Technical Report III

U.S. General Services Administration Headquarters Modernization Phase I

1800 F St. NW, Washington, D.C.

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Technical Report II
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EXECUTIVE SUMMARY

The purpose of Technical Report III is to identify areas of the General Services Administration Headquarters Modernization that present a great opportunity for research, alternative methods, value engineering, and schedule acceleration. Located on 1800 F Street NW, Washington, D.C., this project consists of two phases, with this report focusing primarily on Phase 1. Technical Report III will form the basis for the final thesis proposal.

The General Services Administration Headquarters was originally built in 1917 and updated in 1935. It is renowned for its role in the architectural development of the federal office building type and its neoclassical style. Primarily used as an office building, the existing structure includes nine stories at approximately 724,000 square feet, with an additional 134,000 square feet of new office space in the building's courtyards. This project includes the replacement of interior finishes, preservation of historic features, and upgrade of all building systems.

An evaluation of the LEED Scorecard for the General Services Administration Headquarters Modernization breaks down where credits were earned in their respective categories. With 83 credits obtained, the project earned a LEED Platinum Certification, which exceeded the client's contracted requirement of a LEED Gold Certification.

The interview with the Project Manager offered valuable insight on schedule acceleration scenarios and value engineering topics. Some of the schedule acceleration techniques utilized on the project include the authorization of overtime work and night shifts as well as the implementation of Bluebeam Revu for clash detection and documentation of RFIs. Although there were a limited amount of value engineering techniques that were used on the project, a main item that was value engineered was the lightshade pockets, which saved about $100,000.

The 21st annual Partnership for Achieving Construction Excellence Roundtable allowed students to participate in break-out sessions that discussed critical industry issues about supply chain, efficient delivery of services, and operations and maintenance. This report summarizes two of those sessions, "Energy and BIM" and "Measuring Effective Collaboration," and discusses how they might be applied to the General Services Administration Headquarters Modernization.

After further examination of the constructability challenges, schedule acceleration scenarios, project manager interview, and current critical industry issues, various problematic features on the project were identified, which offered a chance to research technical analysis options. These options include a closer look at the New Addition window glazing, foundation system, site logistics, and the implementation of Building Information Modeling and Short Interval Production Scheduling. These topics will serve as the foundation for the final thesis proposal.

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LEED EVALUATION

To view the LEED Scorecard, please reference Appendix A.

OVERVIEW

The General Services Administration Headquarters is required under contract to obtain a LEED Gold Certification based on the United States Green Building Council's (USGBC) LEED for New Construction and Major Renovations v2009. However, due to the design and construction methods, the building is projected to obtain a total of 83 credits, with potentially 16 more credits, which would earn it a LEED Platinum Certification. Figure 1 shows a summary of the LEED credits by category.

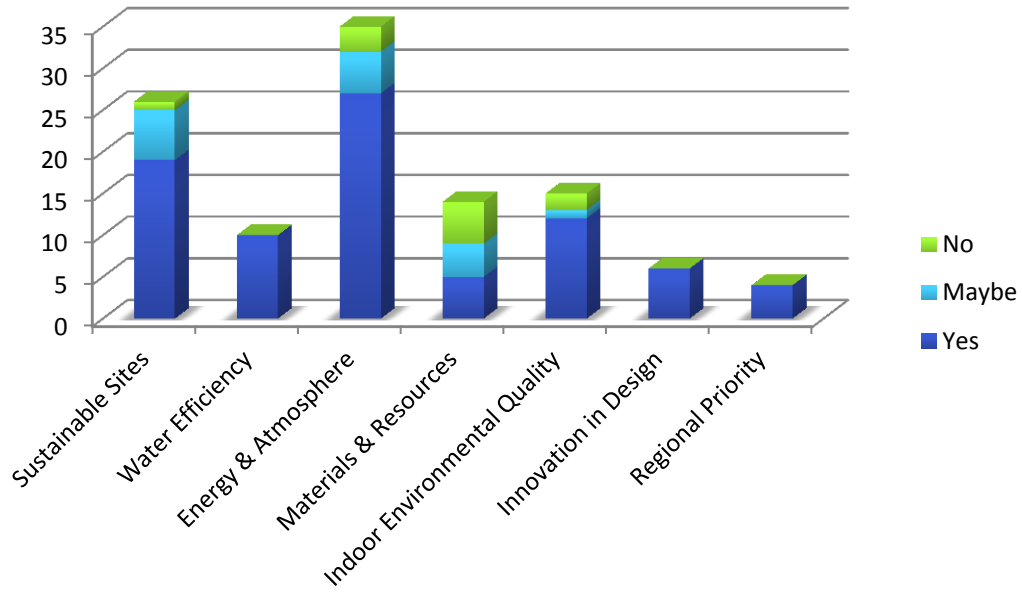

Figure 1: LEED Credit Summary by Category – Developed by Ramuel Holgado

The LEED Scorecard may be referenced in Appendix A. The credits in orange under Materials and Resources, Indoor Environmental Quality, and Regional Priority must be monitored on the site before the specified credit can be satisfied. These credits depend on which products are chosen to use for recycled content and volatile organic compound content. For example, the MR2 Construction Waste Management credit tracks the total percentage of waste that is recycled from the project. All the other credits are design team credits, which are satisfied during the design process of the project. This means that the Designer Consultant, Shalom Baranes Associates, had to follow certain guidelines to obtain the desired credits.

