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TECHNICAL ASSIGNMENT #3

OFFICE/RETAIL BUILDING
WASHINGTON, D.C.

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EXECUTIVE SUMMARY

Technical assignment #3 is meant to identify issues of the project that show potential areas of research. Included in this report is a glance at critical industry issues in the construction world, a critical issue research method, problem identification for the thesis project, and technical analysis methods for each area of study.

The PACE (Partnership for Achieving Construction Excellence) Roundtable introduced several important industry issues affecting today's construction world. Among these issues were prefabrication, BIM (Building Information Modeling), and labor shortages. These three issues provided a basis for me to highlight potential areas of researching a critical issue that I can relate to the office/retail building.

The critical issues research method identifies a critical issue that will be pursued with research relating to the office/retail building project. This will involve studying a major decision that an owner faces during the beginning stages of development in an urban location: Is it better to renovate the existing building, or demolish and re-build it? There are many issues involved with making this decision from the owner's standpoint, and I plan to analyze various factors relating to the project under study.

It is always important to consider what could have been done better after a construction project is complete in order to learn from the mistakes. The problem identification section identifies several problematic features of the office/retail building that could be analyzed in a detailed analysis of technical building systems and construction methods. These problems are identified under the topics of value engineering, constructability review, and schedule reduction.

Finally, the technical analysis methods are a more in-depth look at several problems affecting the office/retail building design and construction. These analysis topics include renovation versus new construction, investigating the pursuit of LEED (Leadership in Energy and Environmental Design) accreditation, and implementing a SIPS (Short Interval Production Schedule). A weight matrix showing the emphasis on value engineering, constructability review, and schedule reduction for each technical analysis is also included.

CRITICAL INDUSTRY ISSUES

This year's PACE Roundtable took place at the Nittany Lion Inn on October 24. There were three panels made up of industry members and faculty who discussed several important industry issues pertaining to construction. Each member of the panel introduced himself and his background before entertaining questions from audience members relating to the topic being discussed. The three topics included prefabrication, BIM, and labor shortages. These three important industry topics gave me a starting point for considering areas of research and study relating to the office/retail building.

Prefabrication

The first industry topic introduced by the panel was prefabrication. Prefabrication is seen and used in many different trades in some aspect, and really should be optimized to its fullest potential. The use of prefabricated materials presents better quality systems, minimized waste, and savings in schedule time. Prefabricated materials are built in a controlled environment to allow for better quality control free of risks from outdoor conditions on a construction site. Less waste is accumulated in a factory setting since the materials can be easily recycled back into the manufacturing process. Buildings are typically completed sooner with a greater use of prefabricated materials, thus allowing for an earlier return on the invested capital for the owner.

Coordination is an important factor to manage when dealing with prefabricated pieces, whether it is as simple concrete wall panels or as complex as a "smart wall" used by Hensel Phelps on the Pentagon Renovation Project. Each party involved in using prefabrication or having work around the prefabricated materials needs to be involved in a careful planning coordination process. Building Information Modeling is one good solution to the coordination issue, as each party can visually see the problems that arise with logistics and sequencing.

Building Information Modeling (BIM)

Next, a different panel introduced the topic of Building Information Modeling, or BIM. The members of the panel really stressed that BIM is more than just 3D modeling and visualization. Instead, BIM is a model-based technology linked with a database of project information.

BIM has many benefits from both a construction and marketing standpoint. In construction, it allows for more prefabrication potential, as well as generating fewer RFIs. It can even be used in estimating for automated take-offs. BIM is also used in marketing proposals, as it has outstanding visual capabilities to show the owner the contractor's plan of action. Aside from that, BIM improves efficiency by helping facilitate project delivery and helps to ease the fabrication effort.

BIM certainly has a long way to go before being used to its fullest capabilities in the construction industry, especially in the issue of implementation. The greatest challenge is getting the entire industry on board, as many companies prefer to do things in a traditional fashion. For BIM to really take off and be successful, standardization for its use needs to be implemented, and practices for the future must be kept consistent. Also, assessing risk and responsibility for the model itself can be an issue. The Project Alliance Contract drives BIM contractually, and architects are often the liable party for flaws in the model.

Labor Shortages

The third and final topic discussed at the roundtable was labor shortages. The industry is seeing more and more trade companies dying out for numerous reasons. These include government regulation of illegal immigrants, as well as parents in the trades not recommending their line of work to their kids. There are some conflicting laws in place regarding documentation of immigrants, which severely affect the job market for construction tradesmen. Also, the image of a construction worker is not very appealing to a middle or high school student.

