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Thames St. Wharf Office Building

Technical Assignment III

Author: Chris Bell
Consultant: Dr. Chris Magent

Chris Bell
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Executive Summery

This technical assignment looks at aspects of the Thames St. Wharf Office Building that were uniquely challenging, how certain issues were overcome, possible problem areas, schedule acceleration, value engineering and areas for further research. This report will become the basis for the final thesis proposal.

The first three sections of this report are based on interviews held with the project owner and construction management team. The first section examines constructability challenges unique to this project. The top three constructability issues are the change in construction management firms, the contaminated site soils, and the lack of coordination with the concrete superstructure. The next section contains methods for schedule acceleration. The critical path, areas of possible concern and consequences of needing to accelerate the schedule are also examined in this section. The third section deals with the value engineering that was done on the project. Unfortunately, not all of the information needed to complete an accurate value engineering section and only the limited information that could be gathered has been shown.

The last two sections of the report are based on the most problematic areas found in the first three sections. First the problems are identified with a short description of why they are issues. Then four major issues are examined in greater detail and broken out into possible research topics. These four topics include analysis on the southern facing glass curtain wall, the expensive mechanical system, the ineffective delivery method that was used and different ways energy affects the building.

Constructability Challenges

Overview:

The current construction team for Armada Hoffler Construction was interviewed to gain insight into some of the challenges on the Thames St. Wharf Office Building. As with the other two technical assignments, only the members of the Armada Hoffler team were available for interviews so none of the unique challenges that occurred during SBER's tenure could be examined fully. The major issues follow.

Changing Construction Managers:

The most unique and also difficult challenge on this project was the switch from Struever Bros. Eccles and Rouse to Armada Hoffler Construction. The change occurred in the middle of the enclosure phase and caused Armada Hoffler to have to figure out what SBER's had completed and how so that construction could continue with as little disruption as possible.

Armada Hoffler had very little information on the project from SBER so they hired a third party firm to evaluate the project and determine what had been completed and paid for to date, what had been built but not yet paid for and what still needed to be constructed. From the report they received from the third party firm they developed a schedule of values for the things they will be responsible to complete. The building owner needed to handle everything prior to the start date on Armada Hoffler's schedule of values giving Armada Hoffler no connection to things billed to SBER. This helped to alleviate any issues for AH that could stem from late payments to subcontractors and subcontractors walking off the job. And the way AH created its contracts with the subcontractors was from May 1, 2009 onward. They would pay their subcontractors only for the work completed after May 1. This meant that certain subs would be getting payments for work completed after May 1 before they received payment for work completed before May 1 because the payments issues with SBER. This prevented subs from walking off of the job due to late payment issues because they would get money for things currently under construction.

Aside from work completed the AH construction team had to discover mistakes that had been made and correct them as they went. The on-site superintendant described it like working on a renovation project with unknown conditions. Most of the issues simply stem from the different methods that one CM firm uses over another. For this project the Armada Hoffler construction team has been trying to keep things on-site as consistent with SBER's methods as possible to prevent any further issues.

Additionally Armada Hoffler did include a small contingency to cover any unforeseen conditions stemming from mistakes made on the work that was already in place when they took over the project. Any work that is required beyond what they have in their contingency will be billed as a change order to the owner as the project progresses.

Mechanical Equipment:

Prior to arriving on-site the Armada Hoffler team developed a construction schedule based on what they were told was completed and what still needed to be done. The schedule that AH had created was dependent upon the mechanical equipment being delivered soon after they arrived in May. It wasn't until the team showed up on-site and was looking through paper work that they realized that the mechanical equipment had not been ordered like it should have been and that there would be a delay because there was no equipment.

To overcome this issue AH ordered the mechanical units as quickly as they could and redeveloped the sequence in their schedule so that the mechanical equipment was no longer on the critical path. Fortunately, the absence of the mechanical units there was no delay in the schedule. The quick reworking of the schedule gave Armada Hoffler enough time to ensure that they will finish on schedule in March.

Soil Conditions:

The contamination in the soils on the Thames St. site caused work to progress slower than originally anticipated and caused a major delay in the project. For reasons that are unknown, the original CM did not expect the sitework to take much longer than it would with clean soil. Unfortunately, this was a drastic miscalculation. The delay most likely stemmed from the extra work required to make an area safe before any people that were not part of the sitework firm could work on it. This meant that for all of the underground utilities and concrete footings first the ground had to be over excavated, then the work area had to be made safe with controlled fill and then the subcontractors were allowed to do the work they needed to do. After the work had been completed the sitework contractor had to come back and backfill over all of the utilities.

