# Monongalia General Hospital

Morgantown, WV


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Construction Management

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## Executive Summary

This technical report provides the initial investigation into the final thesis proposal. It identifies areas on the Monongalia General Hospital Addition and Renovation Project which are good candidates for the bases of further research and analysis for alternative methods, value engineering, and schedule compression.

### Project Manager Interview

Much of the information in the preliminary tech reports are gathered from the construction management personnel on the project. It is through these contacts that allow for a better understanding of the building components, construction execution, and overall project information. The first hand experience and understanding gained from working on the actual project provide an incomparable amount of knowledge about the project compared to just hearing and learning about it. By tapping into the experiences of the practitioners, I can begin to recognize the individual characteristics of the project which will allow me to better analyze and research potential methods to improve the project as a whole.

In this section three focus areas are discussed for the Monongalia General Hospital Addition and Renovations Project. The three topics include constructability challenges, schedule acceleration scenarios, and value engineering. Information for each topic is gathered from discussions and interviews with the project construction team personnel.

### Problem Identification

The most effective changes on a project are ones brought on by identifying an underlying problem or area which may be prone to problems. After taking the time to familiarize myself with the project and gain a working understanding of the construction process, I was able to identify problematic areas of the project. Every project has different areas that require more attention than others. The identified issues on the Monongalia General Hospital Addition and Renovations Project are common to most projects but have specific details unique to the delivery of this project. The details are outlined in this section and are broken down into three topics, exterior façade, phase coordination, and MEP coordination. Additional problems not included in this section but also important are discussed separately in the Project Manager Interview, Section B, particularly in the constructability challenges subsection.

### Technical Analysis Methods

Through research of construction processes and analysis of building systems, alternative scenarios can be tested to learn what we should have or shouldn't have done on a project. By proposing and comparing different options, we can learn what to implement on future projects. Using issues identified in Sections A and B of this report, four main construction management topics are briefly outlined for later analysis and research. The four topics include, exterior façade, MEP coordination with BIM, phase planning and sequencing, and owner education and counseling support.

## A. Project Manager Interview

Often, it isn't until after the project is complete that the picture becomes clearer on what could have or should have been done on the project. Issues that weren't apparent at the beginning of the project become very obvious as the project moves on towards completion. Even though every project is different, taking the good and bad learned from previous projects helps prepare for similar scenarios that reappear. Knowledge gained through experience is the most valuable asset one can have. By speaking with industry professionals who have experienced the good and bad of projects, one can attempt to understand the workings of a construction project. A few specific topics were discussed between myself and a few Turner Construction team members on the Monongalia General Hospital Addition and Renovations Project, in order to better understand the distinct aspects of this project and learn from the experiences.

### Constructability Challenges

One of the biggest challenges that many construction companies have is the owner-client relationship. This may pertain to not only the construction companies but also with design, engineering, and consulting firms as well. As with most hospitals, the Monongalia General Hospital does not have very much experience when it comes to building. The existing hospital building opened in 1977. Since then, the hospital has had no major construction projects, leaving the hospital team very inexperienced when it comes to a construction project. During the course of the project the teams found themselves educating the owner while still allowing them to make discussions on their own, often resulting in constructability challenges along the way. This constant communication, coordination, and most importantly cooperation between teams, is a struggle that impacts the construction of the project in all aspects. An inexperienced owner may not realize impacts certain decisions have on the project cost or schedule and expect unrealistic outcomes. The effort to aid owner decisions, satisfy them, and maintain the project schedule makes a hospital addition and renovation project that much more challenging.

Since the project broke ground with only 70% construction drawings, the architect was forced to deliver 100% construction documents before really coming to complete design. Multiple items were not completely decided upon before the completion of the drawings and therefore required additional RFI's in order for the owner to specify exact items in time. One specific example was the choice of brick for the exterior veneer, which was not decided upon until late in construction. Also, various interior finish items were left unspecified or changed resulting in additional RFI's and change orders. Another issue the construction team faced was that the roofing product originally specified was no longer available at the time of construction. In order to overcome this issue, a comparable product that was compatible with the roof design was found and approved for use.

An additional design problem faced on the project was the spread footing foundations and soil conditions. The footings were sized based from the soil reports taken before excavation. During excavations, testing of the soil by an independent testing agency found the soil characteristics to be worse than anticipated from the initial boring samples. The newly tested samples didn't pass the soil bearing capacity needed for the design of the footings. This required a redesign of the footing sizes by the structural engineer, in accordance with

the new soil bearing capacities found. The delay held up construction for approximately 2 months, during which the construction team continued with soil nailing and other activities not impacted by the delay.

