

# **Technical Assignment #3**

## **Alternative Methods Analysis**



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## Executive Summary

Included in this report is information obtained regarding the design and construction of *Louis at the 14<sup>th</sup>*, a commercial building project located in Washington, D.C. owned by JBG Companies and currently being managed by Balfour Beatty Construction. It is a nine-story residential luxury apartment building with retail spaces on the street-level replacing existing two-story buildings and parking lots on the property. The building is pursuing a LEED Silver certification and is scheduled to be complete in early 2014.

First is a brief description of schedule acceleration scenarios that have been plausible on the actual project as discussed with project manager Will Siegel. Construction activities driving the critical path of the schedule are identified along with potential risks and complications involved in accelerating such activities.

Value engineering areas of the project were discussed with the project manager, also. Several methods and ideas utilized on the actual project are discussed, along with suggestions that were not implemented due to their impact on the architecture or performance of the building.

Following that specific building information is a description of critical industry issues discussed by industry professionals and students at the 22<sup>nd</sup> Annual PACE Roundtable that took place on November 7, 2013.

The first discussion dealt with "Prevention in Design," heavily emphasizing the need for safety to be considered and implemented into the design of buildings. Both safety during construction and permanent building safety were identified and analyzed, as well as the need to create incentives for designers to implement such effort.

The other topic of discussion was "Efficient Delivery of Facility Management Information," which dealt with the exchange of critical building information between the design & construction team to the building owner & maintenance team. The technological gap between these two parties was heavily debated, along with the actual need and necessity for such technology with different types of building owners.

A brief description of possible research topics and analyses for *Louis at the 14<sup>th</sup>* concludes the document, as personally discussed with Dr. Craig Dubler. This mainly included the questionable size of the underground parking garage, as it only covers a portion of the entire building footprint. Therefore, possible research and analysis may be possible in the extension of the parking garage pending schedule and budget changes. Other minor topics of discussion are briefly identified, as well.

## Project Manager Interview

### **Schedule Acceleration Scenarios**

*Louis at the 14<sup>th</sup>*, originally scheduled to start construction in March of 2012 and finish by December of 2013, proposes a challenging schedule with several key elements and threats to its success.

The fabrication and early approval of specific building components and long-lead items early in the project hold major potential to impact the critical path later in the schedule, making early organization and communication a key to timely completion.

Other than the early approval of key items, the critical path begins with the excavation and foundation phases, which introduces one of the largest scheduling risks of the project mainly because of unknown subsurface conditions. As a certain amount of groundwater is to be expected according to the geotechnical reports, there is always still a degree of uncertainty that can cause major delays on the critical path. Occurring on the actual project, more groundwater than expected was discovered that caused time-consuming complications with the dewatering systems and foundation work.

The ascending cast-in-place concrete superstructure then assumes control of the critical path, which is sensitive to logistical and weather delays. Much of the time consumed is governed by sufficient shoring & curing time. It is also essential to have the appropriate penetrations and sleeves identified and planned for the following mechanical, electrical, and plumbing rough-in work that occurs later on the critical path after the building enclosure is installed.

The building enclosure includes the installation of metal panels, brick façade, and window systems. This is a sensitive operation because instead of having more of the same materials, there are several different types occurring that can complicate the installation process. Several mock-ups were constructed on the actual project to mitigate this risk and simplify the process for the different tradesmen. This issue was considered in value engineering options, as well.

The finishes unavoidably complete the critical path on each floor, which involves a long and complex approval process because many materials used are foreign and take longer for review. They must also most adequately satisfy the aesthetic goals of every space of the building.

Throughout the schedule, the tightly congested site also poses the constant risk of error in appropriately executing the traffic control plan, public safety plan, and abiding by the constraints of the adjacent properties. All of these sensitive aspects have serious potential to shut down the jobsite at any time and further delay the critical path.

Potential activities where the critical path may be accelerated occur in the activities previously described through careful planning and proper execution. Otherwise, a general approach used by the project team is to take advantage of early start dates and float flexibility to condense activities closer together. Certain finish-to-start relationships between activities technically do not have this potential, but planning & preparation for the start of an activity can create opportunities to prepare for activities ahead of time, execute work more quickly, and save time on the critical path.

In order to accelerate the critical path as such, early involvement by each and every party involved is the most critical and most costly key to making it successful. For example, lack of planning and coordination can leave substantially more work by missing MEP sleeves and penetrations that can delay rough-in activities immediately following. Coordination among trades and work crews are essential to schedule acceleration.

## **Value Engineering Topics**

Included in the bid by Balfour Beatty Construction included a list of voluntary value engineering suggestions that could potentially save JBG Companies a significant part of their budget while maintaining the quality product for which each party always aims.

