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Sunnyvale Plaza

Mid-Atlantic Region, United States

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Technical Assignment #3

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EXECUTIVE SUMMARY

The following technical report explores several key opportunities for further research to prepare for the final proposal. This report contains analysis on schedule acceleration techniques and value engineering practices utilized by the project team. It also covers critical industry issues discussed at the Annual PACE Roundtable including a discussion on possibilities for Sunnyvale Plaza.

The first analysis consists of schedule acceleration techniques utilized to ensure successful project completion. Several techniques were utilized to keep the schedule on track to fulfill substantial completion. These techniques included using a short interval production schedule to maintain more detailed construction phases during guestroom finishes. The SIPS schedule was utilized due to the high amount of repetitive guestrooms throughout the hotel.

The critical path of the schedule was also analyzed to recognize the most vital components of the construction schedule. The foremost risks included the excavation and construction of the substructure and the skylight structure. These posed the most risk to schedule delays due to the amount of other phases that relied on their completion. The superstructure could not begin or finish until different parts of the substructure were completed. Most of the finishes could not begin until the skylight was finished and the building was conditioned.

A schedule delay can pose several risks towards the hotel and project team. These risks include revenue loss and liquidated damages. Due to the large amount of guestrooms in a central location, the liquidated damages for late completion are especially high. Schedule acceleration techniques were utilized several times throughout the construction process to ensure successful completion and care was taken to ensure that finishes were not damaged.

Value engineering was utilized early in the construction to save costs while maintaining the value of the hotel. Due to the quick pace of the design-build delivery method, it was difficult to fully analyze larger engineering features for value. Most value engineering techniques utilized consisted of the change of finishes manufacturers and materials. Minor structural changes were also made in the substructure cast-in-place concrete system.

The Annual Pace Roundtable was utilized to communicate with leading industry professionals about critical industry issues and opportunities to analyze Sunnyvale Plaza. Two breakout sessions consisted of students and professionals discussing critical issues leading the industry. These sessions included safety prevention through design and multi-trade prefabrication and modularization. Time during the roundtable was also taken to discuss opportunities to evaluate and improve the construction methods utilized on Sunnyvale Plaza. These methods were discussed with an industry professional who gave feedback and resource advice. These suggestions will be utilized to determine several areas of analysis for the final proposal.

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SCHEDULE ACCELERATION ANALYSIS

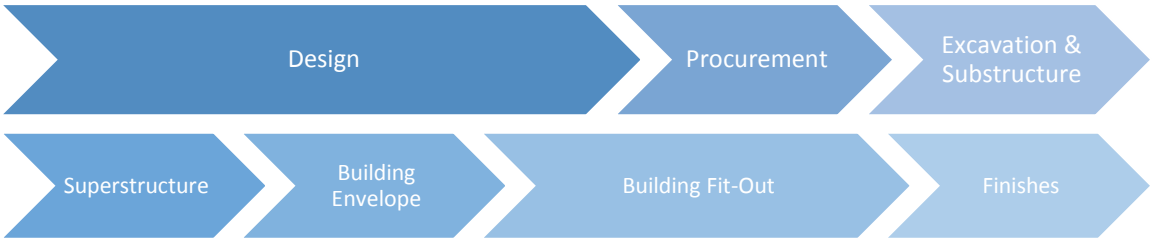
SCHEDULE OVERVIEW

In June of 2006 the first financing package was approved by the council and in February of 2007 private financing came together to complete the proposal. On September 24, 2007, after several reconsiderations for the size of the hotel to reduce financing, the developer signed an agreement to jointly finance the hotel. The official Request For Proposal was released in April of 2001, for a 1,100-room convention headquarters hotel. The original design created 1,500 rooms. After various attempts to gather funding, the hotel design was scaled back from the original design to 1,150 rooms. Sunnyvale released details of the design in October of 2008. The design was submitted to the National Capital Planning Commission late in 2008 and approved early in February of 2009. The project began construction in July of 2011.

Sunnyvale Plaza is expected to reach substantial completion on March 28, 2014 and open for use on April 25, 2014. The total project duration is approximately 34 months to final completion. Table 1 shows the breakdown of scheduled phases throughout the construction process. The following section also defines schedule risks and acceleration scenarios as well as the critical path of the construction phases.

Phase	Start Date	End Date	Duration
Design	11/1/2008	3/27/2013	1149
Procurement	12/26/2012	8/16/2013	168
Excavation & Substructure	3/25/2013	7/15/2013	81
Superstructure	4/2/2013	7/15/2013	75
Building Envelope	2/22/2013	11/13/2013	189
Building Fit-Out	8/1/2012	3/12/2014	421
Finishes	2/4/2013	3/17/2014	291

Table 1: Project Phase Breakdown



CRITICAL PATH

The phases that drive the project schedule the most consist of the excavation and the skylight construction. The slurry wall construction and excavation are the most extensive and critical phases of the project schedule as the rest of the structure relies heavily on the completion of the substructure. Both the substructure and skylight are crucial parts of the critical path and require attention.