Since this project is for the headquarters of the General Services Administration, the modernization of this building is to serve as the showcase project for all future green building initiatives. The client wants to set an example for efficient, environmentally friendly buildings not only for General Service Administration projects, but for the federal government in general. This building will house numerous high-performance green building features such as green roofs, photovoltaic installations at the roof and skylights, radiant floors in the atria, energy recovery, daylight harvesting, greywater and condensate recycling systems, and high-efficiency plumbing fixtures designed to minimize water use. With all these considered, it would only be appropriate for the General Services Administration Headquarters Modernization to achieve a LEED Platinum Certification, which would exceed the contracted needs of the client.

SUSTAINABLE SITES

The purpose of the Sustainable Sites category is to reduce pollution from construction activities and to promote a more environmentally-friendly site. This may be achieved in numerous ways such as managing the erosion of soil, sedimentation of waterways, and propagation of airborne dust. An erosion and sedimentation control plan is required for all construction activities on the project. Additional credits may be obtained through the promotion of alternative transportation, brownfield redevelopment, and the reduction of the heat island effect, among others.

The General Service Administration Headquarters Modernization earned 19 out of a possible 26 credits for the Sustainable Sites category. Subcategory SS4 Alternative Transportation contributed most of these credits. Since the project is located in the center of Washington, D.C., there are several public transit options. In addition, there are 135 bicycle racks and 17 showers designated in the plans. The project will also receive credits for its innovative stormwater design, which allows stormwater to be captured and reused for the cooling tower, implementation of a white roof in lieu of terracotta, and location on a previously developed site. The only credit not in pursuit is SS5.1 Site Development, Protect or Restore Habitat.

WATER EFFICIENCY

The intent of the Water Efficiency category is to decrease the impact on municipal water supply and wastewater systems by increasing water efficiency. It is required to reduce the total water usage in the building by at least 20% by implementing various strategies. Other ways of satisfying more credits include reducing potable water and increasing the efficiency of wastewater reuse.

The project earned all possible credits for the Water Efficiency category. Credits were earned for having dual flush toilets, low-flow showerheads, and low-flow urinals as greywater will be

captured and reused for toilets. A 62 percent reduction in wastewater is expected, which far exceeds the requirements set by the USGBC.

ENERGY AND ATMOSPHERE

The Energy and Atmosphere category contains more credits than any other category. It requires the commissioning of all energy-related systems so that they are installed, calibrated, and perform properly as specified. In addition, the energy efficiency of the building and its systems must meet a minimum level in order to lower environmental and economic impacts. A final requirement for this category is zero use of chlorofluorocarbon-based refrigerants in the heating, ventilating, air conditioning, and refrigeration systems of the building.

A total of 27 out of a possible 35 credits were obtained for the Energy and Atmosphere category. A majority of the credits will be earned in the EA1 Optimize Energy Performance subcategory as the General Services Administration has agreed to modifications in order to achieve the highest number of credits for this particular subcategory, which is 19. Credits will also be earned for having compliant refrigerants and on-site renewable energy as solar panels and solar hot water systems will provide 7 percent building use.

MATERIALS AND RESOURCES

The primary purpose of the Materials and Resources category is to manage the waste produced by the occupants of the building that is transported to and disposed in landfills. This category requires that the building contains a predetermined area where materials for recycling, such as paper, glass, plastics, and metals, can be collected. Additional credits may be obtained by using regional materials, materials with recycled content, and salvaged or reused materials.

For the Materials and Resources category, the project satisfied 5 out of a possible 15 credits. Several of these credits are tracked during construction such as MR2 Construction Waste Management, MR4 Recycled Content, MR5 Local/Regional Materials, and MR7 Certified Wood. Credits will also be awarded for maintaining and reusing a percentage of the existing walls, floors, and roof.

INDOOR ENVIRONMENTAL QUALITY

There are two requirements for the Indoor Environmental Quality category. The first requirement is to enhance the indoor air quality in buildings by designing mechanical ventilation systems to the applicable local code. The second requirement is to prevent or minimize the exposure of tobacco smoke by prohibiting smoking in the building. Other ways to earn credits would be to increase ventilation in the building, use materials that emit low levels

of indoor air contaminants, and monitor the ventilation systems to ensure they are meeting the design requirements.

The General Services Administration Headquarters Modernization totaled 12 out of a possible 15 points for the Indoor Environmental Quality category. Items to be tracked during the construction process include EQ3 Construction IAQ Management Plan and EQ4 Low-Emitting Materials. Additional credits were obtained for having task lighting at each workstation, complying with the Thermal Comfort Design set in ASHRAE Standard 55-2004, and exposing daylight for 75 percent of the spaces in the building. The only two credits not in pursuit are EQ2 Increased Ventilation and EQ5 Indoor Chemical and Pollutant Source Control as MERV 13 filters cannot be installed at the fan coil units.

INNOVATION

The Innovation category allows members of the design team to be creative in their approach by encouraging them to perform above the requirements of the LEED Green Building Rating System. Credits may be earned by achieving innovation in design, implementing an integrative process, or by simply having a LEED Accredited Professional on the design team.

All possible credits were earned for the Innovation in Design Process category. The building will have a 50% reduction in stormwater run-off from a 2-year 24-hour storm, mercury reduction in light bulbs, and a new maintenance contract that will promote green housekeeping. In addition, the design team contains several members who are LEED Accredited Professionals.

REGIONAL PRIORITY

The intent of the Regional Priority category is to promote the environmental priorities of geographically specific regions by awarding credits as an incentive. These credits are earned through existing LEED credits that are identified by holding additional regional environmental significance by the USGBC Regional Councils and Chapters.