This additional work required before any non-sitework could take place on the ground delayed the project at least six weeks. At one point, the concrete contractor mobilized and began working then had to demobilize for six weeks before being able to start again on the footings. After they remobilized they had to work at a slower than desired pace to allow the sitework contractors to stay ahead of them. The sitework contractor also had to be retained for longer than expected and consequently had to issue a change order for the increased work. The ultimate financial impact and remedy of this oversight are unknown.

Concrete Structure:

The concrete structure was built larger than the design had originally intended. It was built correctly per the contract drawings issued to the concrete subcontractor, but those drawings differed from the drawings issued to the other subcontractors. This had the biggest affect on the curtain wall. Multiple beams were poured two (2) inches to long and are now in conflict with the aluminum supports for the curtain wall. Additionally the concrete curbs that support the curtain wall on the ground floor were two (2) inches to tall causing the supports not to fit.

This was a problem that Armada Hoffler inherited and had no control over. They were completely unaware of this issue until they walked onto the site and found it when the curtain wall contractor came to install the curtain wall but was unable to. To remedy the situation the concrete curbs needed to be chipped out the two inches necessary where the window supports would be located. Where the curtain wall intersects the beams the curtain wall will be trimmed around the beam. The beam cannot be chipped away for fear of possibly exposing the rebar. Additionally all of the door openings were too small for the doors and frames that had been ordered and needed to be chipped out to allow the frames to fit. It is still being determined who will pay for the added costs associated with the concrete chipping though it is known that SBER had to pay the concrete subcontractor to demobilize and then remobilize.

Concrete Curb Chip-Out Ground Floor

Concrete Door Chip-Out

Schedule Acceleration Scenarios

Critical Path and Schedule Risks:

The critical path for this project is like most others and consists of excavation, foundation, superstructure and interior finishes. As discussed above a six-week delay occurred due to the contaminated site soils.

Currently there is a slight delay with completely closing up the curtain wall on the western face of the building because the project team is waiting for elevator inspections. They currently have a man and material hoist on the exterior of the building that they are using until they are allowed to operate the buildings permanent elevators. The hoist attached to the building leaving large sections of the facade open and preventing the building from becoming completely weather proof. With the cold winter temperatures fast approaching, the wall needs to be closed to allow the painters to finish painting under the proper conditions. They can't use the permanent elevators until they have been inspected and approved by the State of Maryland and Baltimore City. They have a few weeks of float left until the building needs to become fully enclosed before it affects the schedule but the sooner they are allowed to take down the hoist the better.

Another issue on this project that could have schedule implications is the constant redesign that it has been undergoing. Currently the exterior promenade is under redesign and the expected date for the design completion is unknown. The construction team knows very few details about the promenade other than its general size. They are expecting to have to issue a change order for the work required to complete the promenade and as part of the change order they are expecting to request additional time to complete the added work. The promenade should not change the move in date for Morgan Stanley but will change the duration that Armada Hoffler is on-site. Another redesign was for the layout of the sixth floor. New rooms were added to the floor plan and increased the amount of work required to completely finish the floor. Fortunately the added walls should only increase the schedule by about a day and extra laborers can be brought in to keep the project on schedule.

Schedule Acceleration:

The project is currently on schedule and in the finish phase of construction so if the project were to fall behind at this point with the scope that is currently in place there are a limited amount of things that can be done to accelerate the schedule. The only areas that are still being worked on that have potential to be accelerated are the finishes. The site is already crowded enough because it is the finish phase and there are multiple crews on-site for each trade trying to get everything done in time. This makes increasing work hours the only viable option for making up any losses in the schedule.

The first work hour increase would be to work five 10-hour days a week. If they can't make up enough time with that method Armada Hoffler would institute a seven day work schedule and mandate that the subcontractors to work Saturdays and Sundays. Finally if even more time needed to be made up a night shift would be added. The consequences for all of these methods would be an increase in cost with each method being more expensive than the one listed before it.

The construction team currently does not expect any delays in the project unless they come from a redesign in which case they should be able to get extra time or increased contract amount to pay for overtime work with a change order.

Value Engineering Topics

A formal Value Engineering process took place for the Thames St. Wharf Office Building in mid-2007 before construction began. Unfortunately none of the parties involved in the VE process are still working on the project and were unavailable for contact. The current owner's representative is not sure of what was changed or taken out during that process or if any items or ideas were considered but then not implemented.

The only major thing taken out of the project after the formal VE process was the green roof. It was taken out because it did not benefit the owner's overall goal for the project and added unnecessary expense. The green roof was originally added into the design to help achieve LEED points but after being examined more closely it was determined that it wouldn't help achieve any. The cost of the roof was approximately $100,000 that has since been reinvested in the project in other ways.

Problem Identification

Several issues have occurred on the Thames St. Wharf project that are worth looking into to see if there are any ways to improve them. Most of the issues are related to one another in some fashion and the solution to one could very well mean that other things that are issues could have been avoided. Design management and design integration seem to have caused most of the issues that are identified below.

