FINAL PROPOSAL REVISION 1

NORTHEAST HOSPITAL EXPANSION
123 Medical Lane, USA

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NORTHEAST HOSPITAL EXPANSION

EXECUTIVE SUMMARY

The Northeast Hospital Expansion project is located at 123 Medical Lane, USA. The project will consist of the construction of a new 10 story patient tower, new parking garage, renovation of select patient rooms in the existing hospital wings, and the relocation and upgrading of the central utility plant servicing the entire medical campus. After complete three technical reports the proposal in hand is a detailed explanation of each of the four analyses to be completed for the thesis to be completed in the spring semester of 2015.

Analysis 1: Collaborative Project Delivery

Throughout the construction of the Northeast Hospital Expansion there were numerous communication barriers leading to project inefficiencies. These barriers ranged from late inclusion of specialty subcontractors, scattered job trailers, and a 3D BIM model subcontractors had limited access to. Through the philosophies of integrated project delivery, this analysis hopes to eliminate communication barriers hindering project efficiency producing a more collaborative project environment. These philosophies include earlier specialty subcontractor involvement, co-location, and BIM model access for all involved trades.

Analysis 2: Plumbing Prefabrication and Relocation

The Northeast Hospital Expansion is attempting to achieve LEED Silver and present itself as a sustainable project, but is currently generating a lot of construction waste from pipe being cut during the process of stick-building the branch pipe work within patient rooms. Analysis 2 proposes the relocation of plumbing fixtures in patient rooms to reduce branch run out piping and the opportunity to utilize shared wet wall vents and sanitary pipes. On top of relocating fixtures, the branch piping in each patient room can also be prefabricated to further reduce waste in transport ion and shop fabrication.

Analysis 3: Alternative Retaining Wall

The third analysis is the utilization of a segmental retaining wall instead of the cast-in-place retaining wall specified in the construction documents. The owner expressed regret in approving the construction of the cast-in-place reinforced concrete wall due to the massive cost associated with its construction and the walls unpleasing appearance. A segmental retaining wall has the potential to be cheaper, more pleasing to the eye, and potentially easier to install.

Analysis 4: Schedule Visualization and SIPS Implementation

The fourth analysis looks to accelerate the schedule to make-up 64 lost days due to weather and subcontractors mistakenly performing work out of sequence. Since there are 150 repetitive patient rooms, SIPS intends to maximize the flow of trades through the construction of these rooms. A 4D model of the patient rooms will accompany the SIPS for a visual depiction of the flow of trades to avoid out of sequence work. This 4D model will be loaded with crew sizes to further depict the labor loading at different points in time on the project.

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Analysis 1: Collaborative Project Delivery

Problem Identification

For the Northeast Hospital Expansion, the mechanical and electrical subcontractors were brought onto the project too late with too many communication barriers present. These communication barriers existed physically, technologically, and contractually. Through the philosophies of integrated project delivery, this analysis hopes to eliminate communication barriers hindering project efficiency producing a more collaborative project environment.

Background

The Northeast Hospital Project was bid as the traditional design-bid-build method. The two specialty contractors that won the installation of the mechanical, electrical and plumbing systems were brought onto the project during the end of the design development phase for design assistance. When the time came to mobilization the general contractor, mechanical and plumbing subcontractor, and the electrical subcontractor each had their own job trailers scattered throughout the site. The architect for the project controls the coordinated BIM model in which the subcontractors do not have direct access, which communicate conflicts through the general contractor. These factors led to miscommunications between project team members throughout the construction phase reducing profit margins for all involved parties, causing the need to accelerate portions of the schedule, and potentially diminishing the quality of work already performed.

Potential Solution

In order to reduce the communication barriers for the Northeast Hospital Expansion, philosophies from the integrated project delivery method could be applied. The specialty subcontractors' involvement could be evaluated to determine the earliest point at which their involvement with the design would provide the most benefit to the overall project design. Based on the current project delivery method, the project may have benefitted from subcontractor involvement during the end of the schematic design phase and the entirety of the design development phase. Another philosophy to consider having utilized is providing a co-location for the entire project team. This co-location would replace the individual company job trailers with a sole trailer for all the different trades to run their operations from under the same roof. The last philosophy would attempt to provide all major project players access the same coordinated BIM model. Each of these IPD philosophies has the potential to benefit the overall delivery of the project, but will need to be investigated for potential risks and rewards imposed on the project or project team.