The project obtained the maximum number of credits for the Regional Priority category. Although there are a total of 6 Regional Priority Credits, no more than 4 credits can be earned. The Region Specific Environmental Priorities obtained are EAc1, EAc2, WEc2, and MRc1.1, which must be tracked during construction.

SCHEDULE ACCELERATION SCENARIOS

CRITICAL PATH

The critical path for the General Services Administration Headquarters Modernization can be seen in Figure 2. Activities under the sitework phase include mobilization, initial sitework and demolition, and underground utilities. After the sitework was completed, the foundation could begin. The foundation phase included the caissons, grade beams, and slab-on-grade. Following the completion of the foundation was the erection of the superstructure for the New Addition. Activities for the superstructure consist of the framing, reinforcing, and placement of the columns, walls, and deck as well as the framing for the roof. After the superstructure was erected, the construction of the enclosure for the New Addition could begin. The enclosure consisted of the roofing and the curtain wall in the Courtyard Elevation and the South Elevation. Once the enclosure was completed, the rough-ins and finishes for the New Addition could start. The rough-ins and finishes for the existing building started during the erection of the superstructure for the New Addition. Activities for the rough-ins and finishes included the mechanical, electrical, plumbing, and fire protection systems, drywall, paint, and ceiling grid. Finally, after the rough-ins and finishes were complete, the closeout phase could begin, which included punch lists and final inspections before the project could reach final completion.

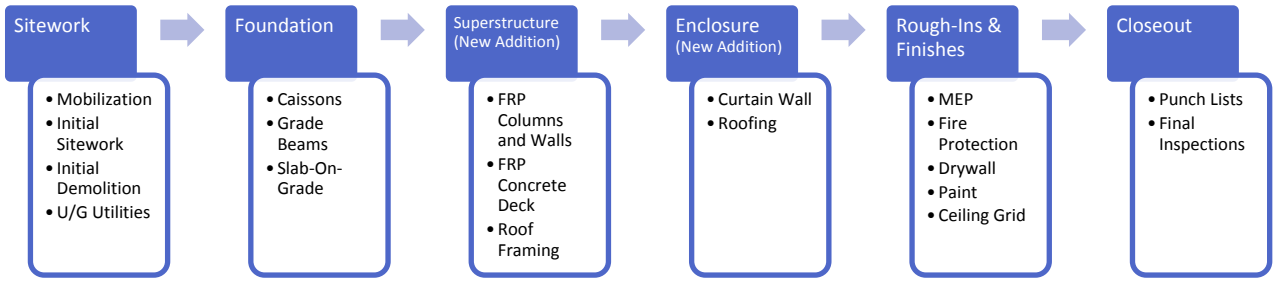

Figure 2: Critical Path – Developed by Ramuel Holgado

RISKS TO MEETING PROJECT COMPLETION DATE

One of the largest risks on the General Services Administration Headquarters Modernization is the completion of the South Lobby. The Architect picked stone that did not meet the American Recovery and Reinvestment Act of 2009 or the Buy American Act requirements. However, the project team underwent a process that determined that American-made stone was not economically feasible. Therefore, they proceeded to continue with the procurement of the original stone picked by the Architect. The stone is being shipped from Italy and is expected to arrive in December 2012.

Another key risk on the project was the delays that the retail permit created. This permit held up the demolition of the tunnel located in Wing 0. The underpinning in this area has already begun, but there are several activities that are finish-to-start. Therefore, a delay in one activity will result in the delay of all proceeding activities.

A final substantial risk on the project is the installation of the permanent power. The permanent power is expected to be finished by the end of November 2012. When this happens, it will provide power to the fan coil units and other mechanical equipment, which would allow flushing and testing to begin.

The team manages these risks by holding an executive meeting every other week to update the Owner on critical concerns. In addition, a separate team meets at least once a week to discuss the permanent power. In general, the project team holds several meetings in order to keep the schedule on track.

KEY AREAS FOR SCHEDULE ACCELERATION

One of the key areas for schedule acceleration used on the General Services Administration Headquarters Modernization was the authorization of overtime work for certain subcontractors. The General Contractor has already negotiated an accelerated schedule with the Owner that will allow the concrete, mechanical, electrical, and plumbing subcontractors to work overtime at time-and-a-half rates.

An additional technique for schedule acceleration utilized on the project was the use of night shifts in addition to the typical day shifts. Since the building was originally constructed in 1917, asbestos and lead-based paint are primary concerns. Each floor of the existing building was closed off one by one so that these hazardous materials could be removed at night. Additionally, the demolition of the buildings in the East Courtyard also took place during night shifts to avoid any conflicts with crews during the day shifts. This strategy allowed for a substantial amount of work to be completed in a single workday. Furthermore, although there is an increase in costs due to running night shifts, the Owner decided it would be beneficial in the long run to proceed with this schedule acceleration strategy.

Another schedule acceleration strategy implemented on the project was the use of Bluebeam Revu for clash detection and the documentation of RFIs. Since the General Contractor already owned the license to use the program, this technique was used at no additional expense. The clash detection allowed for added coordination out in the field, which prevented mistakes and increased production out of the subcontractors. In addition, all RFIs were marked up and documented in Bluebeam Revu and then stored on a shared server that allowed access for

subcontractors. This resulted in better communication between the General Contractor and the subcontractors, which therefore helped increase productivity.

In conclusion, although the aforementioned techniques for schedule acceleration may have increased the cost of the project upfront, it was determined by the Owner that the schedule was a more critical concern than cost for these particular scenarios. This would ensure that the Owner can open over 400,000 square feet of new office and retail space by the May 2013 project completion date.