Difficulties with Design:

A lot of issues on the project have stemmed from issues with design. The architect of record has repeatedly designed and redesigned different aspects of the building causing delays and communication errors between the construction managers and the subcontractors. Additionally over 500 RFI's have been issued to date.

LEED Requirements:

The building owners want to achieve a LEED Silver rating for the building, which has caused the cost of the building to climb to achieve the necessary points. Had the LEED process been managed more closely and integrated into the project at the beginning the total cost could have most likely been reduced. Namely the $10 Million mechanical system that was put in the building to help achieve LEED points could probably be reduced if the south façade of the building was changed from a complete glass curtain wall to something with better thermal properties.

Glass Curtain Wall:

The all glass curtain wall on the south façade and the southern tips of both the eastern and western façades of the building increases the heating loads on the building during the summer months. It is positioned in the worst spot on the building in terms of energy efficiency and integrated LEED design. If the curtain wall was changed to a different system then perhaps money could be saved on the curtain wall system itself and on the mechanical system that was needed to manage the building loads.

Mechanical System:

The expensive mechanical system is also time consuming to install because it has two air handling units installed on each floor. If the system could be more consolidated it could most likely increase the amount of leasable floor space on each floor and reduce the time and hopefully costs of installation.

Lack of Effective Coordination:

As stated in the constructability challenges section of this report the same drawings were not issued to all of the subcontractors with regards to the building structure. Had a more intense coordination process taken place the design differences could have been recognized early on which would have prevented a lot of headache and additional costs later on in the project.

Hazardous Soil Conditions:

The hazardous site conditions caused a large delay in the project that could have been prevented had the proper preparations taken place. SBER should have anticipated that the work taking place in the contaminated soils would take longer than it otherwise would if it were in clean soil. They should have also anticipated the need for a specialty soils contractor to be on-site as long as there were exposed soils not just while major excavation work was taking place. Had the proper planning taken place both time and money could have been saved.

Scaffolding for Southern Façade:

The southern façade of the building is currently out over water until the promenade is completed. This caused an issue with both support for the scaffolding and safety for the workers while they were over the water. Fortunately, for the support issue piles had already been placed in the water for the promenade. The scaffolding was built off the piles and connected to land on either side of the building.

Because the scaffolding was over the water extra precautions had to taken to ensure that no people or items fell off of the scaffolding and into the water. To do this they placed snow fencing on the water side of the scaffolding to prevent any materials from falling off and all the workers were required to tie off to the scaffolding just in case they were to fall.

Technical Analysis Methods

Glass Curtain Wall:

Overview:

The glass curtain wall was placed on the southern façade to give abundant views of the Patuxtant River and Baltimore Inner Harbor. Unfortunately the curtain wall will dramatically increase the amount of heat gain through the southern façade. The proposal is to change the façade from an all glass curtain wall to a brick and glass wall system.

Benefits:

The combination brick and glass southern façade will reduce the heat gain on the southern face of the building by reducing the overall amount of glass and increasing the total R-Value of the wall system. The rest of the building is already a brick and glass combination so fewer subcontractors would be needed making coordination between trades easier. The different curtain wall would also match the Bond St. Wharf building that is located one block east of the Thames St. Wharf Building. Bond St. Wharf is a turn of the century brick and glass building that has been renovated in recent years and converted into retail and office space.

Drawbacks:

The different façade system will reduce the views of the river and the Inner Harbor that the owner desires but the reduction should not be significant if designed properly. Additionally the reduced views shouldn't affect the overall quality of the interior spaces because the edges of the floor will most likely be turned into private offices that will eliminate the views for the majority of the people using the building anyway. The redesign may also take away from the modern look of the southern portion of the building but again if done properly this may not be the case.

Analysis:

The main focus of this analysis will be to attempt to reduce the heat transfer through the façade thereby reducing the size and hopefully cost of the mechanical system while remaining aesthetically pleasing. Due to the amount of float the enclosure has in the schedule, the affects that changing the façade will have on the schedule will not be examined. A comparison between the costs of each system will be done to ensure that any cost benefits gained in the mechanical system are not negated by any additional costs with the façade change.

Research will begin by learning the thermal properties of each system followed by their respective costs. If the thermal benefits of the combined brick and glass systems are insignificant than there will be no need to compare the cost differences of each system. Thermal calculations will be conducted to show the thermal properties of each system.

Mechanical System:

Overview:

Currently the mechanical system consists of two air handling units per floor. Each one is located in its own mechanical room and serves the half of the building that it is located on. While this allows for more control on each floor, smaller units are less efficient than larger ones. The proposal is to consolidate the two AHU per floor system into one larger AHU per floor. Additionally the redesign of the southern façade should hopefully reduce the loads on the building and should reduce the size of equipment that is needed.

