Thesis
Technical
Assignment III

1099 New York Avenue
Washington, D.C.

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Executive Summary

This Technical Assignment takes a look at tentative areas for research analysis and possible improvement for the project at 1099 New York Avenue. Included in this technical report are Critical Industry Issues, Critical Issues Research Methods, Problem Identification, Technical Analysis Methods, and a Weight Matrix that displays how I plan to distribute my time over the next semester.

The Critical Industry Issues section is a brief synopsis of the panel discussions from the PACE (Partnership for Achieving Construction Excellence) Roundtable on October 24, 2007. Issues covered by the professionals include Prefabrication, Building Information Modeling, and Workforce Development.

The Critical Issues Research section shows how I plan to further investigate the utilization of Building Information Modeling (BIM) for the MEP Coordination process. There were some issues with the typical core construction on 1099 New York Avenue and I plan to determine if the conflicts may have been avoidable if BIM had been implemented during prior to installation.

The Problem Identification and Technical Analysis Methods Section highlight areas of the project that I think could use come improvement. The problems identified include sustainability, MEP coordination at the building cores and main lobby, schedule impacts from changing the sequencing of the main lobby activities, and constructability issues with the east façade. Further investigation next semester will be dispersed over four different categories: Critical Issue Research, Value Engineering Analysis, Constructability Review, and Schedule Reduction/Acceleration Proposal. The projected breakdown for my time allotment between these categories is 35%, 20%, 25%, and 20% respectively.

A. Critical Industry Issues

The following is a brief synopsis describing each of the three panel discussions from the PACE (Partnership for Achieving Construction Excellence) Roundtable that was held on October 24, 2007 at the Nittany Lion Inn.

Prefabrication

The general focus of this session was the many challenges that the industry is starting to face as more and more prefabricated components are being implemented into projects in the United States. The discussion began with a compare and contrast with prefabrication in residential and commercial construction projects. Both markets follow similar guidelines for location, code, and architecture.

The consensus was that the key to prefabrication, no matter what level of construction, is making key decisions up front. Trends in decreasing amounts of effort from the design standpoint have been observed which have in turn resulted in a concern for quality from all parties involved. This situation can be improved by including the general contractor or construction manager earlier in the design phase of the project. The earlier in the project that collaboration between all parties begins, the earlier the process of bringing elements to customization can be made more efficient.

There were also considerations for LEED that were discussed as benefits. Some of which include the reduction of waste on site, the operating efficiency of a preinstalled system, and the ease of staying within the 500 mile radius for material shipping.

What surprised me the most was Mr. Charles Yetter's placement on the panel. Mr. Yetter works for Tishman Speyer Properties, a real estate developer in the Washington D.C. area. Typically the push for prefabrication is not on the owner's end, but on the contractor's instead. It intrigued me that there was such push for development from someone in this position.

Mr. Yetter is the owner of the building that is the subject of my thesis, and I was given the opportunity to speak with him the night before the roundtable about a few things. We discussed what role prefabrication had played in the construction of the curtainwall at 1099 New York Avenue.

The curtainwall on my project is a very complicated system in which each panel of glass lays in a different plane. Therefore, the more that can be assembled prior to on site delivery, the more efficient the installation process can be. Before each of the curtainwall panels was delivered to the site, all glazing, flashing, gaskets, and sunshades were assembled as one unit. This way,

installing the system was as easy as "snapping" the pieces together, and problems such as compromising the waterproofing during field glazing could be avoided.

Building Information Modeling

The goal of this session was to present the current status of Building Information Modeling (BIM) in the industry and discuss the different experiences professionals are having with ushering in this new process.

Right now the biggest barrier that BIM is facing is that owners are not requiring the use of it on their projects. This is largely due to the fact that people are generally inexperienced with the BIM process and are unaware of the benefits in can provide. Current challenges include the lack of tools that are available and the inefficient use of the tools that are. Not all designers or contractors are equipped with the appropriate software or hardware to effectively produce a BIM model. Those who are adequately equipped still struggle because of the lack in standards for software formats and data exchange. Translating the information to other parties (i.e. the owner) has proven to be difficult as well.