The majority of these suggestions that were implemented on the project included changes to more economical materials with similar performance specifications, one being the countertops installed in each of the residential units that were substituted for a different type of countertop fabricated in China. The laminate flooring was also substituted with a 5/16" laminate flooring manufactured by Mohawk.

Where sprinkler mains were designed to utilize black steel pipes, CPVC was used instead, as well as for domestic water lines; however, these materials in the parking garage areas were required to remain steel to meet building codes. Another material change occurred in the stainless steel trash chutes, which were changed to aluminized steel chutes.

All of the previously mentioned material substitutes adequately maintained JBG's goal in regards to quality, while other suggestions did not sufficiently meet this goal or did not suit other priorities well enough.

One suggestion that was not able to be utilized included the substitution of metal panels for more masonry veneer, as previously described for the sake of schedule acceleration. This change would require fewer trades working on the building enclosure at a time and offer simpler constructability. While it would potentially be able to accelerate the project schedule, too, the aesthetics of this change would be too great a difference and the final product would not look as originally intended.

As most of the residential units host a balcony with custom glass railings, it was suggested that standard manufactured glass railing be used. These standardized railings did not cooperate with the original design, nor did a potential change from painted galvanized railings to aluminum railings, as they created an unwanted aesthetic discontinuity on the balconies.

It was suggested that insulation requirements on vertical storm risers and vents be deleted since building codes did not require them, but acoustical considerations with adjacent apartments determined this change to be unfavorable to the occupants.

Other suggestions offered by Balfour Beatty Construction included implementing a ballasted roof instead of a green roof, utilizing Sovent piping, offering alternative plumbing packages, water heaters, locksets, cabinetry, and other specific masonry details that would ease constructability.

Overall, very few value engineering changes influenced the aesthetic appeal of the building's interior and exterior, while more of the implemented changes occurred where they would not be as noticeable.

## Critical Industry Issues

### **Prevention Through Design**

This discussion facilitated by Dr. Robert Leicht focused around the idea of incorporating safety in the design of building systems, making more engineers & architects conscious of the risks that can come as a result of their designs. It was first clarified by Bill Moyer of Davis Construction that there are two types of building safety: permanent use and building process.

Building design safety for permanent use refers to the everyday operation of an occupied building, more specifically the maintenance of the building. The design community is not commonly aware of how a building being designed is to be used after it is turned over to the owner. Details such as access heights can substantially influence the risk involved with adequately maintaining the building systems for the owner.

Moyer proposed an example by Davis Construction in which a permanent high-rise window washing system was designed to enhance the structural integrity of the building's curtain wall system using braced platforms, which was a decision made early in the design phase that enhanced permanent maintenance and offered easier constructability.

Another example was discussed in which a pedestrian bridge had one end at grade and the other end above grade like small cliff. As a result, tie downs needed to be incorporated to meet maintenance demands. Had the designer been aware of these maintenance constraints, this redesign could have been avoided.

Building design safety for the construction process focuses around the constructability of a design and the direct risks to the work force involved. It is common for designers to leave safety to the expertise of the contractor, as they are significantly more experienced. The incentives for designers to consider safety in their work were also brought to attention, as they are commonly not contractually obligated or liable for construction-related incidents.

A culture of safety is commonly found amongst contractors, but it must be spread to the design team to further reduce danger and risk. This is most feasible with integrated project teams and design-build projects in which the builder and designer are working together from start to finish. The challenge comes with more traditionally delivered project such as design-bid-build in which the designer and builder are contractually separated and do not collaborate during the major design phases.

It was proposed that safety budgets should be specified when designers are competing for work, since safety often takes a low priority in the industry's attempts at being economical.

The impact of leading industry practices such as BIM, prefabrication, and augmented reality were briefly discussed, as well. The future of the industry is moving toward such technology, opening up more opportunity to target value design, safety concerns, and avoid re-designs or hazards. For example, augmented reality allows an opportunity for safety walkthroughs in which signage, line-of-sight, and egress can be accurately analyzed and adjusted before they become permanent hazards or risks.

Lastly, the need for some form of third party oversight was brought to attention because of the common contractual gap between the builder and the designer, and also the variation in safety among projects. Building codes are not effective enough to control this, nor is OSHA's influence during the design phase enough to impact safety in design. With a third party qualified to review designs using an organized system that can be applied to common building projects, safety in design can be more regulated and practiced.

The U.S. Green Building Council serves as an example for sustainability in which the organization developed a system that could be applied to most projects and offer incentives for project teams to pursue its practices. Safety, in construction and design, could potentially offer this type of opportunity where designers and contractors could be rewarded with forms of insurance benefits and recognition. Such an organization is capable of making safety a common *top* priority in the industry like sustainability has become, making it an attractive goal to all parties involved on a project.

### **Efficient Delivery of Facility Management Information**

Dr. Craig Dubler and Ed Gannon lead this discussion dealing with the transfer of building information from the project team to the owner, more specifically the inefficiencies that exist in this transfer.

