analysis.

Integrated Project Delivery

The current relationship between the architect and the contractor is not very ideal for several reasons. One can be attributed to differing business related goals. This analysis will analyze the idea of using an integrated project delivery method, where the owner, contractor, and architect will all sign one contract. Much of the research conducted will be used to create a project execution plan that could have been implemented at this project's inception.

Structural Steel System

The original plan for the structural system was to use structural steel. Barton Malow suggested the idea of using concrete for the north end of the building so construction could begin earlier. This changed the entire design of the project which could have been avoided if the contractor was brought on earlier. If a steel contractor had been part of the design, this project could have started just as earlier and been constructed faster. I will analyze the construction cost and schedule reduction of using a steel structure. I will create two 4-dimensional models to show the differences.

Prefabrication of Brick Veneer and Curtain Wall

Because enclosures are a major part of the critical path, an analysis into the use of prefabricated systems will be conducted. This will allow for quicker installation and lower labor costs. It will also allow for a safer construction site if the curtain wall can be installed from the interior of the building. A brief amount of time will be spent to increase the energy efficiency of the systems.

West Campus Utility Plant

The east side of campus uses a centralized utility plant, but Towson decided not to build one when the expanded to the west. This analysis will take a look at the impacts that a central utility plant would have had on West Village Commons if one was built. I will research the changes a utility plant would have on the building load, efficiencies, and distribution systems.

-Project Description-

Towson University of Maryland, located in Baltimore began a progressive expansion onto west campus about 10 years ago. West Village will become the epicenter for student living at Towson University, and the West Village Commons will be the center piece for the entire area. The 85,000 square foot commons building will be home to dining amenities, study spaces, and a large, flexible multipurpose room. Towson's new green initiative on campus has prompted the University to strive for a LEED Silver rating. West Village will use low flow plumbing fixtures, regional materials, a green roofs system, and several other sustainable techniques.

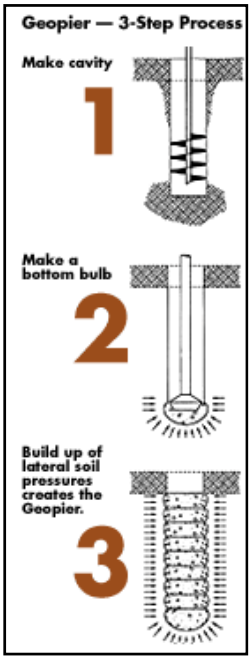

Figure 1: Geopier Installation

West Village has some interesting engineering systems, one of which is the structural design. The foundation for the north end of the project utilizes Ram Aggregate Piers (Geopiers). Figure 1 is an image from GeoStructures that shows how a Geopier is installed. The foundation construction is fast; all 80 of them will be completed in about 2 weeks.

The north end of the building is a 4 story concrete structure with drop panel columns. The south end is a bridge over an existing roadway and is made of structural steel. It is a two story structure beginning on the 3rd floor of the north end. Another interesting system is the mechanical design; there are seven separate air handlers, located on the roof and in the basement. This allows for greater control and backup if one of the AHU were to breakdown.

The project has a $27 million dollar budget and is broken into two separate bid packages. Bid package A contains all initial site work, foundations, under slab MEP, and structural concrete, and bid package B is all of the remaining trades. The Barton Malow Company was brought on as a construction manager at risk early in the project. They created the two packages so as to begin construction earlier. Figure 1 below is a table from Technical Assignment 1 which shows the cost breakdown of the two packages.

Building Construction Cost		
Package	**Construction Cost (CC)**	**CC/SF**
Bid Package A	$5,222,789.04	$61.44
Bid Package B	$21,924,265.00	$257.93
Total	$27,147,054.04	$319.38*
*Does not include earth retention, landscape, site utilities, design and preconstruction fees		

Figure 2: Construction Cost Breakdown

The project schedule will take approximately 19 months to complete and will be open in time for the 2011 school year. Some of the main issues on the critical path include Levels 3 and 4 structural concrete, all exterior studs and sheathing, brick veneer, the east curtain wall, and the basement MEP room. The project site is very constrained with a one-way only access road to the LOD. All contractor parking is located half a mile away, and with no large areas for shakeout, large materials must be delivered the day they are installed.

West Village is relatively small in stature, but it is not without difficulties. My proposal will evaluate different options that the project could have taken to mitigate constructability issues.

