FINAL PROPOSAL REVISION 2

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: IPD Methods Implementation

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: Patient Room Re-Design for Shared Wet Wall

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. This also adds many unnecessary days of work. 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: SIPS Utilization for Patient Floors

The third 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. Labor-loading will also be examined at different points throughout the project.

Analysis 4: Preassembled Steel Connection Bridge

The fourth analysis is attempting to further accelerate the schedule by utilizing preassembly of steel members in the steel bridge connecting the exiting hospital to the new patient tower. Steel sections will have to be checked on their ability to actually be placed both from a constructability standpoint and safety. This analysis hopes to provide a method that could have mitigated some of the weather delays incurred on this project.

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Analysis 1: IPD Methods Implementation

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 effects 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 today's project teams the trust can be built for fully collaborative teams in the future.

Analysis 2: Patient Room Re-Design for Shared Wet Wall

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: SIPS Utilization for Patient Floors

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.

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 turnover and occupancy. Since the MEP contractors and framers have begun 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. This analysis will also diver into tracking labor-loading at different points in the project and see how this labor-loading is affected by SIPS.

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.
- Adjust crew sizes for a continuous flow of work
- Review for constructability and analyze the labor-loadings for potential logistical issues
- Analysis for an schedule savings and labor-loading

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. There is also the potential for saved costs since labor hours are expected to be reduced.

Analysis 4: Preassembled Steel Connection Bridge

Problem Identification

During the construction of the superstructure of the patient tower for the Northeast Hospital Expansion, the owner representative stated that a potential 64 days were lost due to the weather. More specifically he was referring to the unnatural amount of snowstorms that occurred the previous winter. One area where the erection of steel in particular appeared to cause difficulty was at the connection bridge. This bridge was documented as having spent 17 extra days in the field to complete.

Background

The Northeast Hospital Expansion project is creating a patient tower located to the south of the Northeast Hospital's existing facilities. These two different buildings will be connected with a steel bridge located on the second floor of both buildings. This steel bridge is to be constructed on top of existing to remain operating rooms located on the first floor of the existing Northeast Hospital facility. These operating rooms will not be in use during the construction of the steel connection bridge. When it comes to looking at the existing project schedule, the steel connection bridge is estimated at taking 95 days to construct its structure. The project team tracked a total of 17 days of additional work that needed to occur in the field for the bridges construction.

Potential Solution

In an attempt to make-up additional days during construction, preassembling portions of the steel connection bridge used to connect the existing hospital to the patient tower addition should be looked into. By preassembling steel members prior to lifting them into place, members can either be brought to site in one already connected piece reducing the total number of lifts necessary, therefore speeding up the installation process. Beyond just speeding up installation, members can be preassembled indoors and unaffected by the weather outside. Finally, preassembling members reduces the number of connections ironworkers need to make at high heights putting themselves at a further safety risk.

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:

- Understand the current means and methods being employed for erecting the steel connection bridge
- Determine limiting factors and create potential preassembled members
- Determine how members will be placed and lifted into place on-site
- Evaluate the constructability and safety concerns with possible methods
- Predict schedule impact from utilizing preassembled sections
- Decide which methods work the best for placing the preassembled sections

Expected Outcome

This analysis can expect to provide the project with some schedule savings. Along with the schedule savings, preassembled sections have the potential to reduce the number of safety hazards that already exist on the job site. Finally, by conducting this analysis, a better understanding can be gained as to how steel lifts and steel erection as a whole work.

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 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.

Suggested Grading Breakdown

Analysis 1: IPD Methods Implementation – 15%

- Critical Industry Research Topic

Analysis 2: Patient Room Re-Design for Shared Wet Wall – 30%

- Includes breadth in mechanical design

Analysis 3: SIPS Utilization for Patient Floors – 25%

Analysis 4: Preassembled Steel Connection Bridge – 30%

- Includes breadth in structural design

Appendix A: Breadth Topics

Breadth 1- Shared Plumbing Vents and Sanitary Resizing

Accompanying analysis 2, 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 – Crane Lift Verifications

Analysis 4, creating preassembled steel for the connection bridge, will be paired with crane lift verifications. When the steel members are preassembled there are additional dead loads applied to the steel member during the pick. Depending on how the steel members are being lifted, a check should be conducted to first verify that the crane being used will be able to lift the preassembled sections. Next, different pick options need to be presented and tested to verify that none of the members will fail in shear or bending since the member will be loaded different during the lift than how the designer had intended for the final design. These checks will help determine how large preassembled sections can be made, whether these sections can be lifted, and from where pick points can be located.

Appendix B: Spring Schedule

Joshua Miller Option: Construction Management Advisor: Craig Dubler

Northeast Hospital Expansion	January				February					March					April						
Activity	Week 1	Week 2	Week 3	Milestone 1: Complete Anaylsis 1 1/23	Week 4	Week 5	Milestone 2: Complete Analysis 2 2/13	Week 6	Week 7	Week 8	Milestone 3: Complete Analysis 3 3/6	Week 9	Week 10	Milestone 4: Complete Analysis 4 3/20	Week 11	Week 12	Milestone 5: Complete Final Report 4/3	Week 13	Final Report Due 4/8	Presentation 4/13	Week 14
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																					
Review current steel erection means and methods																					
Analyze shear & moment in connection bridge																					
Re-design to optimize for modularization																					
Perform safety evaluation to select best lift option																					
Evaluation Impact to Schedule																					
Perform analysis																					
Analysis #4																					
Indentify necessary activities																					
Estimate crews and durations																					
Cada model of necessary floors																					
Evaluatie Labor Loads																					
Perform analysis																					
Review and Revise Analyses																					
Complete final report																					
Construct and practice final presentation																					
Update CPEP																					
ABET Assessment Chart																					
Write Reflection																					

Legend	
In-progress	
Complete	
Mech/Pumb Breadth	
Structural Breadth	