Fixing the problem of labor shortages starts with pushing the federal government to allow for easier documentation abilities for immigrants interested in working construction, as well as improving the image of a construction worker to young people. The huge competition for a limited work force drives the wages up, and immigrants can make quite a living working in a construction trade. Some companies are taking the initiative to implement high school programs to try and gage interest in students to go and work in the construction industry, particularly in the trades, upon graduation.

CRITICAL ISSUES RESEARCH METHOD

The critical issues research method chosen for the office/retail building pertains to the decision made by owners and developers to either renovate an existing building or demolish and re-build it, particularly in an urban setting. Space in a highly populated downtown area, such as Washington, D.C., is at a premium. Most times, downtown construction either involves a renovation of an existing building or a complete demolition of the existing building to be rebuilt with new construction. There are advantages and disadvantages for each method of construction, and careful analysis should be considered for each project before any action is taken. The challenge facing the industry in an urban market lies within what is the most profitable design and construction method for all parties involved to ensure a high quality building is constructed. Maximizing the space available for lease while minimizing the construction time is the key for project success in a highly-developed downtown area.

The goal of the research is to come up with a systematic approach to decide what the better option in an urban environment is: renovation or new construction. This will mostly benefit the owner, but does involve all parties to work together and deliver the project in an efficient manner. The research will include interviewing experienced owners and urban developers to find out what their criteria includes when figuring out whether to renovate or demo and rebuild. The goal is to get at least ten industry professionals to perform the interview survey and summarize the results from those.

Several survey/interview questions (for developers) will include:

- Do you primarily chose to renovate over demo/new construction, or vice versa?
- What are the major factors involved with the decision?
- What are the advantages/disadvantages of each method?
- What are the biggest challenges in each method?
- What would you recommend for a project description similar to that of the office/retail building (my thesis building)

I plan on compiling the surveys and interviews, then summarizing the results. The research will rely heavily on responses to the surveys distributed to industry professionals. The surveys are directed mainly towards developers, but I plan on interviewing architects and contractors with modified questions to see how different (or similar) the preferred method on construction and goals for each party can be. Since my thesis building is located in Washington, D.C., I will primarily focus on industry members from the downtown D.C. area. However, the research could potentially be used on a broader scale outside of the D.C. metropolitan area. Aside from interviews with industry professionals, I will research published articles on this issue to add to my report.

PROBLEM IDENTIFICATION

Value Engineering

- Demolishing the entire building and erecting it again as new, adding more rental space and maximizing floor to floor height of the building.
    - A central atrium designed into the new construction would allow for a more aesthetically pleasing workplace with greater daylight allowances.
- Prefabricating more materials, such as the building envelope or interior walls on the first floor and the core, will reduce labor costs and increase quality when produced in a controlled environment.
- Taking steps towards LEED accreditation improves sustainability and indoor environmental quality.
- Using epoxy paint in place of intumescent paint for steel fireproofing.

Constructability Review

- There are a few different façade types and materials used to tie into an existing structure, and managing the building envelope system on the project is important to avoid leaks.
- There were many two-story curtain wall panels put into place, which was very labor intensive. Prefabrication of larger size panels would decrease the labor and schedule time.
- With many different contractors, including the general contractor and various tenant contractors, site congestion was an issue. Careful planning and delegation of delivery times, site storage, sequencing, etc. should be considered.

Schedule Reduction

- Demolishing the building and erecting it again as new. The selective interior demolition was a major delay in the schedule.
- Implementing a short interval production schedule for the core of typical office space floors 2-10.
- Using a greater amount of prefabricated materials for the building envelope.
- Using an alternate project delivery system, such as design build, rather than design-bid-build.
- Working overtime to complete the project and get the tenants moved in sooner.

TECHNICAL ANALYSIS METHOD

The ultimate goal of the technical analysis is to create a high quality office/retail building while reducing the project schedule. The schedule reduction methods, along with the constructability review and value engineering, will be analyzed to determine the construction costs the owner can save and the profit of leasing out the office and retail space sooner. The three analysis topics include renovation vs. new construction, investigating the pursuit of LEED (Leadership in Energy and Environmental Design) accreditation, and implementing a SIPS (Short Interval Production Schedule).