VALUE ENGINEERING TOPICS

OVERVIEW

Value engineering is a method commonly used on construction projects to improve the value of products or services through extensive analysis and is usually implemented by the engineers, designers, or the project management team. With that said, the General Services Administration Headquarters Modernization contained a limited amount of value engineering techniques that were actually realized. The few proposed value engineering topics evaluated and approved by the Owner were executed mainly due to the positive effects on cost and schedule.

KEY AREAS OF VALUE ENGINEERING

A main item that was value engineered on the General Services Administration Headquarters Modernization was the lightshade pockets. Originally, the Architect called for a custom color instead of a stock color. After closer evaluation and with the approval of the Owner, a matching stock color was chosen instead of the custom color, saving approximately $100,000.

Additionally, the project management team had credit change orders. Included in these were the deletion of the retail elevator in Wing 0, the elimination of the metal panels around columns in favor of drywall, and the deletion of the stainless steel handrail in lieu of painted steel pipe.

These key areas of value engineering correlated with the goals of the Owner because of improvements in cost-savings and schedule acceleration. Techniques such as those aforementioned not only save the Owner money, but they also accelerate the schedule due to either implementing easier construction methods or not having to complete an activity at all, such as the retail elevator.

VALUE ENGINEERING IDEAS NOT IMPLEMENTED

There were no other true value engineering ideas on paper for the General Services Administration Headquarters Modernization other than those listed previously. Due to the magnitude of the project and the goal of the Owner to have it act as a showcase project for the General Service Administration, significant time and efforts were put into the design and planning phases. Therefore, minimal value engineering ideas were considered. Those that were considered were implemented mainly for budget and schedule improvements, as the Owner wanted to detract from the original design as little as possible.

Although the project did not have any other value engineering ideas, the General Contractor solicited numerous bids for audio-visual, information technology, and security systems. These were allowances that were not part of the base bid contract. Although none of the items were negotiated, there were several bidders on these scopes. These bidders may have suggested different items other than what was specified in order to have an overall lower price. If the Owner accepted a lower bid, they would include it with the acceptance of the overall price.

CRITICAL INDUSTRY ISSUES

To view the PACE Roundtable Student Form, please reference Appendix B.

OVERVIEW

The 21st annual Partnership for Achieving Construction Excellence (PACE) Roundtable focused on "Improving Efficiency through Innovation" and was held at the Penn Stater Conference Center on November 6, 2012. This event allows for the interaction between industry professionals and students through discussions about current industry issues while creating opportunities for students to generate ideas for their Senior Thesis through break-out sessions and focus groups. The underlying themes present throughout the PACE Roundtable centered on improving efficiency in new tools, processes, and industry drivers. A list of the break-out sessions may be observed below.

Break-Out Session I

1. Supply Chain: Integrating Strategies and Technologies
2. Efficient Delivery of Services: Measuring Effective Collaboration
3. Operations and Maintenance: Energy and BIM

Break-Out Session II

1. Supply Chain: Modularization
2. Efficient Delivery of Services: Efficient Use of Integrated Design
3. Operations and Maintenance: Model Handover

Prior to the break-out sessions, a student panel discussed the integrated educational experiences offered by Department of Architectural Engineering at The Pennsylvania State University. After the break-out sessions, focus groups were formed and consisted of a few students assigned to an industry professional. During this time, potential student research topics relating to the previously discussed critical industry issues were discussed.

BREAK-OUT SESSION 1C – OPERATION AND MAINTENANCE: ENERGY AND BIM

The first break-out session attended was "Operation and Maintenance: Energy and BIM." Although BIM was not implemented onto the General Services Administration Headquarters Modernization, due to the building's advanced mechanical, electrical, and plumbing systems along with its several high performance green building features, the operation and maintenance of energy, with or without the implementation of BIM, naturally became an intriguing critical subject matter.

As newer technologies are implemented into projects, buildings become more complex and thus become more difficult to operate. As a result, operation and maintenance has become a primary issue long after a building has been complete. The integration of BIM may help with the process; however, many owners are not pushing BIM on their projects and may not be as knowledgeable on the benefits of using it. Projects that have implemented BIM also have their share of challenges as several industry professionals present at the break-out session echoed the difficulty of identifying and linking the correct information to put in a BIM model.

A primary subtopic discussed during the break-out session was the possibility of incorporating ties between a model and the controls of a building. Currently, the technology does not exist to manage controls through a model as many industry professionals debated the value of integrating building automation systems with a static BIM model. One of the few benefits mentioned of doing so was the ability to find the physical location of a tie to its control. However, many believed there currently is no need for this integration as it may be best to keep both entities separate.

Another interesting subtopic introduced tried relating the accurate financial assumptions and energy impact with the owners. Many owners who are active in energy conservation want to know how their buildings are performing as they are the ones who are paying the energy bills. Several solutions were discussed on how to manage energy savings, including a guaranteed savings contract. However, many industry professionals were skeptical with this solution because in reality, it is up to the owner to use the building the way they want (e.g. choosing to leave the lights on in an unoccupied space). Many industry professionals suggested tweaking the energy model over time to get more accurate results, but stated how difficult and time-consuming this process may be. A general consensus suggested that it may be beneficial to offer rewards for post-occupancy changes that help improve energy savings.

The industry professionals also deliberated how to balance energy efficiency with occupant comfort. One industry professional believed that there must be a baseline set for comfort so that a majority of the occupants are comfortable. Another industry professional argued that the “human factor” must be taken into consideration as occupants may be more productive if they are more comfortable. The discussion then continued on whether this was more important than energy conservation. Possible solutions considered included profit sharing ideas and integrating a way so that occupants can physically see the impact of their behavior, such as leaving stickers at critical locations that explain the energy usage of their actions. In the end, the general conclusion was to always keep occupancy behavior in mind when attempting to reduce energy usage in a building.

