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Technical Report 3

Doctors Community Hospital | Lanham, MD

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EXECUTIVE SUMMARY

This technical report is an initial examination of areas that could potentially benefit from additional in-depth research throughout the remainder of the thesis process.

The first three sections are based on an interview with a project team member at Doctor's Community Hospital. The discussion revolved around three key areas: Constructability Challenges, Schedule Acceleration, and Value Engineering. Constructability challenges that were identified and discussed are the congested site, the expansion above the TransCare patient wing, and the tie-in of the new mechanical penthouse to the existing structure. Schedule acceleration focused on how the façade activities can be accelerated, acceleration that occurred around steel erection, and the costs and techniques associated with both. Two items were identified for Value Engineering, the removal of a 5,000 gallon tank, and the change in the patient room head-wall unit.

The Problem Identification section brainstorms situations that may have an impact on the project in a negative way. Four such problems were identified and discussed; BIM Implementation, a new façade, site congestion, and owner indecision. The technical analysis that follows generates ideas and possible solutions for the previously identified problems. Methodologies for these analyses are also recognized.

CONSTRUCTABILITY CHALLENGES

Each construction project is unique. Even if the same building, same plans, and same team members are involved, new variables may arise that can create challenging issues that must be addressed in order for the project to be successful. The expansion at Doctors Community Hospital is no exception to this rule. Three different issues that created unique challenges for the project team, and their resolution, are analyzed below.

SITE CONSTRICTION

FIGURE 1- VIEW LOOKING FROM THE NORTH TO SOUTH OF THE ONLY ACCES ROAD ON SITE

The DCH expansion project is especially challenging due to the very tight nature of the construction site. A private property adjoins the site directly to the west, whose property line is only about 30 feet from the edge of the building expansion footprint as shown below in figure 1. This narrow pathway is the main access to the site for almost all deliveries. Project deliveries on the north end are extremely limited since trucks larger than pick-ups have difficulty navigating the tight turns.

Compounding the problem of this limited access, is the location of new ductbanks. New utilities are routed down the middle of this 30'wide access path shown at left in figure 1. This placement creates a coordination dilemma since as the road is opened up for installation of the utilities, it even further constricts the site access. Also located along this access road is the material hoist, which takes up space and further adds to the congestion as shown in figure 2. Not only does the hoist take up valuable space, but it also means that workers on site will be moving through the area which will put pedestrian traffic in extremely close proximity to vehicular traffic.

Multiple steps were taken to address the congested site and help ensure that the site was run as smoothly as possible. Deliveries were carefully coordinated with suppliers and subcontractors. Gilbane left made it the responsibility of the subs to ensure that deliveries were scheduled at proper times, and proper information was relayed to drivers so that congestion was not an issue on site. If the subcontractors were failing, then Gilbane took over these responsibilities to ensure an orderly site.

FIGURE 2- EAST ELEVATION WITH MATERIAL HOIST IN PLACE

FIGURE 3- LOCATION OF CUT ACCESS ROADS

Access roads were cut to facilitate direct access to the main gate. These access roads, shown in figure 3, allowed trucks to come up Mallory drive (to the east, shown in purple), and not have to move through the Hospital campus, helping to alleviate congestion on campus and keep construction traffic separate from general hospital traffic. This access road is crucial to the success of the project and according to one project team member, "This project would be impossible without these roads."

TRANSCARE OVERBUILD

Construction of a new building in an open field presents challenges, but when a portion of a building is being erected on top of an existing structure, even more unique challenges can present themselves. The project at Doctor's Community Hospital is no exception.

A 3-story steel structure is being placed on top of an existing 2 story steel structure. Several challenges were presented by this endeavor. First, many of the stub ups from the existing structure were not located at their exact places as indicated on previous as-built drawings. This discrepancy created misalignments when the new columns were to be placed. Additionally, the

survey team has been having difficulty reconciling the discrepancies between the drawings and the field conditions.

These challenges were addressed and resolved in two ways. First, the structural engineer was involved as soon as the conflict was found to help with a solution. It was decided that 10"x10" plate would be placed on top of the existing columns. This solution allowed for the columns above to be placed in their proper location, even if they varied by as much as an inch off center in any direction, yet still allowed for all of the load to be safely transferred to the existing columns. The other measure to help ensure proper placement of the new columns was close coordination between the project engineer and the survey team. The Gilbane project engineer on site and the survey crew foreman worked together closely to interpret drawings and sketches from the structural engineers to ensure that new columns were being aligned properly.