First, operations & maintenance paperless systems were introduced where Michael Arnold, Chief Facilities Officer of the Roman Catholic Diocese of Pittsburgh, brought about Newforma. Newforma is project information software that addresses the basic needs of organizing, finding, tracking, sharing, monitoring and reusing technical project information.

It was quickly pointed out that the owner and the users of this information are not always competent with the technology being handed over to them by the project team, creating difficulties and inefficiencies with the information turnover. Paper is universally known, but today's technology is not.

With this technical gap in mind, BIM was brought to attention and whether or not it is useful or necessary to operations & maintenance or asset management. This level of necessity may depend on whether newer or older facilities are being managed.

For example, Penn State University manages many older facilities that depend on paper documentation and information rather than technology, and switching between this method of organization and those of its newer buildings can have complications, especially with maintenance staff.

Therefore, the level of technology utilized in the transfer of facility management information can greatly depend on the competency or the needs of the owner.

Early involvement of the building owner was heavily discussed, as well. Spending face-time with the designer and builder can be invaluable to the owner's success with managing the facility years after the project turnover.

The owner has this opportunity to specify minor requirements or demands that may be minuscule to the project team, but greatly ease operations and maintenance. Long-term assets and attributes that only the owner can recognize can also be incorporated into decision-making. This involvement can also minimize any redesigns or fixes that may prove necessary after something is built and money is already spent.

Contractual language has the ability to influence the delivery of facility management information, too. While some designers and builders are concerned for a building's operations only to a short point defined by its warranty, others are maintaining ownership of operations & maintenance costs for an extended period before turning it over to the owner.

Clark Construction proposed an example in which Clark owned the operations & maintenance costs for the first 35 years after completion. With this contractual agreement, the design and construction was more carefully considered for long-term benefits and savings. For example, it was determined by this project team that terrazzo floors, although more expensive up front, would be more economical to maintain down the road than carpet would, so terrazzo was installed instead. Although this careful planning was done for selfish reasons on the project team's part, the owner still greatly benefits in the end.

With the design team acquiring the costs of operations and maintenance for an extended period, the full life cycle costs of the system designs are more honestly considered, which can include initial cost, cost of maintenance, cost of replacement, and cost of repairs, all of which can reap benefits for the building owner.

## **Feedback from Industry Roundtable**

Possible research topics and analyses regarding the construction of *Louis at the 14<sup>th</sup>* were briefly discussed with Dr. Craig Dubler at the conclusion of PACE Roundtable.

A major topic of discussion was the parking garage area occupying only a portion of the full building footprint, which seemed unusual considering that the parking garage could be extended much larger, allowing JBG Companies more payback from charging parking. This change has the potential to create schedule and cost analyses to compare to the actual partial parking garage.

With that discussion came the weighing of priorities by JBG Companies to determine what would be most appealing as the building owner, specifically the time-critical aspect of the project meant to bring in tenants as soon as possible and collect rent. It is possible that a better time in the rent cycle when more people are signing new leases would be May or June, which is about when the project would be completed if the parking garage was extended.

Other topics were briefly mentioned that included, the installation of ground-source heat pumps, cast-in-place concrete, and elevator controls as the building is turned over floor-by-floor.



## **Appendix**

(the following contains worksheets completed at the 22<sup>nd</sup> Annual PACE Roundtable on November 7, 2013)

Student Name

Russell Voigt

Session 1:

Topic:

Safety Through Design

Research Ideas:

- 1) contractual obligations & liabilities that can be given to the design to share some responsibility with the contractor
- 2) spread <sup>safety</sup> culture to designers & owners  
developing an organization and/or rating system like the USGBC for safety both design & construction related that can have benefits such as insurance discount

Session 2:

Topic:

Facility Mgmt Information

Research Ideas:

- 1) technical knowledge barrier b/w owner and project team for turning over info... ~~to~~ develop a system more suited for owners
- 2) making O&M + FM incentives for designers that are more capable of making an impact on ~~efficiency~~ O&M efficient O&M details.

Session 3:

Topic:

Research Ideas:

1)

2)

Industry Member:

Craig Dubler

Key Feedback:

Which research topic is most relevant to industry? What is the scope of the

- elevator control as floors are turned over

\* parking garage extension to full building footprint

- ground source heat pumps?

~~(see other pg?)~~

- longer schedule
- more profit for owner later on
- higher up-front cost
- \* → differential settlement p. with existing foundations

- quality vs schedule

↓  
rent cycle May/June? possible target completion date

- cast-in-place ~~→~~ precast ... too complex with MEP/floor heights

Suggested Resources:

What industry contacts are needed? Is the information available?

\* incentives to extend project schedule with larger underground parking (owner's agent)

idea: NEST residential BAS control system ... energy savings

↳ ask Professor Brennan Glantz