Another huge challenge that this building project faced was the sensitivity involved in hospital construction, especially with renovations. A construction site can be very dirty place, far different from the strict standards of a hospital building. Since the new tower connects directly to the existing building, construction trades had to be often reminded to eliminate any unwanted construction debris from being carried into the existing hospital building. Many of the local tradesmen have never worked on a project such as a hospital that requires such care in the cleanliness of the construction site. Although it was the duty of these trades to properly maintain work areas, the construction management team was ultimately responsible for the jobsite. The site supervisors constantly reminding workers to properly work and maintain areas up to the proper cleanliness standards needed on a sensitive project such as this. The demolition and construction during the renovations phase inside the existing hospital building required the most attention from the tradesman and supervision team. It was through constant supervision and awareness of the health concern, and cleaner construction practices that helped keep the hospital from any construction related disturbances.

## Schedule Acceleration Scenarios

A project of this magnitude attracted a lot of publicity from the community, bringing added pressure on the construction team to deliver the project on time. Since the construction team received some unexpected delays, most of which are mentioned in the constructability challenges, the opportunity for schedule acceleration was taken when the idea to install electrical conduit into the concrete floors was presented. After seeking permission from the structural engineer the method was quickly welcomed as a way to make up schedule. The electrical contractor was remarkably proactive by taking this approach and working with the concrete contractor to run the electrical conduit for rough-installation before the slabs were poured. This greatly reduced time needed for electrical routing later in the schedule while also reducing congestion in the MEP spaces above the ceilings.

One activity that began to see schedule problems was the interior drywall. As the MEP activities began to finish, the schedule fell onto interior finishes to govern the remaining schedule completion. The interior finishes are dependent upon the drywall being complete which had fallen behind schedule due to manpower constraints. The local interior contractor did not have the manpower to keep up with the schedule demands, and the requirement to use union tradesman, in which the local unions did not have extra workers, put the project in a bind. The construction management team assessed the progress and devised a schedule outlining the remaining milestones for the drywall contractor to hit in order to keep up with the schedule. By working closely with the subcontractor they were able to concentrate manpower in the right areas at the right time to finish the drywall as fast as possible.

## Value Engineering Topics

Many value engineering ideas were presented from the construction management team to the owner during curse of construction to help keep costs down. This was done by eliminated a few unnecessary items found

in the building. The first is the elimination of the epoxy flooring in closets and leaving the finished concrete as the floor finish. A second floor finish change was swapping out expensive terrazzo tile for carpet in some areas which didn't need top quality flooring. Working with code and local fire marshals, they also eliminated a few automatic doors, crash rails, and lighted safety bollards throughout the building.

One value engineering proposal was presented and implemented, but ultimately had to be discarded upon conflicting discoveries in the field. The sprinkler system in the existing building renovation areas were originally planned to be demolished and have new lines installed. The new idea proposed to leave the main branch lines in place and only relocate the individual swing arms, saving time and money. Since the sprinkler system didn't need any modification besides relocation of the ceiling penetrations, this seemed like a good idea. It wasn't until after the decision had been made to implement this value engineering plan that they found out the new ceiling heights along with the new MEP distribution lines clashed with the existing sprinkler lines left in place and required them to be removed. The idea was scrapped and the engineer redesigned to sprinkler system as initially planned.

A value engineering idea that could have been suggested was the use of a curb machine in replace of conventional forming for the new curbs put in around building. A curb machine, although generally more expensive, provides a smoother flowing and better looking curb.