Overall, the session provided some valuable insight on this current topic. It was surprising to learn about the difference of priorities of the industry professionals present as some valued cost-savings and energy efficiency, while others were more invested in the interests of the owner and comfort of the building occupants. There were also several key research areas that derived from the break-out session including the integration of building automation systems into a model, the connection between owners and their desire of implementing BIM and energy conservation solutions, and the balancing of energy-saving processes with the comfort of building occupants. All of these topics relate to the General Services Administration Headquarters Modernization and present research ideas that may be further explored.

BREAK-OUT SESSION 2B – DELIVERY OF SERVICES: MEASURING EFFECTIVE COLLABORATION

The second break-out session attended was "Delivery of Services: Measuring Effective Collaboration." The General Services Administration Headquarters Modernization, which is a $200M project, has over 60 subcontractors, over 250 workers at any given time, and 3 general contractors, which includes the joint venture between The Whiting-Turner Contractor Company and Walsh Construction as well as Hermosa Construction Group, LLC, which is participating in a mentorship program under Whiting-Turner. It is for these reasons that measuring effective collaboration is an important critical industry issue that relates to this project.

Naturally, the main topic of this discussion was how collaboration can be measured. What goals can be quantified and how can we determine if collaboration is occurring? Even though people work in the same room, does this mean that they will collaborate? Many of the industry professionals believed the issues of collaboration rely on the principles of mutual trust and respect. Numerous ways of how to increase collaboration among all members of the project were then discussed. One example would be to have a collaboration charter that would lay groundwork for collaboration. For example, the project team can enforce an RFI turnaround time of three days rather than a couple weeks. Another solution raised was to have breakout sessions between the different parties on the project to discuss specific details, such as having the architect meet with the various trades. Risk sharing, which indicates as a sign of trust, was also mentioned as a possible solution with the inclusion of performance incentives and disincentives. With that said, there were several challenges of collaboration on a construction site including the consideration of lower tier subs and location or geographic dispersion. The industry professionals believed that these collaboration issues can sometimes be avoided by setting requirements before the bid and concluded that the foundation for collaboration should be established at the very front end of the project during procurement.

Another subtopic of the break-out session tried to define how collaboration improves the product. It was agreed that it would create a "better, faster, and cheaper" product and may

provide a competitive edge while enhancing margins. However, this may depend on the project delivery system as a design-build project may generally incorporate more collaboration than a design-bid-build project. For the latter project delivery system, the industry professionals relied on the importance of past experience. General contractors generally tend to gravitate towards subcontractors that they have had a positive experience with in the past because of how difficult it may be to induce collaboration and compromise.

The end of the break-out session summarized how this critical industry issue is a "people problem" and does not necessarily relate to technology. However, an interesting research topic contrived from this contemplates how technology can help increase collaboration. What effects of BIM and other innovative ideas can encourage collaboration and what would be the effects on cost? This relates back to the owner and whether they are willing to sacrifice initial cost for better performance, which, in turn, relates back to a better, faster, and cheaper product. The industry professionals then talked about how the trend is shifting toward creating a better product more so than a faster and cheaper one, which produces better long-term performance.

In conclusion, this break-out session contained valuable information about this industry issue that relates to multiple technical analysis options. It was surprising to hear about the amount of difficulties and different stories that the industry professionals have had with collaboration issues on their respective projects. In addition, this session consisted of various research topics that may be applied to this project including the measuring of collaboration on-site, the effects of collaboration on creating an improved product, and the implementation of technology on projects to increase collaboration. These areas of interest have a large impact on the General Services Administration Headquarters and may be researched more in depth in the near future.

INDUSTRY CONTACTS AND ADVISORS

Numerous industry contacts were present during the break-out sessions, focus groups, and general discussions throughout the day. These contacts provided insightful knowledge regarding various research topics that may be beneficial to explore. A couple of the key contacts met during the PACE Roundtable that might be able to advise with the area of work related to the General Services Administration Headquarters Modernization are Michael Barnhart and Brooke Easley of Forrester Construction because of how knowledgeable they are of the means and methods of construction in the Washington, D.C. area. In addition, The Whiting-Turner/Walsh Joint Venture Project Team and the faculty of The Pennsylvania State University Department of Architectural Engineering can provide great assistance with research analysis to be completed in the coming months.

PROBLEM IDENTIFICATION AND TECHNICAL ANALYSIS OPTIONS

OVERVIEW

Since the start of construction, the General Services Administration Headquarters Modernization has been relatively successful as it continues towards its project completion date set in May 2013. However, after further review of the constructability challenges, schedule acceleration scenarios, project manager interview, and current critical industry issues, several difficulties and complications on the project were identified, which presented an opportunity to examine and explore various technical analysis options.

NEW ADDITION WINDOW GLAZING

The curtain wall on the south façade of the New Addition of the General Services Administration Headquarters rises over 60 feet in height and spans the entire length of the atrium. The increased amount of daylighting provides effective internal lighting while reducing the energy usage of light fixtures. However, large surfaces of glass tend to have increased solar heat gain, which may affect the usage of the building's heating and cooling systems. Therefore, it may be advantageous to examine other window glazing options that contain a lower U-factor or lower thermal emissivity.