-Critical Industry Issue-

Integrated Project Delivery

Opportunity for Resolution

The construction world we live in currently embodies one of hostile and adverse relations, little collaboration, and finger-pointing mentalities. When issues of design and construction occur, they appear too late for pro-active solutions. Innovative efforts are hampered by wasted time defending liability and the quality of a finished product deteriorates. Designers lack the experience of nuts and bolts construction; Constructors have no ability to give input on design, cost, schedule, etc…until it is too late in the project; and owners face a process whittled with unforeseen costs and a vague vision of their product. The architecture, engineering, and construction industry is a trying world that sometimes lacks professionalism and efficiency, but the world of Integrated Project Delivery (IPD) could offer a solution this industry has been searching for.

West Village Commons did bring in a contractor early to help plan out the construction sequence and create an accurate estimate. But the relationship between the contractor and the architect is very strained. Victor Sanvido of Southland Industries told me during a conversation that the Architect does not understand the financial risk the contractor takes on, and the contractor does not understand the professional liability the architect takes on. The goals of both are not aligned and until they are, project communication and efficiency will not reach full potential. There needs to be a delivery system that unites the key members involved, the architect, contractor, and owner, and creates common goals for the entire project team.

Research Goal

This industry topic can be a daunting task to evaluate because it is hard to place a physical value on efficiency. Because this delivery system is quite new, it will be challenging to find quantifiable solutions. The goal of this research is create a delivery system that would have harnessed the full potential of communication, the benefit of bringing on a contractor at project inception, signing a single contract based on project goals, and utilizing the full potential of BIM technologies. I will also research possible solutions to IPD issues such as bonding and insurance problems and quantifying profit based on project goals. Finally I will compare and contrast the AIA sample IPD contract and the AGC's Consensus contract; find the commonalities and research solutions to the differences. IPD will be the overarching theme for my entire Thesis project: How IPD could have made these analysis topics possible, and the cost benefit of using an integrated delivery system.

Methodology

- Research different symposiums and conferences regarding IPD
- Continue conversations with individuals who have worked on IPD projects
- Analyze the preconstruction costs for bringing on a contractor and key subcontractors early
- Research the possible solutions to bonding, insurance, and contract issues
- Create project goals and risk distribution among the key trades
- Create a project execution plan that may have utilized at project inception. This plan will indentify key members (including key subcontractors), identify the project goals, describe the BIM plan, distribute risk among the parties, develop a design plan, and distribute project responsibility.
- Analyze the execution plan for cost benefits, advantages, and disadvantages.

Resources

- Industry leaders who have worked on the few IPD projects (or similar delivery methods), especially Southland Industries, Barton Malow Company, and DPR Construction.
- AGC and AIA symposiums reports on IPD
- Barton Malow Project Team
- Towson University Owner Representative
- Barton Malow Legal Department

Expected Outcome

The outcome from my research should create a plan that could have been used for Towson West Village Commons. University projects are a great candidate for IPD because they have very experienced building industry personnel. IPD requires a very involved owner. My largest goal is find some hard evidence of value that IPD may provide, whether it is cost savings, schedule savings, or the ease in the construction process. Using a project such as Sutter Medical Center, which used IPD, as a model will help give me a basis for creating West Village's project execution plan.

-Analysis I-

Structural Steel System

Opportunity for Resolution

The project originally was planned as an all steel structural system, but the contractor suggested using concrete so construction could begin earlier. The project would have had to be 100% designed before construction could begin. With concrete, the project could be broken up into an early bid package and begin before design was complete. Currently concrete is falling behind due to rain delays, and is proving to be a menace to coordinate embeds and sleeves. Concrete also takes much more time to construct, especially when forming drop panels around the columns.

Research Goal

The focus for this analysis will be to evaluate the cost and schedule impacts of constructing an all steel system. I will create a steel sequencing plan with durations from the current steel erector. The goal is provide a system that will satisfy all building loads as well provide an efficient construction process.

Methodology

- Design a typical bay and distribute among the north end of the building. The changes in the mechanical system and façade will have an effect on the structure, and will also be taken into consideration. This analysis ties in with my structural breadth
- Speak with steel erectors to estimate durations, more specifically piece set per day.
- Estimate the cost difference in material and calculate the savings from general conditions due to reduced time
- Create steel sequencing plans that maximize efficiency.
- Create two 4-dimensional models to compare the current design and an all structural steel design.
- Create a site plan that will maximize the small amount of space for shakeout.
- Analyze the impact on overhead mechanical space, ties in with mechanical breadth

Resources

- Project Team from Barton Malow
- Structural Engineer for West Village commons
- Revit and NavisWorks
- Structural Faculty and Classes previously taken.