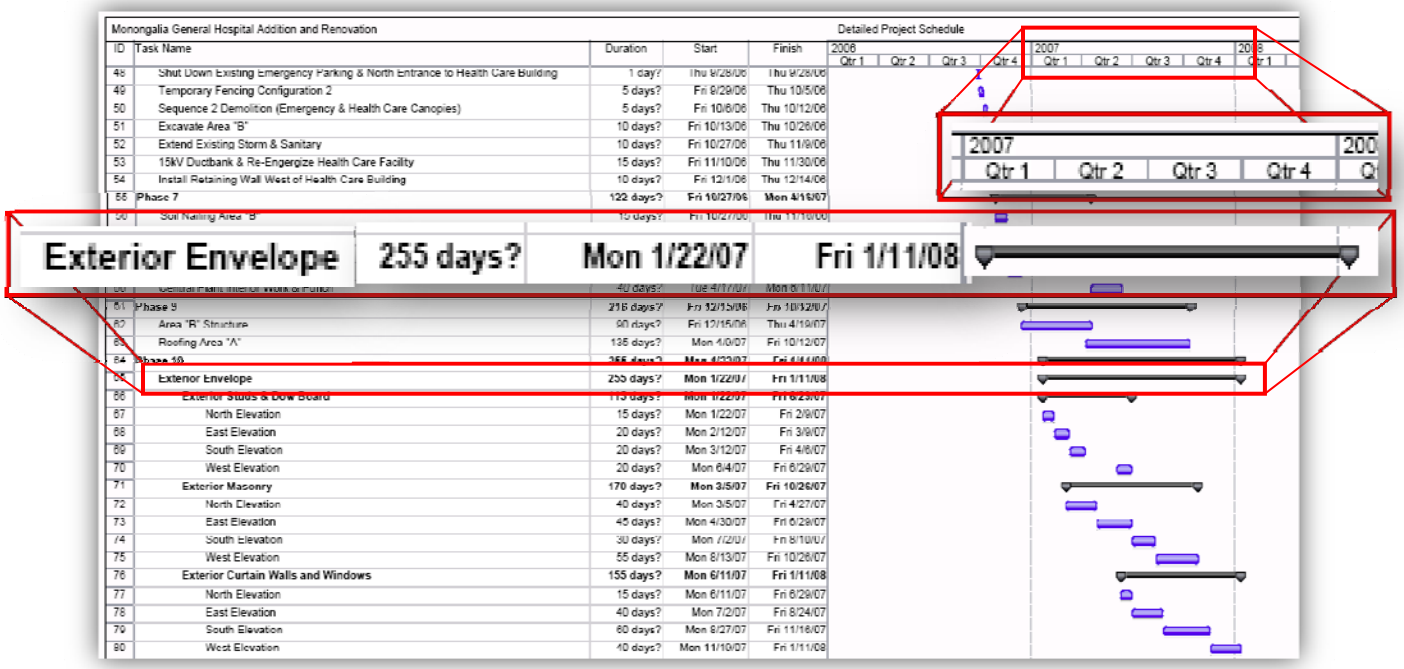
## B. Problem Identification

Every project has its own unique features that require a team of dynamic individuals to foresee and react to problems that arise on the project. Using the knowledge gained from prior research, the preceding technical reports, and discussions with project team members, several potential problem areas for the Monongalia General Hospital Additions and Renovations Project have been briefly identified.

### Exterior Façade

The new tower connects directly into the existing hospital building which has a red brick exterior. The choice to continue with a matching masonry façade for the new tower is evident in order to seamlessly tie the two buildings together.

However, the schedule for the exterior façade calls for almost an entire year's worth of time for exterior façade construction. In order for finishing activities such as interior drywall, the building must be fully enclosed, making this milestone very critical to the completion of the project on time. This critical path activity needs to be looked into for schedule reduction or a possible alternative façade system to help reduce the exterior construction duration and impact on the overall schedule.



## Phase Coordination

An area of concern for any renovation project is the phasing of the project to reduce the impact of construction on the areas still in use in the building. A hospital project is evermore in need of proper phase planning, as its loss in functioning result in an impact on the community's health and safety, not to mention the usual cost ramifications. The impacts of the adjacent tower addition as well as the renovations in the existing building require proper phase planning and coordination from both the hospital and the construction team. Additional research and analysis to improve the phasing and scheduling could benefit the hospital and constriction team as well as the overall project schedule.

## MEP Coordination

A hospital's mechanical, electrical, and plumbing (MEP) systems are more intricate and consist of more parts and equipment than the average building. The need to provide constant quality healthcare to its patients often requires larger and more complex systems. Additionally, renovation projects pose challenges of their own such as the removal of MEP work without disrupting the functioning of the rest of the building. Tying back into the MEP systems for the new layout of the space also requires additional attention due to the increase in potential problems that may arise. With the highly complex new hospital tower MEP systems and the renovated existing hospital spaces, additional proper planning is needed to coordinate each of the sensitive activities involved with the building's MEP systems. As with most projects, but increasingly more with the hospital addition and renovation project, this inevitable problem area can always use additional analysis of the coordination process and construction methods, to reduce costly and timely field clashes and trade conflicts.

## C. Technical Analysis Methods

Using the problem areas identified in Section B, four construction management analysis activities have been developed to address these issues. A brief description of the analysis and research needed to address the issue, as well as how the analysis and research will be completed, is provided for each.

### Exterior Façade

The current exterior façade for the new tower building uses a red brick veneer with metal stud backing. The entire exterior enclosures construction duration is almost a year long. This timely critical path activity is a crucial part of the project. Enclosing the building not only signifies as a construction milestone, but also permits the interior work to continue on towards the finishing stages. The hand laid brick veneer façade needs to be analyzed to shorten the lengthy duration.