The construction of the superstructure cannot begin until the substructure of Level S3 has been completed. Therefore, the excavation and substructure must stay on track to ensure that the superstructure construction can begin on-time. Also, the superstructure can only reach the eleventh floor above grade until the rest of the substructure is secured. Thus, it is critical that the substructure stays on schedule to ensure that the superstructure can continue to advance during construction.

The skylight structure is also a very important part of the critical path. The structural components of the skylight cannot be installed until the superstructure is complete. Therefore the skylight is the last structural element installed in the superstructure. The finishes for Sunnyvale Plaza cannot be installed until the building is sealed and conditioned. Therefore the final pieces of glass around the perimeter need to be installed before most of the finishes can begin. Due to the installation of the large statue, the skylight installation is already limited to other activities being completed and must be closely monitored within the schedule.

Image 1: Skylight Construction

Image 2: Skylight Construction

SCHEDULE RISKS

As mentioned in the previous section, a major risk for the project is the high quality finishes being installed in the guestrooms that make up a majority of the hotel. Theses finishes cannot begin until the skylight is completed and the building is dried in. It is crucial to avoid damaging any of the finishes due to the tight schedule of all of the guestrooms. If any damages are reported, extra work will need to be done to maintain the schedule. Due to the high amount of guestrooms in the hotel, it would be difficult to make up for any delays due to damages.

As a major hotel located in a city center, there is high risk in completing on time. The hotel consists of 1,175 guestrooms, which generate a high amount of revenue. Due to this, the liquidated damages for each day that the hotel is not open is very high. As a convention center hotel, events and rooms are already being booked for the weeks immediately after the opening date.

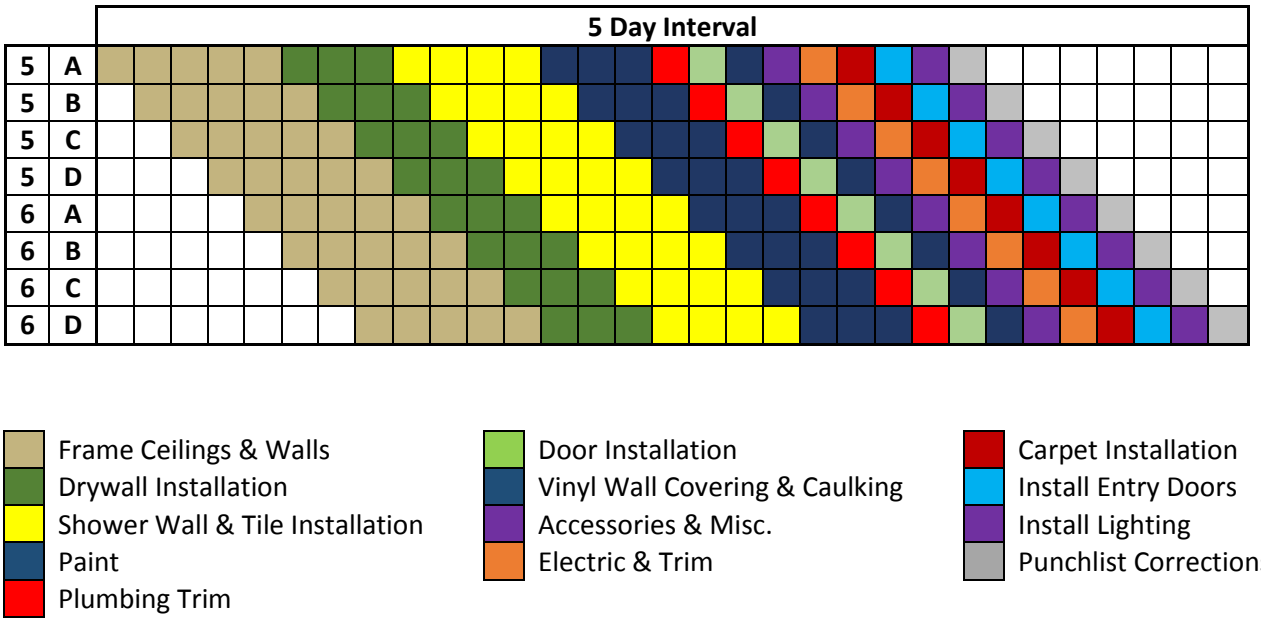
SCHEDULE ACCELERATION

Due to the size and complexity of the project, it was difficult to pinpoint specific schedule acceleration strategies. Several strategies were utilized to help keep the schedule on track during different phases of construction. Acceleration techniques are continually being implemented when problems arise throughout the construction phases. Most techniques are minor and require extra work to catch up. Using a Short Interval Production Schedule helped keep the finishes of each guestroom on schedule. Accelerating the schedule to an earlier completion date was not heavily pursued due to the goal of creating a conference hotel. The primary purpose of Sunnyvale Plaza is to create a conference center hotel compared to a heavily used tourist hotel.