Analysis Steps

To achieve a more collaborative and efficient project delivery, the integrate project delivery philosophies considered for adaptation will undergo the following analysis steps:

- Review the general contractor, architect, and major specialty subcontractors' contracts for contractual language preventing further project team collaboration.
- Interview the project team on where they believe their input provides that greatest impact on the project.
- Research the cost, benefits and requirements for earlier design support from specialty subcontractors.
- Evaluate and compare the costs and benefits associated with hiring a specialty contractor for each phase of the project.
- Research the affects of co-location and the associated costs and benefits
- Interview industry members who have worked in a co-location
- Analysis the project for potential areas for co-location
- Research the BIM model ownership, file-sharing and updating, and security
- Determine appropriate methods to implement each IDP philosophy or not

Expected Outcome

From researching and interviewing members of the project team and other industry members, it is expected that the application of IDP philosophies to the Northeast Hospital Expansion would have allowed for a more collaborative team environment. By harboring a collaborative team environment, it is thought to alleviate the amount of miscommunications between team members.

Critical Industry Research

With construction bid estimates and schedule becoming more precise, the project teams of today need to be capable of adapting to a more collaborative and fluid work environment. The emergence of the integrated project delivery method has aided in keeping project teams ahead of the ever-condensing margins for communication errors. Though IPD is not an entirely new concept, some contractors and owners are reluctant to utilize this project delivery method. This holds especially true for areas in the industry like the east coast of the United States. This analysis intends to demonstrate how philosophies from the IPD method can be applied to other delivery methods building trust between contractors and owners. By implementing several principals from the IDP approach in todays project teams the trust can be built for fully collaborative teams in the future.

Analysis 2: Plumbing Prefabrication and Relocation

Problem Identification

Through conversations with the plumbing contractor on the Northeast Hospital Expansion, there was an excessive amount of pipe wasted during the projects construction. Excessive waste due to construction has the potential to affect a project's LEED score and the sustainability of the project as a whole. By the relocation of plumbing fixtures and implementing prefabrication where capable, the project's overall waste could be reduced with the additional benefit of accelerating the construction schedule.

Background

The Northeast Hospital Expansion is attempting to obtain a LEED certification level of LEED Silver. Even though the project team is not pursuing LEED points through construction waste management, the project is still attempting to take steps to be sustainable where sustainability makes sense. The plumbing contractor has noted that there is a large amount of piping wasted due to the location of plumbing fixtures and the process of stick-building the branch piping in the patient rooms. Currently the same plumbing contractor is prefabricating the pipe mains that consist of a domestic hot water line, domestic hot water recirculation line, domestic cold water line, medical air, oxygen, and medical vacuum lines. This main loop is located in the ceiling running directly through the center of each room. In total there are 30 patient rooms on each of the five patient floors to be fit out. Each patient room is similar in appearance and layout. The branch piping consists of domestic cold and hot water lines supplying the two sinks, the dialysis supply and waste box, and the water closet. Branch piping also consists of the medical air, oxygen, and medical vacuum lines to the headwalls in each patient room.

Potential Solution

To reduce the amount of waste currently created from the construction of the plumbing system in each patient room, a potential solution is for the possible relocation of plumbing fixtures to share wet walls. This solution would allow for fixtures to be positioned closer to the plumbing mains reducing the amount of branch piping required in each patient room. Additionally plumbing fixtures placed back to back on the same wet wall have the potential to utilize the same vent and sanitary lines. Along with the relocation of plumbing fixtures, all of the branch piping in the patient rooms could be prefabricated. Prefabrication has been proven to reduce material waste as well as increase construction quality and safety. If the branch piping was prefabricated the potential also exists for the acceleration of the project schedule.

Analysis Steps

In an attempt to present the Northeast Hospital Expansion project with the ability to reduce construction waste from their site, the following analysis steps will be taken:

- Interview the plumbing contractor and gage a more precise estimate on the amount of waste generated from the stick-built branches and their ability to prefabricate
- Review the IBC 2009 for hospital room restrictions
- Research additional codes that may apply to hospital patient rooms
- Identify plumbing fixtures that can be relocated
- Layout the new placement of plumbing fixtures for a single floor
- Review the layout to make sure quality of care is valued over efficiency
- Re-size vent, sanitary, and supply piping as necessary
- Preform detailed estimate of the branch piping
- Compare to the original estimate of the branch piping
- Research the benefits and restrictions of prefabrication
- Analysis how material deliveries, installation, and schedule are affected by prefabrication

Expected Outcome

The analysis on the relocation of plumbing fixtures and prefabrication of branch work in patient rooms is expected to greatly reduce the amount of construction waste generated from the installation of pipe. With the implementation of prefabrication to all branch piping the schedule should expect to experience an acceleration. The solution will also aim to place quality of care is placed in a higher regard to efficiency.