In order to conduct an analysis on different window glazing options, certain criteria must be accounted for in order to measure the effectiveness of the alternate systems. First, a comparison of the initial cost against the payback period with the different glazing types would need to take place. This would include the effect on the building's energy usage on lighting fixtures and heating and cooling systems over time. Additionally, the impact of changes to the architectural features to the façade of the New Addition must be accounted for. Any research needed may be obtained from the MEP Manager or Quality Control Manager of the project team.

FOUNDATION SYSTEM

The foundation system for the New Addition of the General Services Administration Headquarters Modernization consists of 25 caissons that are driven approximately 75 to 80 feet below grade and were designed to be located beneath the loads of the grade beams, which transfer the loads from the columns. At $1.56M, the caissons account for nearly 30 percent of the structural systems. Therefore, with a price that's relatively high compared to the rest of the structure, it might be beneficial to explore options that offer better value at a lower price. These options may include deep or shallow foundations types such as mini piles, spread footings, raft or mat slabs, and combined footings.

The analysis for this area of research would begin with an examination of the geotechnical report. There are several factors within a geotechnical report that contribute to the process of choosing a foundation system including subsurface conditions, soil types, and location of the water table. In addition, foundation loads, such as the soil bearing capacity, soil pressure, building live load and dead load, and seismic force, must be taken into consideration. Any research needed may be acquired from either the Whiting-Turner/Walsh Joint Venture Project Team or the Civil Engineer, which is A. Morton Thomas Engineering. After different types of foundation systems have been analyzed, a comparison of cost and constructability can determine the best alternate foundation system.

FULL IMPLEMENTATION OF BUILDING INFORMATION MODELING (BIM) AND THE INTEGRATION OF $37M IN ALLOWANCES

The implementation of BIM in the construction industry continues to grow as it makes the collaboration of knowledge between owners, designers, and builders easier than ever. Since the General Services Administration Headquarters Modernization does not incorporate BIM into any phase of the project, it may have been beneficial to fully implement BIM from the early stages of the conceptual design, through the design and construction phase, and finally through its operational life. Models created during the design phase can help increase coordination thus potentially leading to schedule acceleration, especially for larger, more complicated projects. New field management software, such as Autodesk BIM 360 Field, combines BIM with mobile technologies allowing for use in the field to automate field processes and distribute plans and drawings to all personnel on the project. After the project has reached its completion date, model handover to the owner may help with the managing of building automation systems and energy efficiency.

In order to analyze the effects of BIM on the project, a baseline must be set for different project goals, such as the impact on schedule acceleration, quality control, and cost savings. Since the Owner has established the integration of $37M in allowances throughout the schedule of the project, further research can determine where this money has been allocated and whether it would be appropriate to spend a portion of it on the full implementation of BIM. This portion would include money spent on personnel, training, and software, among other factors. The initial cost of implementing BIM can then be compared to its impact on flow of information, quality control, and schedule. Research may be obtained from the Project Manager in regards to the schedule and distribution of the allowances approved by the Owner. Additionally, it will also be important to define the needs of the Owner, Construction Manager, General Contractor, Subcontractors, Architect, and Engineers and determine how BIM can meet these

needs. Finally, an examination on the use of BIM after model handover can help explore energy conservation options on building controls and automation systems.

SITE CONGESTION, MATERIAL HANDLING, AND SAFETY

Due to the construction site location in downtown Washington, D.C., site congestion, material handling, and safety became primary issues on the project. As the project progressed, the amount of space on site generally decreased, mainly because of the construction of the New Addition in the East Courtyard. Laydown areas were located in both the East Courtyard and along E Street NW, as a public space permit was obtained. Parking on site was limited to only deliveries, lifts, cranes, and construction vehicles as all subcontractors and members of the project team were required to find parking elsewhere in the city.

An analysis for this topic would include the exploration of multiple site logistics plans and their impact on safety and production. This may be accomplished through the use of 4D modeling software such as Synchro or Autodesk Navisworks through different phases of construction and would be especially advantageous for construction activities taking place in the East Courtyard or other confined spaces. Measurements on the impact on productivity and schedule acceleration may be taken and evaluated against the current project schedule. All research concerning site logistics and safety planning may be obtained from the Project Manager and Safety Manager of the project team.

CREATING A SHORT INTERVAL PRODUCTION SCHEDULE (SIPS)

There have been numerous activities on the General Services Administration Headquarters Modernization that have presented challenges. Due to the advanced mechanical, electrical, and plumbing systems to be installed paired with the complexities of the current schedule, coordination of the construction services emerged as an interesting area of concern. That being said, several areas of work appear to be repetitive, especially on the existing wings, which would present a great opportunity to research the benefits of integrating SIPS on the project.

One of the main areas of concern for this topic relates to the repetitive construction activities on the project that may encourage the use of SIPS. An analysis must first be conducted to determine if SIPS would be an appropriate method to approach the project. In order to measure its effects, it must ultimately be compared to the current schedule and its impact on schedule acceleration. Furthermore, an analysis on the cost savings of construction and the benefits of having tenants occupy the building earlier can then be conducted. In order to research the topic, the project team must be contacted to determine the most repetitive activities along with the best scenarios for dividing the different areas of the building for the purposes of applying SIPS.