SHORT INTERVAL PRODUCTION SCHEDULE

The use of a Short Interval Production Schedule was very important for this type of project. A SIPS is a detailed schedule that focuses on a day-to-day or weekly construction process. It is utilized for a process that is very repetitive and consistent throughout the entire progression. With over 1,000 hotel suites that are identical throughout the entire building, Sunnyvale Plaza is a prime situation to utilize this type of schedule. Two short interval schedules were developed for the guestrooms and core corridors of all of the floors above-grade. The SIPS utilized for the guestrooms incorporate all portions of the typical hotel suite on a five day interval per section of each tower. Each floor is separated into two phases, North Tower and South Tower, and within each tower there are four more detailed phases. Each phase makes up approximately 14 hotel suites. As each phase in a tower is completed, the contracting team moves to the next phase and continues to the next floor.

It is important to maintain consistent movement throughout the guestrooms on each floor. Due to the high capacity of the short interval production schedule, if one team falls behind, the entire schedule can be delayed. Utilizing this strategy to keep the schedule on track is not necessarily an acceleration technique, but surely creates a consistent and efficient work flow. It is difficult to determine, but can be a benefit to the overall project schedule.



OVERTIME

Having crews work extra hours throughout the week was also a necessary, although less attractive, strategy. Some trades were required to return to complete extra work if the schedule fell behind. This is obviously more costly, but sometimes necessary to accelerate trades during the short interval schedule. Due to the complexity of the short interval schedule, overtime work was utilized to ensure that the schedule was on track.

VALUE ENGINEERING ANALYSIS

Value engineering is a strategy utilized by a project team to save costs or increase value on a project. Although cost savings are pursued during value engineering, it is important that the project team does not decrease the value or quality of the project by cutting corners. The project team must ensure that it is meeting the goals of the owner while trying to utilize value engineering.

KEY AREAS

Due to the quick pace of the design-build delivery method, it is difficult to fully analyze the wide range of value engineering possibilities. Smaller techniques have been implemented within the project, but no major redesigns were evaluated once the project construction began.

During the preliminary conception of Sunnyvale Plaza, the size of the hotel changed many times. The original design for the hotel consisted of a 14-story hotel with six restaurants and two levels for ballrooms and meeting room space. After receiving a third financing package, the hotel was redesigned to incorporate more levels for ballrooms and several more levels for guestrooms.

As part of the value engineering strategy, several minor changes were made to the design once construction had begun. These strategies included changing the rebar of the below-grade cast-in-place concrete structural system. Levels S1 and S2 rebar sizes were reduced, and the concrete strength increased in the structural system. This created cost savings and an easier pouring environment for the concrete trades. Several guestroom finishes were also value engineered. Several manufacturers were screened to meet the needs of the owner for the guestroom finishes. The manufacturer that was able to create equivalent finishes at lower costs was chosen for the guestrooms.

CRITICAL INDUSTRY ISSUES

ABOUT THE PACE ROUNDTABLE EVENT

The Partnership for Achieving Construction Excellence, PACE, roundtable is hosted by Penn State University every year. This year, the 22nd Annual PACE Roundtable was held on November 7th, 2013 at The Penn Stater Conference Center. Leading industry professionals met with Penn State Architectural Engineering students to discuss current industry topics and critical issues. The roundtable was also a valuable opportunity for students to discuss possible ideas for their student thesis project. The topic of the roundtable was "Whole Project Delivery" and focused on a holistic concern for critical industry issues.

The roundtable consisted of two breakout sessions and ended with a focus group session. The breakout sessions involved of topics including sustainability, information technology, and integrated processes. The two sessions discussed below consist of Safety – Prevention Through Design, and Multi-Trade Prefabrication and Modularization. The Focus Group Session provided a valuable opportunity to interact with an industry professional in a more personal collaboration. This opportunity allowed students to discuss key ideas and possibilities for their student these projects.

BREAKOUT SESSION #1

The first session, "Safety – Prevention Through Design" focused on the discussion of designing a safer construction environment. The concern originated from the design industry not having enough awareness for the risks involved in constructing the actual building. The general contractor has typically assumed the role of safely maintaining a construction process, while the design team has had little or no involvement in safety. Contractors generally set up safety stations throughout a building as needed and maintain critical area of danger throughout construction. Design contracts also have little or no safety language involved in the contract language. If any safety issues are recorded, they must be submitted to the owner to be addressed.