Renovation vs. New Construction

During the interior demolition period of the project, several problems came up and delayed the construction schedule. Since demolition was on the critical path, and no work could start before the interior walls were correctly gutted, a careful plan and assessment had to be done. In this case, a major problem occurred when there was confusion with the demolition contractor's scope of work, which in turn caused the project to not meet important milestone dates.

In addition to the selective demolition issues, the number of core drilling submittals also produced some delay in schedule. Any time before the existing concrete floor slab could be penetrated, a lengthy and time consuming process had to be conducted. First, the area had to be scanned from both the underside and top of the slab, and the reinforcement bars had to be marked with chalk. It was important to differentiate between top bars and bottom bars. Then, the general contractor took a picture of the spot in question, and forwarded that on to the structural engineer as a submittal who carefully analyzed it before approval. Confirmation from the structural engineer had to be obtained before any core drill in the existing concrete slab was performed. This system caused several time delays, as issues sometimes came up very suddenly and a drill needed to be made right away. This could not be done until the contractor properly documented the area in question as a submittal to the structural engineer, who sometimes took a couple weeks to return it as approved or rejected.

These issues mentioned are unique to a renovation project, and could be avoided if the entire building was demolished to be rebuilt as new construction. At first glance, new construction seems to be a lot pricier for an owner/developer, but it also eliminates certain issues and brings up the opportunity to vastly improve the building. New construction would allow for the square footage of rental property to increase, as well as the floor to floor height. The total demolition and rebuilding also allows for better aesthetic qualities and can maximize efficiency and functionality.

LEED Implementation

LEED accreditation is becoming more popular in today's design and construction industry as owners and developers are looking to become more environmentally friendly and sustainable. For the office/retail building, however, there was not much consideration for LEED accreditation. I am interested in investigating the systems and construction methods involved in this project and recommend areas of potential points in the LEED classification system. The goal will be to see how feasible and desirable it is for this office/retail building to achieve a LEED gold rating.

The LEED scoring is made up of six categories, including sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design process. For the office/retail building, the highest potential areas for LEED points fall under the categories of sustainable sites, materials and resources, and indoor environmental quality. Alternative transportation in the form of public transportation access and bicycle storage is a good possibility under the sustainable sites category. Also included in that category is the potential for an improved storm water management system and a roof garden. The materials and resources category deals a lot with the construction methods and materials involved. Points awarded for improved building reuse, construction waste management, resource reuse, recycled content, and local/regional materials are all achievable. Finally, the indoor environmental quality category will rely a lot on the HVAC system design in the building. This could be modified to accommodate the LEED points of carbon dioxide monitoring, increased ventilation, the use of low-emitting materials, controllability of systems, thermal comfort, and amount of daylight.

This analysis will look at what needs to be done to make this a LEED gold building in terms of cost and schedule factors. My research will also involve looking at similar type projects and talking to additional industry members, both designers and contractors, to get a better understanding of LEED projects and implementation methods for urban development. Finally, I plan on asking the owner of this office/retail building if these changes were feasible and worth investing in to gain LEED accreditation. Although construction of this building is already complete, it may give the owner something to consider for a future project with similar features.

Short Interval Production Schedule

On this ten-story core and shell office building, there is a lot of repetition involved in the construction. This repetitious activity, when combined with equal sized spaces, allows for implementation of a short interval production schedule, or SIPS. SIPS, also known as a "parade of trades", is a great tool used to decrease the project schedule. Each trade involved in a certain area has a defined amount of time to complete their task, which then moves onto the next trade who has the same amount of time to complete their task. The service core of the typical office floors of 2-10 allows for a SIPS to be effectively implemented.

I will complete the analysis by equally dividing up the service core into four areas and determining an amount of time needed to complete a task. I will obtain this information by

talking to industry members, namely subcontractors, to determine a reasonable amount of time to complete each task. R.S. Means is another source I can use to assist me in my research, which will primarily focus on schedule reduction methods. When using a SIPS method, it is very important that each trade is on board and understands the importance of keeping up with their respective work in order to not push back the schedule.

WEIGHT MATRIX

The following weight matrix is a breakdown of the emphasis on value engineering, constructability review, and schedule reduction for each technical analysis:

WEIGHT MATRIX					
Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
New vs. Renovation	25%	5%	5%	10%	45%
LEED	20%	5%	5%		30%
SIPS	5%			20%	25%
Total	50%	10%	10%	30%	**100%**