APPENDIX A

LEED SCORECARD

GSA 1800 F St.
17 March 2011

Owner -- Skip Vaughn, General Services Administration (GSA)
Architecture -- Bob Karow, Shalom Baranes (SBA)
Civil -- Jerry Kavadias, AMT
MEP -- Ken Schram, Syska Hennessy (Syska)
Interior Architecture -- Studios
Sustainability -- Bharati Karmarkar, Esi Waters, GreenShape (GS)
General Contractor -- JR Russell II, Petar Radakovic, Walsh Construction (WC)
Specifications -- Kathy Alberding, Heller & Metzger (HM)
Landscape -- TBD (LA)
Lighting -- John Coventry, Coventry (Light)
Commissioning Agent -- Heery (HR)
Kitchen Design -- Michael Pantano, Culinary Advisors (CA)

LEED 2009 - New Construction, Major Renovations						Pts.	Review	Documented under v2.2	Action Items	Responsibility	
83	13	3	11	Total Proposed Project Score		110				Doc.	Coord.
				Certified 40 to 49 points **Silver** 50 to 59 points **Gold** 60 to 79 points **Platinum** 80 points and above			D/C	2600 FTE		
19	5	1	1	**Sustainable Sites**		26					
Y	M+	M-	N								
Y				SSPR 1	**Construction Activity Pollution Prevention**	0	C		Verify E&S plan meets EPA 832/R-92-005 (Sept.1992). Unchanged.	AMT	
1				SS1	**Site Selection**	1	D		Document previously developed site.	AMT	
5				SS2	**Development Density & Community Connectivity**	5	D		SBA to complete under community connectivity. GS to send requirements.	SBA	
1				SS3	**Brownfield Redevelopment**	1	D		Document asbestos, PCB remediation. GS to send documentation requirements.	GSA	
6				SS4.1	**Alternative Transportation**, Public Transportation Access	6	D	2.2	Numerous public transit options. Document.	SBA	
1				SS4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1	D	2.2	135 racks, 17 showers. Locate in plans. Document.	SBA	
	3			SS4.3	**Alternative Transportation**, Low-Emitting and Fuel Eff. Vehicles	3	D	2.2	135 spaces to be reduced to 50. Remaining spaces can be hybrid and/or preferred parking (senior staff and driver in hybrid vehicles).	SBA	
2				SS4.4	**Alternative Transportation**, Parking Capacity	2	D		Pursue Option 4 -- No new parking.	SBA	
			1	SS5.1	**Site Development**, Protect or Restore Habitat	1	C		Confirm if courtyards to be landscaped.	AMT	
		1		SS5.2	**Site Development,** Maximize Open Space	1	D		Confirm if green roof and pedestrian hardscape is 20% of site area.	AMT	
1				SS6.1	**Stormwater Design**, Quantity Control	1	D		Stormwater to be captured and reused for cooling tower. Graywater for toilets and urinals. Likely to earn innovation for exemplary performance. Confirm with calculations.	AMT	
	1			SS6.2	**Stormwater Design**, Quality Control	1	D		Using Bay Savers. Confirm how overflow is handled. Confirm BMP for average annual rainfall.	AMT	
1				SS7.1	**Heat Island Effect**, Non-Roof	1	C	2.2	Light concrete to be used. Document.	SBA	
1				SS7.2	**Heat Island Effect**, Roof	1	D	2.2	Terracotta replaced with white roof, meets 75% requirement. Document.	SBA	
	1			SS8	**Light Pollution Reduction**	1	D		Syska to determine if historic fixtures can be compliant, perform photometric analysis.	Syska	
10	0	0	0	**Water Efficiency**		10					
Y	M+	M-	N								
Y				WEPR1	**Water Use Reduction**, 20% reduction	0	D		Project will far exceed requirement.	Syska	
4				WE1.1	**Water Efficient Landscaping**, Reduce by 50% , No Potable Water Use	4	D		Confirm hose bib and sprinkler to be used on roof. No other irrigation.	LAN	
2				WE2	**Innovative Wastewater Technologies**	2	D		Graywater to be captured and reused for toilets. 62% reduction in wastewater expected.	Syska	
4				WE3	**Water Use Reduction**, 30%, 35%, or 40% Reduction	4	D	2.2	Dual flush toilets, low-flow sensor lavs, low-flow showerheads, low-flow urinals. Currently showing 62% with graywater reuse.	Syska	
27	3	2	3	**Energy & Atmosphere**		35					
Y	M+	M-	N								
Y				EAPR1	**Fundamental Building Systems Commissioning**	0	C		Heery to re-review design.	HR	GSA
Y				EAPR2	**Minimum Energy Performance**	0	D	2.2	ASHRAE 90.1-1999 and 2007 requirements met. See EA 1 notes.	Syska	
Y				EAPR3	**Fundamental Refrigerant Management**	0	D	2.2	Document intent for comprehensive CFC phase-out.	Syska	
19				EA1	**Optimize Energy Performance (ASHRAE 90.1 2007)**	19	D		SBA confirmed that GSA has agreed to modifications inorder to achive highest number of credits.	Syska	
4			3	EA2	**On-Site Renewable Energy,** 1%, 3%, 5%,7%,9%,11%	7	D		Solar panels,solar hot water in design provide 7% building use. Confirm integrated solar. Cnfirm if cogen can contribute. Document.	Syska	
2				EA3	**Enhanced Commissioning**	2	C		SBA to send out Heery commissioning report for review.	HR	GSA
2				EA4	**Enhanced Refrigerant Management**	2	D		Refrigerants are compliant. Document.	Syska	
	3			EA5	**Measurement & Verification**	3	D		Syska to confirm if current scope included development of M&V plan.	Syska	
		2		EA6	**Green Power,** 35% for 2 years	2	C		GSA to confirm current purchases, amount needed based on model.	GSA	