Analysis 3: Alternative Retaining Wall

Problem Identification

During a site walk, the owner expressed disappointment at the cost and unappealing appearance of the retain walls constructed on the South side of the project site. In retrospect, the owner wished they had considered an alternative system that was less expensive.

Background

The retaining wall the owner is referencing is located at the south most portion of the site. It stretches the entire length of the site following the curvature of the patient tower. The purpose of the retention wall is to hold back the soil removed in order to make for a smooth roadway underneath the patient tower and connect the roadway leading to the ambulance bay to Dameron Drive on the east side of the site. The retaining wall is cast-in-place reinforced concrete. The wall remains 12” thick throughout its entirety with a toe and key that vary in length with the amount of soil held back in the give area. The wall retains a minimum of 1.5 feet to a maximum of 6 feet of unbalance fill. The water table does not affect the retaining wall. At this time the actual cost of construction could not be obtained.

Potential Solution

Cast-in-place retaining walls are not the only options for holding back fill. This retaining wall has the potential to be constructed as a segmental retaining. These retaining walls can be constructed rather cheaply in supposedly less time than the traditional cast-in-place method. Many people prefer these types of retaining walls since they come in a variety of colors, shapes, and textures. The segmental block units allow for the wall to easily form curves as well.

Analysis Steps

In order to determine the cost savings incurred from utilizing a segmental retaining wall instead of a cast-in-place retaining wall the following analysis steps will occur:

- Request for the actual cost of the retaining wall from the general contractor or owner.
- Perform a detailed estimate of the existing retaining wall.
- Research design and construction process for segmental retaining walls.

- Familiarize myself with NCMA's SRW Design manual and SRWall Software.
- Design the alternative retaining wall.
- Perform detailed estimate of the segmental retaining wall.
- Review for constructability and safety concerns associated with the new retaining wall design.
- Adjust project schedule for new duration of segmental retaining wall.
- Compare material cost, labor costs, activity duration, and aesthetics to cast-in-place wall.

Expected Outcome

Before conducting an analysis to determine the potential cost savings and time saving associated with constructing a segmental retaining wall instead of a cast-in-place wall, it is expected that the segmental retaining wall will cost less. It is not however expected to receive a great time saving that some people insist is possible. This is due to amount of segmental blocks that will need to be laid in comparison the amount of concrete that can be poured for cast-in-place. The aesthetics should also be improved with the switch to a segmental retaining wall.

Analysis 4: Schedule Visualization and SIPS Implementation

Problem Identification

During the construction of the superstructure of the patient tower for the Northeast Hospital Expansion, the project lost 64 days due to the weather. The project team still wants to meet their final competition date. The area the project team thought they would have the best chances of making up the lost time was with the mechanical, electrical, plumbing and finishes in the patient rooms. Unfortunately the project team has seen trades work out of sequence leading to additional set back.

Background

The 64 days were lost due to an extra harsh winter that began earlier than anticipated and lasted long into the typical spring season. Since the construction activities halted by the weather were concrete pours and steel erection that occurred on the critical path the entire site experienced delays. The project is heavily relying on the mechanical, electrical and plumbing subcontractors to make up time, but room finishes will ultimate determine when each floor is ready for turn over and occupancy. Since the MEP contractors and framers have began work on the patient rooms, the framer and electrical contractor have operated out-of-sequence twice leading to additional scheduling issues. There are a total of 150 patient rooms with 30 on each floor being fit out. Each room is extremely similar in size and with what trades have activities within them.

Potential Solution

In an attempt to avoid the additional out-of-sequence schedule issues and to aim for the most efficient and productive flow of trades, this analysis would implement SIPS to the patient room floors. The SIPS schedule would break each floor of patient rooms into workable zones for each crew with a specific duration to complete the zone before moving to the next zone. Instead of this solution just solely focusing on creating the most efficient flow of trades to make up time. This potential solution will also include a 4D model to help the trades visualize the workflow and stay in sequence and on time.