The primary question, once a model is developed, is "at what time does the design liability shift to the contractor?" This is where the lines between authoring and using the model become blurred. A design firm may create a model, but it is the contractor who will be using it for such processes as estimating, scheduling, and coordination of trades. How much of the model should be completed before it is turned over? Who is at fault if an error is found in the field after construction begins? Should the contractor have changed the model if a conflict was noticed beforehand? What changes can be made to facilitate this process and make BIM more productive? The most surprising thing was that no one really knew. There is no real structure to the BIM process just yet. The lack of a standard procedure leaves so many crucial questions to go unanswered.

One of the challenges that my thesis project is facing right now is the construction of the building cores. On paper the design appeared as if all the mechanical systems would fit into the space allotted, but as installation progressed Davis Construction found that the plenum, in actuality, was not large enough. Here a BIM model could prove to be very useful. If the designers had created three dimensional representations of their designs, each of them could have been merged together and used to present an enhanced graphical representation of the finished product for the project team. As a result, the conflict would have been discovered well before any installation had begun and eliminated the need for redesign in the field and loss of time in the schedule.

Workforce Development

The topic of discussion on this panel was the creative techniques to address labor and management workforce challenges. The most common challenge that professionals are facing is the language barrier. Laborers are becoming more difficult to manage, as most of them no longer speak English. In addition, the level of education of employees has become a concern. Many laborers have not had schooling past the high school level. Companies do offer Spanish courses and vocational training to their employees, but have become more hesitant to do so recently as a result of a high turnover rate. Companies do not find it favorable to invest their time and resources when employees are difficult to retain.

There was a general consensus that industry needs to take action and develop a strategy before the issue becomes a crisis. This should be a company-wide goal, not just an effort from the human resources department.

1099 New York Avenue is located in Washington, D.C. where an overwhelming portion of the labor force is Hispanic. The language barrier most certainly is a concern for the project on a daily basis. Because of the competition however, the low cost of labor makes it nearly impossible not to hire these workers. Communication on this project, as well as any other, is essential to a successful completion. Each of the contractors on the project has made a conscientious effort to make communication with all employees a possibility, but not everyone is able to connect without some form of translation.

B. Critical Issues Research Method

Critical Issue: Utilizing Building Information Modeling for MEP Coordination

Problem Statement: With decreasing plenum spaces and increasing complexity of design, it has become more of a challenge to coordinate multiple systems in a single space. There needs to a method that meets this challenge in the industry and creates a precedence for future projects.

To begin my research I would like to interview different professionals that are currently using BIM for coordination purposes and create a general consensus of what the standard operating procedure is since there is not one currently in place. I will ask them what parties are typically involved, what roles they play, what their process is and if there were specific instances where BIM proved to be exceptionally beneficial. From this survey, I will develop my own process and create a three dimensional model of the typical core on my thesis project and its mechanical systems based off of the construction documents. I will do this by using AutoCAD or one of the

Revit Applications. Once the model is complete, I will import it into a viewing application that has collision detection capabilities, review where the design flaws are located, and make the necessary adjustments to the system.

Once my review is complete, I would like to gather information from professionals who currently do not use BIM for coordination. They will be asked questions similar to those I asked to the professionals who us BIM. I will then outline my own procedures and then begin to compare the two methods. Areas of focus will include, but are not limited to, efficiency of design, schedule duration, and communication between trades. Other topics of discussion may include the learning curve that is experienced while implementing BIM.

This resulting process can be a baseline for how MEP Coordination in the industry can be conducted using BIM technology.

C. Problem Identifications

Sustainability

Shortly after construction on 1099 New York Avenue began, Tishman Speyer Properties adopted a new company wide policy which stated that all new projects were to achieve at least a LEED Silver Rating. 1099 New York Avenue was not designed to be a sustainable building, therefore in order to achieve this rating the design and construction methods would have to be altered.

Schedule Impact

One of the signatures of a Tishman Speyer Building is the lobby. Each lobby is designed to be a high end gallery space that used as a selling point for potential tenants. From the perspective of a real estate developer, the earlier the lobby is done, the earlier they can begin to attract prospective clients and make a profit. Currently the lobby is one of the last items to be completed and turned over in the building.

MEP Coordination

During core construction of the building it was discovered that although the MEP systems had been coordinated on the drawings, there was still difficulty with fitting all the components into the physical space. A redesign of the plenum space was required to ensure that each system fit.

The same problem has been noticed in the lobby area as well. With the installation of the stone flooring and the ceiling system above, the available usable space is decreasing. This causes concern, because as stated before, the lobby is one of the main selling points of the building.