Expected Outcome

The outcome hoped for this analysis is to show how a structural steel design would help shorten the project schedule and maximize construction efficiency. I will consult Barton Malow to evaluate the cost of working overtime to make up for weather related issues. By creating two 4-dimension models, I can create a good visual representation of the difference in construction. With using IPD, a steel subcontractor can be brought in during design. I would like to prove that this expedites the design and construction phases by minimizing construction issues, maximizing erection time, and eliminating the shop drawing phase.

-Analysis II-

Prefabricated Curtain Wall and Brick Veneer

Opportunity for Resolution

Currently, enclosures are a major part of the critical path and is key to beginning work in the interior of the project. There is very small space between the site fence and the building exterior work which makes construction difficult. Finally the project is only pursuing 4 LEED points in optimizing energy. Towson could be seeing greater long time energy cost savings by using a more efficient enclosure system.

Research Goal

By analyzing a prefabricated system for the curtain wall and the brick veneer, I hope to show that critical path can be shortened. I hope to show that while prefabrication may have more material and transportation costs, labor costs will be minimal. I would also like to show that installation of the curtain wall sections may be safer if done from the interior. In terms of energy efficiency, I would like to research a system that would provide greater energy savings. I would like to analyze initial costs and long term savings of this system.

Methodology

- Analyze the current site to see if prefabrication installation is possible.
- Create a site plan to shows shakeout and sequencing of installation. Explore interior installation process.
- Analyze safety benefits
- To tie in with structural breadth, calculate additional loads on the proposed structural steel system by using prefabricated enclosures.
- Apply durations and sequencing to 4-dimensional model.
- Research energy saving curtain wall systems and conduct a cost analysis of initial vs long-term.
- Compare architectural value of precast brick vs. laying brick

Resources

- Revit and NavisWorks
- AGC, USGBC, and AIA publications on energy saving materials
- Barton Malow Project Team
- Precast fabricator and erector (possibly Shockey Precast)
- Curtain wall contractor

Expected Outcome

I hope to prove that by using prefabricated panels of brick and curtain wall, that the time saved and the labor cost saved will outweigh initial material costs. I expect to show that the process is not only safer, but also more efficient. I also hope to prove that this system could be more energy efficient proving long term savings. This will tie into my IPD theme by showing that a precast contractor, if brought on early, will be able to design with the engineer. This can eliminate the shop drawing phase and allow adequate fabrication time. It will be interesting to see the effects that IPD could have on LEED.

-Analysis III-

West Campus Central Utility Plant

Opportunity for Resolution

The east portion of campus runs all heating and cooling utilities through a central utility plant. When the plan to create West Village came to fruition, no central utility plant was planned. One of the reasons was that the apartments would be privately owned, leasing the land from Towson. Without a central plant on west campus, the individual buildings have to create their own energy with their own air handlers. West Village Commons specifically has 7 different air handlers, leading to increase in structural load on the roof and an increase in initial mechanical costs. Electrical utilities may have been tied in with the east campus grid (whose source is the east utility plant), but instead Towson decided to just allow Baltimore Gas and Electric (BGE) to run power. They now rely on BGE's electrical costs.

Research Goal

The goal for this research topic is to explore the cost benefits of using a central utility plant to create heat and cool air for West Village Commons. Some of my time will be evaluating the advantages and disadvantages to the entire West Campus areas, but the majority of the time will be spent evaluating the costs savings of eliminating some of the 7 air handlers. This will tie in with my structural breadth by lowering the dead load on the roofs. I will also evaluate the effect on mechanical ductwork and air distribution (which ties in my structural breadth and mechanical breadth).

Methodology

- Interview Towson's facilities management for reasons not to use a centralized plant
- Analyze a similar university utility plant to use as a model (possibly Towson's east plant of Morgan State University's new chiller plant).
- Use the model to determine cost of a central utility plant
- Analyze West Village Common's ventilation needs and eliminate all the air handlers, except the ones needed for ventilation.
- Analyze on the change in air distribution system and ductwork (ties into structural and mechanical breadth).
- Conduct a cost analysis of the decrease mechanical equipment, lower structural cost of the roof, and change in ductwork.
- Research the energy advantages and disadvantages of using a centralize plant.