Analysis Steps

In order to determine the amount of time that can be made up through this analysis the following analysis steps will be taken:

- Identify the construction activities and their sequence that must occur in each patient room.
- Estimate the length of time each activity will take to conduct and assign a crew size.
- Break each floor into an appropriate number of work zones to avoid the crews from working in the same space.
- Create a model of the patient rooms to link to the schedule and crew sizes
- Review for constructability and analyze the labor loadings for potential logistical issues
- Analysis for an schedule savings and practical use

Expected Outcome

Through this analysis, it can be expect to save time, but it is doubtful the savings will be enough to make up the 64 days. If time can be saved through the potential solution in the other analysis, there is the potential that all together the 64 days could be made up. Utilization of the 4D model to show sequencing and labor loading may assist subcontractors in staying in accordance with the schedule and knowing what must be completed to not hold up the following trade entering the work zone.

Conclusion

Each of the above four analyses have the potential to assist with the construction of the Northeast Hospital Expansion. These analyses range from breaking down communication barriers in an attempt to create a more collaborative project team, the design and implementation of a cost saving segmental retaining wall, the relocation of plumbing fixtures with prefabrication to eliminate construction waste, and even the effective use of schedule visualization in combination with SIPS to make-up lost work time. This thesis will allow for the examination of today's most prevalent issues in the construction industry, while potentially providing insight as to how the Northeast Hospital Expansion project could have been improved in hindsight.

<u>Suggested Grading Breakdown</u>

Analysis 1: Collaborative Delivery Method – 15%

- Critical Industry Research Topic

Analysis 2: Plumbing Prefabrication and Relocation – 35%

- Includes breadth in mechanical design

Analysis 3: Alternative Retaining Wall – 25%

- Includes breadth in structural design

Analysis 4: Schedule Visualization and SIPS Implementation – 25%

Appendix A: Breadth Topics

Breadth 1- Shared Plumbing Vents and Sanitary Resizing

Accompanying analysis 1, the relocation of plumbing fixtures and prefabrication of branch piping, breadth 1 will undertake the resizing, rerouting , and sloping all the shared vent and sanitary piping affected during the relocation of fixtures. Preforming this breadth will require the use the International Plumbing Code (IPC) 2012 for resizing and pipe sloping. The rerouted pipes will be coordinated with the other trades to confirm no clashes are caused. This will included the space necessary for hangers.

Breadth 2 – Design Segmental Retaining Wall

Analysis 3, the implementation of an alternative retaining wall system, will be paired with design of the segmental retaining wall. The design for the segmental retaining wall will be conducted using SRWall Software. This software can be obtained through the National Concrete Masonry Association (NCMA) on a 30-day trial. 30 days is believed to be more than enough to complete the design necessary for the new segmental retaining wall. Free tutorials exist to walk new users through the program. Time has been allotted in the proposed schedule to account for learning and understand the software. After the segmental retaining wall is designed it will be compared to the original cast-in-place retaining wall for cost savings, time savings, and possible space savings during construction. This breadth will consist of an updated schedule, retaining wall estimates, and detailed site logistics focused specifically on the retaining wall portion of the site.

Appendix B: Spring Schedule

Northeast Hospital Expansion Schedule	January				February					March					April				
Activity	Week 1	Week 2	Milestone 1 1/23	Week 3	Week 4	Week 5	Milestone 2 2/13	Week 6	Week 7	Week 8	Milestone 3 3/6	Week 9	Week 10	Week 11	Week 12	Milestone 4 4/3	Week 13	Final Report Due 4/8	Presentation 3/13
Analysis #1																			
Request contracts/Interview Project Team																			
Research co-location/Call industry members																			
Perform analysis																			
Analysis #2																			
Interview Southland PM/Review Building codes																			
Create and review room layouts/Re-size pipes																			
Perform cost estimates/Adjust schedule																			
Perform analysis																			
Analysis #3																			
Perform estimate of cast-in-place																			
Familiarize self with SRWall software																			
Design SRW using SRWall software																			
Estimate cost and schedule impact of new SRW																			
Perform analysis																			
Analysis #4																			
Indentify necessary activities																			
Estimate crews and durations																			
Cada model of necessary floors																			
Link model and adjust activities																			
Perform analysis																			
Review and Revise Analyses																			
Complete final report																			
Construct and practice final presentation																			