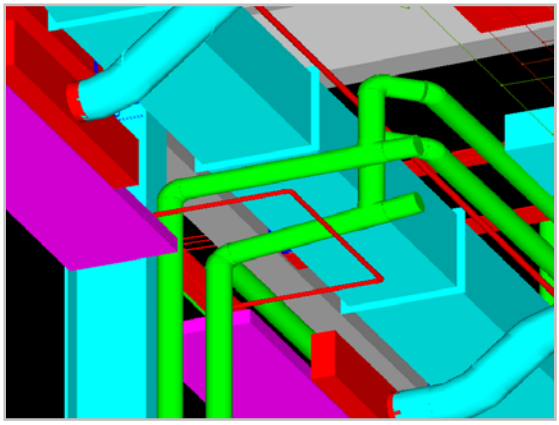
Alternate façade systems such as precast panels will be the main area of focus in reducing the exterior enclosures construction time. Ultimately, a system with significant schedule reductions but minimal to no cost increases is ideal. The decrease in schedule will also inherently reduce overall project cost adding to the potential benefits of the system. Additionally, the constructability of the system will also play a role in the research, analysis, and final decision on the alternate exterior façade system. The goal is to not only reduce the construction duration and overall schedule, but also to maintain low costs, ease of construction, site logistics, and even provide an increase in value to the owner with the alternate system.

### MEP Coordination with BIM

The identified MEP issues found in hospital buildings and renovation projects require extra attention in order to coordinate the large amount of equipment, piping, and ductwork. With the large amount of distribution piping and ductwork to each of the private patient rooms, emergency and operating rooms, surgery centers, and intensive care units, the above ceiling MEP spaces become very congested. The event of systems clashing with one another is inevitable. Conventional 2-dimensional drawings can only go so far in the design of and construction of each the systems. Clashes between systems result in costly redesign and construction changes, in addition to schedule delays. In order to reduce conflicts between MEP systems, additional coordination between trades and contractors can be scheduled to work through the designs and detect issues before they hit the field. These supplementary meetings can be great aids in fixing errors before they impact the project cost and schedule, but require a lot of dedication between the contractors in order to work together as a team. Even with increased coordination, RFI's (request for information) and costly change orders are inevitable, but technology is finally catching up to the construction industry to provide cutting edge tools for the project teams to use. Such tools include 3-dimensional design programs

for various trades to build their proposed systems in a virtual world before ever being constructed in the field. These tools are becoming more and more popular by all parties and in all phases of the project. The more complex MEP systems such as the ones in a hospital building can significantly benefit from these tools. By looking into the use of various tools now available to aid such issues as MEP coordination and clash detection, I hope to find a cure for costly headaches that most intricate MEP systems bear.

Research in these areas, often termed BIM for Building Information Modeling, is exploding throughout institutions and the industry. I plan to tap into the research information, couple it with the Monongalia General Hospital Addition and Renovations Project, and devise a case study analysis on the usefulness of the various tools. Outcomes such as project cost decreases and schedule reductions will be key targets for the BIM uses. Interviews with knowledgeable BIM individuals can also provide a great deal of information for research into the effectiveness of the uses in general and on the Monongalia General Hospital Addition and Renovations Project.



## Phase Planning and Sequencing

Many value engineering ideas stem from the need to decrease project costs, increase project constructability, or reduce the project schedule. Although re-engineering the project may accomplish these goals, many project components become compromised in order to achieve the goal. Value engineering the project design is a practical way to increase project constructability by identifying and eliminating unrealistic design components. It also is a great way to reduce the building cost by swapping systems or components for alternative lower-priced items. However, the best way reduce construction time is to evaluate the processes and individual activities involved in the construction of the project.

The importance of a strict project schedule on a hospital project and to a renovation project, are identified in Section B. Proper scheduling and activity planning are required to build the project in a reasonable fashion, and to reduce any impact on the continuous use of the building throughout construction. Lean production ideas stemmed from production industries such as automobiles, can be implemented to more thoroughly plan the construction process and reduce the overall project schedule. Throughout construction additional improvements can be made by constant performance evaluations in the field and changes to activity resources. Further research in these production techniques can yield potential schedule reductions without ever changing the design of the project. Similarly, analysis of the different process strategies for compatibility with the Monongalia General Hospital Addition and Renovations Project will be done to hopefully give way to changes resulting in schedule duration savings.

## Owner Education and Counseling Support

As discussed in Section A under constructability challenges, the active participation of the owner can be crucial to the success of a project. While the experiences of the owner cannot always be helped due to the nature of the owner, they can help themselves and others on a project by either taking an initiative to learn the building process or by teaming with a partner who does. When an owner can't make informed decisions in a timely manner it affects all parties. The use of a supplementary aid council or agency can greatly help to organize and manage the owner's responsibilities on a project, in turn reducing possible headaches, delays, and cost increases due to late changes. On this project in particular, which had numerous delays due to the owner's inexperience, I feel an owner consulting agency would be extremely valuable to the project. Designers and construction managers do aid some of the owner's decisions but often times come after a problem arises. Various project cases with owner consultants or agencies versus inexperienced owners acting on their own could be researched and compared to obtain concrete evidence of this claim.