PENTHOUSE OVERBUILD

Another challenge that presented itself was the overbuild on the 5th floor for the mechanical penthouse. The same problem as previously mentioned in the Transcare section of this report presented itself again on the 5th floor build out. Base plates and close coordination were again employed to remedy the situation. However, a new problem presented itself in the penthouse. Existing columns and beams that must be welded to were coated in lead paint. Lead paint, when left undisturbed is not harmful to those nearby, however, it releases toxic fumes when put under the extreme heat of welding. This issue must be resolved.

The lead paint condition was unknown prior to its discovery when tying in the new steel to the existing structure. Gilbane subcontracted a lead paint abatement specialist as soon as the discovery made so the schedule was not impacted more than necessary. They were able to minimize the impact down to only about two weeks of lost time by acting quickly to fix the situation.

SCHEDULE ACCELERATION SCENARIOS

CRITICAL PATH

This construction project has a critical path that is similar to other buildings. The path flows through the underground site work and foundations, and then moves into the structure. As the structure tops out, the façade begins from the bottom working towards the top of the building. Once the building is water tight, Mechanical, Electrical, and Plumbing trades begin their work with main runs first. As the mains are completed, branch circuits and ductwork are the next step. As the branch circuits and in wall conduit is finished, the drywall is closed up, and the final finish trades move through working from bottom to top. Renovations in the existing building are the final step on the critical path.

PROJECT COMPLETION RISKS

Several items, both known and unknown at the onset of construction have put the project completion date at risk.

1. Discovery of lead paint on existing columns that needed to be welded.
    - The existence of lead paint in the building was expected at the onset of construction since the project was originally built in the 1970's. The surprise for the project team was when they found the existing columns of the building painted with lead paint. This paint needed to be safely removed before the steel erection could move forward.
2. Placement of PEPCO (Electric Company) ductbank on main access road created two risks.
    - First, PEPCO mandated that no work was to be put in place on the east side of the building, since it was immediately adjacent to, and above, the area in which PEPCO employees would be working. This required Gilbane to re-sequence work to ensure that no trades (sheathing, metal stud, masons, etc) were putting work in place on the east side. Fortunately, this request was able to be accommodated through re-sequencing and minimized the amount of time that could have been lost.

- Second, PEPCO required that the entire east side also be covered with safety netting to prevent any falling objects from injuring their workers below. The installation of this netting took roughly a week, and delayed the installation of the duct bank, which can impact the critical path previously mentioned.

3. Owner Decisions for Emergency Department fitout
    - The owner has not made final decisions for equipment to be installed in the Emergency Department such as an X-Ray machine and a MRI machine among other items. Without these choices, final design documents for the emergency department cannot be completed so trades cannot begin work in the area. This situation has not impacted the critical path yet, but if it continues to go unresolved, the emergency department will move on to the critical path and could risk delaying the project.

POTENTIAL ACCELERATION

One area that has potential for acceleration, and that the team is taking advantage of currently, is on the façade of the building.

It was originally written into the scope of work for the sheathing contractor that they would have access to the mason's scaffold to install this substrate. However, the need for the project to accelerate the façade changed these needs. The CM rented multiple lifts so that the sheathing could be placed independently of needing the scaffolding from the mason. This was an added cost for the CM, but allowed the mason to work more effectively since they would not be in the same workspace as the sheathing contractor. Additionally, since sheathing is installed faster, this also allowed the subcontractor to work ahead and move on to his other activities (interior partitions and metal studs) earlier.

The façade was also accelerated by having the mason work on larger areas at one time. Originally, less scaffolding and less manpower were going to be used by the mason. The project has needed to accelerate the façade in order to get the building water tight as quickly as possible in order to keep schedule. This need has increased the amount of scaffolding and manpower used by the masonry subcontractor. They have been able to avoid using overtime for this trade. The added cost of the additional scaffolding that was beyond base contract is being absorbed by the CM.

Other acceleration needs arose earlier in the project, about the time of steel erection. These needs, specifically in underground MEP trades, were met by utilizing overtime. Contracts on

this project such that overtime is at a set rate, as laid out in the contract, and includes all premium charges. As a result, change orders can be done on a "time and materials" with the rates already known to both the subcontractor and the CM. Depending on what factors lead to the need for acceleration, the change order can be written as an "In-scope change" where the CM absorbs cost, or an "Out of Scope change", where the CM will recover costs from the owner.

VALUE ENGINEERING TOPICS

IMPLEMENTED VALUE ENGINEERING

Value engineering can be a very important part to any construction project. It creates an opportunity for project participants to come together and help the owner get the most for his or her money, or to eliminate items that are not necessary to reach to owner's goals. Several different value engineering ideas were presented and implemented on this project, but the two largest in terms of monetary value will be discussed.