Safety coordination is integrated into the entire project team and utilized throughout all construction phases. The group began discussing how important it is that design teams begin to address the risks involved in constructing the building. Not only is it important to be aware of the construction phases while designing a building, but it is important to understand the future maintenance needed to preserve the building. Examples of this that were discussed include avoiding the need for ladders while performing routine maintenance, or creating a design that does not allow the public to create a dangerous situation. The design team can create a safer working environment for the tenant if the planned maintenance of the building is understood early in the design process. This discussion also involved the growing use of prefabrication and

the construction logistics involved in the lifting and placing of large structural components and racks of building systems. More planning and logistics is needed to ensure the safety involved in the construction of more complicated prefabrication components.

The next discussion included the contractual language involved when securing a design team. Many design teams don't include any safety responsibilities in the contract language. The concern was expressed that a typical design team will not be interested in being involved in contractual obligations with safety of a construction process. It was also expressed that design teams may be more interested in being involved if they were aware early on and compensated financially.

The discussion then targeted the possibility of regulatory enforcement of safety design. While the Occupational Safety and Health Administration and International Building Code set restrictions on what can and cannot be done, is the design process in need of a regulatory safety enforcement? It would be difficult to create regulatory code for the design of a building that has not been designed yet. Most safety is created as it latches onto an already designed building. It would also be difficult to maintain regulation with building designs becoming more innovative and advanced. Consequently, it may come down to a design team having a greater understanding of construction risks. Having a better comprehension of these risks can create a safe habit of design.

An opportunity to kick-start the use of safe design can be implemented in a similar fashion of the LEED program that has begun to grow rapidly. By creating a checklist, design teams can try to accomplish as many safe tasks as possible while designing a building. Eventually, this can become a standard of practice within the industry. A study can also be conducted to determine the most at-risk scenarios during construction. This will teach engineers about the bigger issues within construction.

BREAKOUT SESSION #2

The second session, "Criteria and Drivers for Effective Multi-Trade Prefabrication and Modularization" focused on the discussion of bringing all trades together with better coordination for the expanding prefabrication market. This discussion included the wide variety of situations and complexities available for prefabrication and the ability to coordinate every trade involved in the building systems. The discussion also included different examples of prefabrication and modularization and the logistics and planning involved in successfully utilizing these strategies.

Several examples of prefabrication were discussed at the beginning of the breakout session to show the possibilities and availability of prefabrication. Some examples included the modularization of bathroom units within healthcare sectors. Although healthcare construction is very specific and limiting, it is still possible to utilize prefabrication. Another example consisted of a bridge that needed to be assembled quickly. The bridge was prefabricated in several pieces and shipped to the jobsite. The pieces were then assembled on-site in one weekend to avoid excessive closure of the road. A crucial concern during the bridge assembly was the lift capacity of the crane. It was important to ensure that the team did not exceed the lift capacity with such large bridge pieces.

Another discussion that took place during the breakout session included the need for early planning and whole team commitment to fully integrate prefabrication. This creates a much greater level of complexity for the project team. Fortunately, Building Information Modeling has enabled a much easier prefabrication process by fully modeling building systems aside each other. As BIM grows and becomes more advanced, prefabrication will become easier to utilize and implement into whole building systems.

The concern for liability of multi-trade prefabricated units was also expressed during the discussion. For example, if multiple trades share a rack that was prefabricated, who is liable for the rack and who takes responsibility for storage and installation of the rack? Another problem with prefabrication is that lending institutions do not want to pay until the equipment is physically on the jobsite. If prefabricated materials are stored off-site or at a manufacturing warehouse, lending institutions will refuse to pay for the materials.

FOCUS GROUP: STUDENT RESEARCH TOPICS

After the two breakout sessions, groups of three students met with an industry professional to discuss their thesis projects and develop ideas to study for the spring semester analysis. Through discussion with David Maser of Gilbane Inc. I have developed several key possibilities and resources that may benefit my thesis project. The project team is utilizing a Short Interval Production Schedule to maintain the schedule during finishes of the 1,175 guestrooms. Since these guestrooms are identical to each other, it can be beneficial to template the room components for production efficiency. The possibility of paneling the guestrooms as prefabricated units can benefit the schedule. Eggrock Modular Solutions was suggested as a resource for modular bathroom units. By modularizing bathroom units for all of the guestrooms, the schedule can be accelerated greatly. This advice will be utilized to produce several key areas of analysis for the final proposal.

Appendix A:

PACE Focus Group Notes