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				Certified 40 to 49 points **Silver** 50 to 59 points **Gold** 60 to 79 points **Platinum** 80 points and above		D/C		2600 FTE		
5	4	0	5	**Materials & Resources**	14					
Y	M+	M-	N							
Y				MRPR1 **Storage & Collection of Recyclables**	0	D	2.2	Identify locations and path to pick-up. Space unchanged.	SBA	GSA
1	1		1	MR1.1 **Building Reuse,** Maintain Existing Walls, Floors and Roof. 55%, 75%, or 95%	3	C	2.2	Confirm percentage building reuse. 95% reuse earns 3 points under v3.	SBA	
			1	MR1.2 **Building Reuse,** Maintain Interior Nonstructural Elements	1	C		Point not feasible. Include maintained elements in MR 2.		
1	1			MR2 **Construction Waste Management**, Divert 50-75%	2	C		Include in specs. Track during construction.	WC	SBA
			2	MR3 **Materials Reuse,** 5-10%	2	C		Not attempting due to building scale and cost of materials		
1	1			MR4 **Recycled Content,** 10%-20% (p.c. + 1/2 p.i.)	2	C		Review submittals for compliance. Track in construction.	WC	SBA
1	1			MR5 **Local/Regional Materials,** 10% - 20% manufactured, harvested regionally	2	C		Review submittals for compliance. Track in construction.	WC	SBA
			1	MR6 **Rapidly Renewable Materials,** 2.5%	1	C		Point not feasible but Include finishes where appropriate, in TI guidelines.		
1				MR7 **Certified Wood**	1	C		Review submittals for compliance. Track in construction.	WC	SBA
12	1	0	2	**Indoor Environmental Quality**	15					
Y	M+	M-	N							
Y				EQPR1 **Minimum IAQ Performance**	0	D		Document.	Syska	
Y				EQPR2 **Environmental Tobacco Smoke** (ETS) **Control**	0	D		Modify policy. Eliminate smoking on balconies.	GSA	
	1			EQ1 **Outdoor Air Delivery Monitoring**	1	D		Confirm which densely occupied spaces would need CO2 monitors. Auditorium.	Syska	
			1	EQ2 **Increased Ventilation**	1	D		Confirm not feasible for project under LEED 2009.		
1				EQ3.1 **Construction IAQ Management Plan**, During Construction	1	C		Include Construction IAQ requirements in specs.	WC	SBA
1				EQ3.2 **Construction IAQ Management Plan,** Pre-Occupancy	1	C		Coordinate with tenant fit-out scheduling/scope. Plan for testing - include in budget. Test before furniture. Include in specs.	WC	SBA
1				EQ4.1 **Low-Emitting Materials**, Adhesives & Sealants	1	C		Include in Tenant Improvement Requirements. Document.	WC	SBA
1				EQ4.2 **Low-Emitting Materials**, Paints & Coatings	1	C		Include in Tenant Improvement Requirements. Document.	WC	SBA
1				EQ4.3 **Low-Emitting Materials**, Flooring Systems	1	C		Include in Tenant Improvement Requirements. Document.	WC	SBA
1				EQ4.4 **Low-Emitting Materials**, Composite Wood & Agrifiber	1	C		Include in Tenant Improvement Requirements. Document.	WC	SBA
			1	EQ5 **Indoor Chemical & Pollutant Source Control**	1	D		Cannot install MERV 13 filters at fan coil units.		
1				EQ6.1 **Controllability of Systems**, Lighting	1	D		Task lighting will be provided at each workstation. Document.	Syska	
1				EQ6.2 **Controllability of Systems**, Thermal Comfort	1	D		Syska to confirm 50% threshold reached.	Syska	
1				EQ7.1 **Thermal Comfort**, Design (ASHRAE 55-2004)	1	D		Project will comply. Document.	Syska	
1				EQ7.2 **Thermal Comfort**, Verification Survey	1	D		GSA to administer occupant survey after each phase.	GSA	
1				EQ8.1 **Daylight & Views**, Daylight 75% of Spaces	1	D		Considering blast curtains. Confirm and documents after alternates selected.	SBA	
1				EQ8.2 **Daylight & Views**, Views for 90% of Spaces	1	D		See above.	SBA	
6	0	0	0	**Innovation in Design**	6					
Y	M+	M-	N							
1				ID1.1 **Innovation in Design:** TI Guidelines (or SS 9 in C&S)	1	C		SBA to det. if GS will assist in developing.		
1				ID1.2 **Innovation in Design:** Public Education Program	1	C		GSA to confirm feasibility.		
1				ID1.3 **Innovation in Design:** Green Housekeeping	1	C		GSA to pursue with new maintenance contract.		
1				ID1.4 **Innovation in Design:** Mercury reduction in light bulbs	1	C		Confirm ability to achieve.		
1				ID1.5 **Innovation in Design:** SS 6.1 Exemplary Performance	1	D		Confirm with calculations, 50% reduction in stormwater run-off from 2yr 24 hr storm.		
1				ID2 **LEED Accredited Professional**	1	C		Bharati Karmarkar and others are LEED APs.	GS	
4	0	0	0	**Regional Priority Credits**	4					
Y	M+	M-	N							
1				RP1.1 **Region Specific Environmental Priority:** EAc1 (40%/36%)	1	C		Confirm 36% savings and doc after alternates selected end of 9/10.		
1				RP1.2 **Region Specific Environmental Priority:** EAc2 (1%)	1	D				
1				RP1.3 **Region Specific Environmental Priority:** WEc2	1	D				
1				RP1.4 **Region Specific Environmental Priority:** MRc1.1 (75%)	1	D			WC	

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APPENDIX B

PACE ROUNDTABLE STUDENT FORM

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