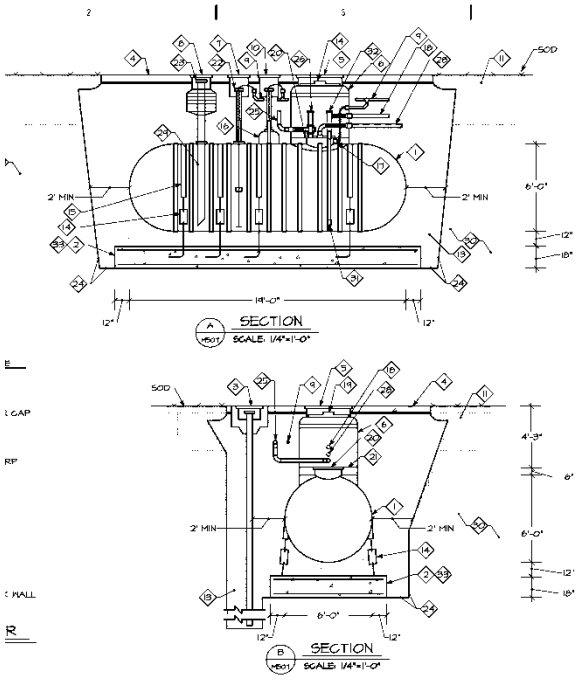

FIGURE 4- DRAWING OF 5,000 GALLON TANK THAT WAS REMOVED FROM SCOPE

The first major item was the removal of a 5,000 gallon fuel oil tank, shown in figure 4 at left, that was to be installed to feed duel-fuel boilers. The location of this tank was to be underground and in the middle of the road to the east of the building. This road is the same one that already has the new duct banks being installed and is also the main access for the entire site. The head of building operations indicated that he does not run the duel-fuel boilers on oil ever, but rather sticks strictly to natural gas. As a result, in order to help alleviate a possible impact on the schedule, and also to remove something from the scope that was not going to be beneficial to the owner, the fuel-oil tank was removed. This action resulted in a roughly $150,000 saving for the owner, and removing and item that could have possibly caused complication for the CM due to its installation location. Removing this tank correlated very closely with the owner's goal since it saved money, and was able to delete an item that would sit dormant and never be used.

The other major item that received value engineering was the head wall units in each patient's room. The head wall is located at the head of each patient's bed and consists of all the connections a patient may need such as medical gas, vacuum, nurse call, bed docking station, and outlets, both regular and emergency. The original design called for each of these items to be put

in place separately in a typical metal stud partition wall. This would have required each trade to run pipe or conduit from the ceiling down to the outlet level. Instead, it was decided to use prefabricated head wall units which are installed in three separate pieces. They make all the necessary connections above the ceiling, thus reducing work and material. This action resulted in a roughly $50,000 credit back from the Electrical, Mechanical, and Drywall trades totaling roughly $150,000. The new method also shortened the schedule, which aligns with the owner's goal of getting the hospital functional as quickly as possible.

REJECTED VALUE ENGINEERING IDEAS

No actual value engineering ideas of any significance were rejected on this project. The closest item was that the owner decided to not pick up an add alternate for the renovation phase. The goal of the alternate was to add additional finish work in the renovated portion of the hospital in order to help improve the quality and keep the existing portion looking very similar to the expansion. It included repainting of all rooms, refinishing all floors, and replacing almost all ceilings. The current scope only refinishes select rooms. The idea was rejected to help save costs in the front end. Members of the project team seem to think that the scope will be added back into the contract once the owner and employees see how well the expansion turns out.

PROBLEM IDENTIFICATION

The Doctors Community Hospital presents several unique challenges and problems that could warrant an in depth investigation as part of a thesis analysis.

BIM IMPLEMENTATION

DCH is not utilizing any BIM techniques, and could substantially benefit from incorporating at least 3 uses.

1. **3D MEP Coordination**
    - This use is traditionally considered the "low hanging fruit" of BIM uses. It can be implemented on site and does not necessarily require a BIM model to be generated in the design phase, those it would be helpful if such a model were created. With the volume of mechanical and electrical work that is being squeezed into the ceiling plenum space, it is surprising that MEP coordination is being done by typical 2D electronic coordination and even some work was done using light tables in the construction trailers. Gilbane has the resources available in the company to implement this use.
2. **As-Built Record Drawing**
    - Through conversations with the owner, they have expressed interest in the possibility of future expansion. This desire is also indicated in the design; there are stub ups above the 1st floor Emergency Department expansion for future vertical growth. Problems on this round of expansion have stemmed from inaccurate dimensions and locations of existing conditions. An accurate As-Built housed in a building information model could help facilitate expansion in the future.
3. **4D Planning and Site Space Utilization**
    - The DCH campus is extremely congested and must also maintain an existing, operational hospital. Furthermore, two other construction projects have already begun site work on campus. Due to the limited space, site planning becomes critical, and must be able to stay highly dynamic as the phases of the project move forward. This need lends itself very well to utilizing 4D Site Planning. It can also serve as a valuable tool for communicating the site plans to subcontractors and the owner.