Benefits:

Reducing the size of the equipment that is needed should reduce the total cost of the system. Currently the mechanical system is the most expensive aspect of the building. Any savings that are made with the mechanical system could either be reinvested back into the project or could simply reduce the total cost of the project. Any reduction in the total cost of the project would reduce the amount of time it takes for the building to return a profit for the owner which is always a benefit. And if possible it would probably be less expensive to have only one AHU per floor instead of two. Fewer connections would be needed and as stated before larger units are more efficient overall than smaller ones. Additionally one unit may increase the amount of rentable floor space on each floor by eliminating one of the mechanical rooms.

Drawbacks:

Using one AHU per floor may reduce the amount of zone controls per floor but the costs savings may be worth it and depending on the unit that is selected and how the system is set up zone control may not even be affected.

Analysis:

The analysis for the mechanical system will include a basic redesign of the buildings mechanical system. This will not be a complete redesign but should hopefully give enough insight to whether or not any savings could be had by changing the mechanical system. The different types of mechanical systems available will have to be investigated for both efficiencies and cost effectiveness. The schedule impacts of each type of system will also be evaluated because the mechanical system is on the project's critical path. The total evaluation of the mechanical system will include initial cost, operation cost, schedule impact and energy saving abilities.

Project Delivery Method:

Overview:

Issues developed on this project due to the design not being closely managed and lack of coordination. Changing the project delivery method to an Integrated Project Delivery Method (IPDM) would eliminate these issues. The traditional design-bid-build delivery method used on this project, while familiar, created issues along the way.

Benefits:

Using an IPDM as the delivery method would create a more integrated design that would benefit the project as a whole along the way. Had all the necessary parties been brought together at the beginning of the design phase instead of incrementally as needed the building systems would relate better to each other. This would ease the LEED process by allowing each design team to change its design based on the needs of other the other system designers. For example had the architect known how much the HVAC system would cost they could have possibly changed their design to lower the HVAC cost. Also the issue of coordination could be easily solved. If all of the design firms worked together instead of trying to piecemeal the building together the project could have been coordinated during design and only one set of drawings would have been issued to the subcontractors removing some of the errors that occurred. Also with multiple design teams working on the same project at the same time the chances of mistakes being caught during design instead of during construction are much higher. And finally with the IPDM the construction management can assist with the costs of the design and help bring the final building costs down for the owner while still leaving the owner highly involved in the process.

Drawbacks:

The IPDM is a relatively new delivery method and people are always timid about trying new ideas especially when a lot of money is on the line. Also H&S Properties is a very experienced owner and convincing them to allow someone else to manage the design process could prove to be very challenging. They are going to want to be very involved in the entire project from design through construction and may believe that with an IPDM they will be shut out from design like they would be with a design-build project.

Analysis:

The analysis for this topic will involve research into the basic methods of how the integrated project delivery method works. It will involve looking at case studies and if possible talking to people who have worked on IPDM projects. The basic evaluation will be in terms of efficient design and construction practices. The current method of design-bid-build creates a lot of wasted efforts for each group and doesn't always deliver the best possible product. A secondary objective will be to examine any cost and possible schedule benefits from using this method.

Energy:

Overview:

The topic of energy is very important in buildings as energy costs continue to rise. It is especially important in one that is striving for a LEED rating. Looking at ways to make this building more energy efficient may be a big way for the owner to save money in the long run. Another aspect of energy that may help increase the profitability of the building is some form of on-site renewable energy.

Benefits:

Lowering the building's operation costs is a huge plus. It will save the owner money and will also increase the marketability of the building. Firms that move into the building will be able to market themselves as "green companies" in some fashion or another and please their customers. And producing energy through on-site renewable resources also has potential financial benefits for the owner. First the more energy they are able to produce on-site the less that will have to be purchased from the utility companies. Second if they produce enough energy there is the possibility to resell the excess energy back to the utility company.

Drawbacks:

The increase in upfront costs may be too high to warrant the increase in energy efficiency or the use of on-site renewable energy. This project is being pursued as a for profit venture by the owner so cost is a very important aspect. Currently H&S is planning on owning the building for multiple years to come but that may change as markets change so they do not want to commit to something that will have an exceptionally long payback period.

Analysis:

The analysis for the energy efficiency aspect will depend on the results of the analysis for the mechanical system. If it is found that a system can reach the current goals set forth by the owner for less than $10 million then the next step will be to see how much more efficient the system can become using the savings to improve the system.

For the on-site renewable energy portion the different types of on-site renewable energy system available will have to be researched. Then they will have to be studied to determine their financial feasibility. Their payback period will have to be evaluated and it will have to be determined what percentage of energy can be produced on-site to be cost effective.

The major goal of this section is to determine the cost effectiveness and feasibility of improving the energy aspects of the finished building over time.