Constructability

The east façade consists of punch out windows and a masonry system that rests on brick shelves. Below the elevation is a public alley that has to remain accessible for the duration of the entire project. This presents a sequencing problem with the trades since a swing station must be used in lieu of stick-built scaffolding. If the scaffolding were used, multiple trades could be working simultaneously as opposed to in succession of each other.

D. Technical Analysis Methods

Sustainability

In order to make 1099 New York Avenue a sustainable project, several building systems and construction methods would have to be augmented to meet LEED specifications. Investigation into this issue would have to begin with research in the U.S. Green Building Council's requirements for the different LEED Ratings. Once obtained, the construction documents should be reviewed to see if any aspects already meet LEED specifications. Next, a list of areas for improvement should be composed and be assigned the point values. Possible areas of focus could include the mechanical system, the addition of a green roof, building enclosure, and the recycling of waste materials.

Typically on a project, the largest portion of LEED points comes from the mechanical system. To analyze this for my project, I would research the common components that are used on sustainable projects, determine which ones would be integrated the best and perform an assemblies estimate to provide cost differential information.

Currently, the roof of the building is designed to be accessible to the public. In light of this, the addition of a green roof becomes another valid LEED option. If vegetation were to be incorporated into a certain percentage of the roof area, the rating for the building would be higher. Of course changing the composition of the system would require investigation into the structural integrity of the current roof structure in order to ensure the new system can still be supported. To do this, I would have to determine how a green roof would alter the loading on the roof then compare it to the maximum load allowed. If the weight of the green roof exceeds that load, then I would have to calculate if a new slab thickness, additional reinforcement, or change in column stress would prove to be sufficient.

For the building enclosure, the appropriateness of the energy and light transfer levels could be investigated to see if the meet LEED specifications. The composition of the north and east facades could be analyzed as well for proper materials and insulation.

During the construction process, recycling waste materials can earn points for a project. The implication of a plan in which 50%-75% of all materials are recycled could prove to be beneficial. A cost analysis could be provided.

Schedule Impact

In order to change the completion date of the lobby, all predecessors will have to be reviewed. I will need to determine the earliest point in time that interior construction can begin. Then the effects that the change will have on site logistics will have to be analyzed. To open the site to the public, site work along the south elevation would have to be complete, the fence removed, material delivery into the building and lay down would have to be rearranged.

I will also have to see how this change will affect the total duration of the project. Completing this portion of the project early may in turn increase the overall schedule since the sequencing throughout the building will be altered to accommodate this change. This issue would be best investigated by using a scheduling program such us Primavera Project Management.

MEP Coordination

Both MEP Coordination uses could be easily investigated by using Building Information Modeling (BIM). Creating a model of each area would create an enhanced graphical representation of the system that could be used to clarify each trade's design. Beyond creating a model, I could also do an in depth analysis of Building Information Modeling and its current uses in the construction industry. I could compile a report that would be a comparison of efficiencies between several different projects that utilize BIM for MEP coordination and those that do not. This analysis can be done during the design and construction phases of the project in order to show the advantages of BIM throughout a full cycle.

Constructability

To solve the sequencing issues with the east elevation, the means and methods of an alternative wall assembly could be investigated. The use of the swing station cannot be changed because of site logistics; however, there may be another type of wall system that may be better suited for this type of installation. External Insulation Finishing System (EIFS) may be one of the plausible substitutions and a value engineering item as well. Research could also be done on other types of enclosures or scaffolding options.

With the redesign of a system, other areas of the project will have to be investigated as well. The structural system will have to be analyzed to see if it has the capacity, insulation and energy transfer will have to be considered, the change in material cost, and construction duration will have to be presented as well.

If a different system does not prove to be beneficial, an analysis of the current sequencing could be done to see if a different order or activity duration would be the better alternative.

E. Weight Matrix

The following table is a visual representation of how I plan to distribute my time between the research and analyses mentioned above.

Description	Research	Value Engineering	Constructability Review	Schedule Review	Total
Sustainability	15%	10%	10%		**35%**
Schedule Impact			10%	10%	**20%**
MEP Coordination with BIM	20%			5%	**25%**
East Façade	5%	5%	5%	5%	**20%**
Total	**40%**	**15%**	**25%**	**20%**	**100%**

Table E.1 Weight Matrix for time distribution