Resources

- Towson's Facilities Management
- Barton Malow's Morgan State University Chiller Plant project team
- Mechanical Faculty
- Mechanical Contractor

Expected Outcome

I hope to be able to prove that there is significant energy and cost savings that come with using a central plant. While the plant may require significant funds to construct, savings will be found in eliminating the number of decentralized systems and in creating a more energy efficient mechanical system. My goal is to also show the benefits of a central plant in terms of reliability. Many universities contemplate the idea of using a central plant for their own energy generation and my goal is to show all of the benefits and setbacks a school could face. It will be interesting to see the revenue generated by selling heating and cooling to the surrounding apartments.

-Schedule of Analysis-

Critical Industry Issue

- Jan. 12th – Begin Initial Research
- Jan. 20th to Jan. 30th – Interview industry leaders
- Jan. 30th to Feb. 5th – Analyze Benefits and Costs
- Feb. 5th to Feb. 10th – Research contract, bonding, and insurance issues
- Feb. 10th to Feb 20th – Create IPD Project Execution Plan
- Feb 21st to Feb 25th – Document advantages and disadvantages to IPD plan and its impact on design and construction
- Feb. 26th – Review with faculty advisor
- Feb 27th to Feb 28th – Revisions

Analysis III – West Campus Utility Plant

- Jan. 12th – Begin Initial Research
- Jan. 20th to Jan. 30th – Interview industry leaders
- Jan. 30th to Feb. 5th – Analyze Benefits and Costs savings (initial and long term)
- Feb. 5th to Feb. 10th – Research a similar university plant and sustainable energy sources
- Feb. 10th to Feb 20th – Analyze building load requirements and analyze building system needs
- Feb 21st to Feb 25th – Document results regarding distribution, decrease of dead load on roof, and energy costs of West Village Commons
- Feb. 26th – Review with faculty advisor
- Feb 27th to Feb 28th – Revisions

Analysis II – Prefabricated Curtain Wall and Brick Veneer

- Jan 12th – Begin initial Research
- Jan. 20th to Jan. 30th – Consult Precast Contractor and Curtain Wall Contractor
- March 6th to March 10th – Analyze cost and schedule durations
- March 10th to March 17th – Analyze sustainability of wall system and find most efficient
- March 18th to March 24th – Incorporate into 4-Dimensional Model and create site plan
- March 25th to March 27th – Documents results
- March 28th – Consult faculty advisor
- March 29th to March 30th – Revisions

Analysis I – Structural Steel

- Jan. 12th – Begin Initial Research
- Jan. 20th to Jan. 30th – Consult structural faculty and Barton Malow team on why concrete was given as a VE
- March 6th to March 17th –Design Typical Floor Bay, Roof Bay (minus air handlers eliminated from Analysis III), and typical wind bracing
- March 18th to March 24th – Change current model to a steel model and incorporate into 4-Dimensional model
- March 25th to March 27th – Analyze Costs and Schedule and Documents results
- March 28th – Consult faculty advisor
- March 29th to March 30th – Revisions

-Weight Matrix-

The following table is a breakdown of how I will be allocating my time among the research and analysis for my thesis proposals.

Building Construction Cost					
Description	**Research**	**Value Engineering**	**Constructability Review**	**Schedule Reduction**	**Total**
Integrated Project Delivery	25%			5%	30%
Structural Steel			10%	15%	25%
Prefabrication	5%	10%		10%	25%
West Campus Utility Plant	10%	5%	5%		20%
Total	40%	15%	15%	30%	100%

-Appendix A-

Breadth Analysis

Structural Breadth Description

For my first breadth I will conduct a structural calculation for the change in the structural system from cast-in-place concrete to structural steel. I will perform the calculation for a typical bay on one of the floors and distribute it to the rest of the project. I will also calculate a roof bay for all building loads, minus the subtraction of air handlers due to the use of a central utility plant. I will distribute this bay throughout the roof. I calculate the change in loading on the exterior girder beams which will be supporting the new prefabricated brick veneer.

My structural breadth ties into my analysis of using Integrated Project Delivery because IPD will allow a structural contractor to help during the design phase. I will also analyze the impact on overhead mechanical systems (mechanical breadth) for the depth of beams may have an impact on distribution.

Mechanical Breadth Description

For my second breadth I will research the effects that a steel system and a central utility plant would have on the overhead distribution of the mechanical system. I will also be analyzing the effects that a central utility plant has on energy efficiency and energy cost reduction. Because sustainability will have an impact on energy source a utility plant, I will break down the cost savings this will have on West Village Commons.

This analysis will tie into the structural steel analysis in that the depth of steel beams will decrease the amount of room for overhead mechanical systems. A central utility plant will also lower the dead loads on the roof of the building, as well as claim back valuable building space. The type of systems required for West Village Commons will drastically change when a utility plant is used.