BRICK FAÇADE

The façade for this project is hand laid brick which can be very time consuming. It has already caused delays that the CM is trying to recover by adding additional scaffolding for the mason so that the subcontractor can increase its man power. Gilbane also rented lifts for the sheathing contractor so that they could move ahead of the mason and not have to share scaffolding as originally planned. This situation is creating a burden on the schedule and impacting the water tight completion date. It could prove to be beneficial to investigate whether an alternative façade system such as precast, would have proved economical and beneficial for the schedule.

SITE CONGESTION

The Doctors Community Hospital project team is facing a constant challenge managing a very congested site. Delivery coordination and material laydown are two issues that consistently impact the project as it moves forward towards completion. The site immediately adjacent to the property line on the east of project is a private property that was offered for sale to the hospital, but the hospital deemed it too expensive. There have been several opportunities over the past years for the hospital to purchase this land. It could prove an interesting and beneficial investigation into what the cost-benefits would prove to be if this purchase were made. The additional space could have added material laydown area, eased traffic congestion, and provide more land for future expansion of the hospital.

OWNER INDECISION

Owner's are the driving force behind any project. They are providing the design vision, design program, and the money for the project. Without direction, a project can begin to wander and drag out much longer than the construction really warrants. Two major items are currently sitting in the owners court and are slowly becoming a more critical issue as the time continues to pass. Equipment for the Emergency Department fit-out continues to go unselected. Specifically, as the X-Ray machine and MRI machine are still unknown, final design cannot be completed. Furthermore, these items are long lead items and require time to be manufactured and shipped to site. This continued indecision can and will eventually impact the final completion date that the owners desires, which can in tern result in extended overhead and lost revenue.

TECHNICAL ANALYSIS METHODS

TECHNICAL ANALYSIS 1: BUILDING INFORMATION MODELING

Building Information Modeling is fast becoming more prevalent in the industry. While not many studies have been generated to provide quantitative data for how much improvement is gained from its use, anecdotal evidence and case studies highlight many of BIM's benefits. It would be possible to analyze efficiencies that could be gained from the multiple uses that were outlined in the problem identification section of this report. . The most beneficial way to study this will be to develop a BIM model to help accurately gauge the level of detail needed and desired for the outcomes. Impacts on the project could be a potential cost savings and a reduction in schedule.

TECHNICAL ANALYSIS 2: PREFABRICATED FAÇADE

The façade of this project has become a problematic feature. It has begun impacting the schedule and started adding cost for the CM that may or may not be able to be recouped through change orders to the owner. The masons are attempting to provide as much manpower as they can while still maintain efficiency, but they are not being completely successful. The scaffolding also takes up valuable space that even further constricts an already narrow eastern portion of the site.

An analysis of this situation would need to look at multiple factors that guide the decision. First, it must be determined if the aesthetic goals of the project can be met. The impact on the overall cost of the building is the next parameter that must be evaluated. Next, impact on the schedule must be reviewed since this can impact revenue or extended overhead, depending on how the impact is made. The effect of having a crane on site longer must also be evaluated since this can impact both cost and schedule.

TECHNICAL ANALYSIS 3: IMPROVED SITE LOGISTICS

A congested site is not a desirable situation for any CM to have to undertake as part of a project. Generally speaking, the more space a project can have to use, the easier the project can be built, provided that the space is utilized efficiently. As previously mentioned, there was an opportunity for the hospital to purchase the adjacent property prior to construction. Through surveys, cost estimates and revenue projects, it could prove to be an interesting analysis whether

purchasing the land would have been the best decision. Benefits of purchasing the land would be more material laydown area and improved traffic flow on site for deliveries.

TECHNICAL ANALYSIS 4: EQUIPMENT SELECTION

As long lead item selection is delayed, it can have a negative impact on the project. Designers must continue to wait to issue final design drawings on the ED which in turn can hold up the trades from bidding and completing their submittals and coordination drawings. This delay can continue on to the point that it eventually pushes out the completion date of the ED phase of the project. By surveying design team members, subcontractors, the CM, and the owner, total impact on the project can attempt to be assessed. It can also be analyzed on different intervals, and figure out how delays of different durations may affect the project in terms of both costs and schedule and possible lost efficiencies in the schedule.