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Technical Assignment 3

Kaiser Permanente- Medical Office Building

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Executive Summary

This technical report is intended to identify areas of the Kaiser Permanente Tysons Corner project that are viable options for research and analysis. The areas for improvement that will be considered include alternative construction methods, value engineering, energy or cost savings opportunities, schedule acceleration, and more. These potential changes will be explored based on feedback from the Kaiser Permanente Project manager, Hector Valdez, as well as current topics affecting the industry. These areas for improvement will aid as a basis for analysis for the final thesis proposal.

The main topics of feedback from Hector Valdez included constructability challenges, schedule acceleration scenarios, and value engineering topics. The knowledgeable information that Hector Valdez offered gave a greater insight on the project's core areas for improvement. The three main constructability challenges mentioned were waterproofing issues, the existing waffle slab configuration, and the simultaneous construction of the new onsite parking garage project. The activities that became potential schedule risks were changes in MEP system configurations, interior build-out, the extensive QA/QC inspections required, and the waterproofing of the existing building perimeter. Value engineering was an opportunity for components of the building such as the replacement of the exterior precast panels and glazing. The deletion of the cold rolled channel reinforcement for the partitions also utilized value engineering and saved the owner \$90K.

The 20th Annual PACE Roundtable was a beneficial opportunity to learn about current industry topics, speak with industry members, and apply these topics to the research for potential analysis areas. The major topics of the event included Sustainability and Green Building, Process Innovation and Technology Applications. The key topics of discussion in the Process Innovation: *Assembling/ procuring an integrated team* session were defining IPD and identifying the obstacles of IPD such as owner buy-in, creating contract documents, and finding applicable projects for IPD. The key topics of Sustainability/ Green Building: *Learning Systems for training a sustainable workforce* were what a sustainable workforce is, identifying how to improve a sustainable workforce, the benefits of a sustainable workforce, and the characteristics of a sustainable workforce.

The problem identification and potential analysis section reviews the problematic features of the Kaiser Permanente Project and the potential research topics associated with these issues. The first issue was the time associated with the existing waffle slab design change and approval for fire-rating/insulating the coffers. This delay heavily impacted the schedule, cost and other trade's work. The project delivery method will be changed from design bid build to design assist to explore if the design process will improve this issue. Waterproofing the existing building perimeter was the second issue identified because it is an addition to the original scope of work and impacts schedule, cost, and completion of other activities. A potential analysis area to research for this issue is to incorporate the waterproofing activity into the original schedule. Factors such as the effect on the GMP amount, the logistics of the site, and the schedule duration will be explored. Another issue identified was the cracks and water

infiltration of the existing precast panels. An analysis will be done to replace the existing precast panels and glazing with a Curtin wall system. Considerations such as the structural effects, cost, and schedule impact for this replacement will be further analyzed to determine benefits to the project. The time associated with interior build-out was another issue recognized on the project. An analysis will be done to see the benefits of prefabricating drywall and MEP units to increase the production of interior build-out. Lastly, the lack of sustainable initiatives and LEED certification for this project is a lost opportunity for energy and cost savings for the building. To address this issue, a study will be conducted to compare the energy and cost of an LED temporary lighting system versus the standard fluorescent temporary lighting system used. Also, the option for a green roof for this project is a feasible feature that will be researched to determine the benefits attributed.

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Constructability Challenges

Similar to many construction projects, construction issues and logistics were experienced daily on the Kaiser Permanente jobsite. The top three challenges that were identified by the DPR Project Manager, Hector Valdez, are outlined below. Since the Kaiser Tysons Project includes the interior build-out and refurbishment of a 30 year old building, many challenges arose that were not initially identified by the design team and owner. The ways in which these issues were dealt with by the project team are explained and if further work was needed to remediate these challenges.

Waterproofing Issues

The Kaiser Tysons Project faced many issues mostly related to waterproofing, since it is a 30 year old existing building. The design team and the owner did not anticipate the amount of waterproofing issues that were found in many different areas throughout the building. The first concern was leaks found on the foundation wall in the Lower Level and Basement level. This led to water infiltration in these levels and further testing was administered. The results indicated a solution for this problem needed to be addressed. The construction team has presented a proposal to excavate around the entire perimeter of the building, remove existing waterproofing, and replace the new waterproofing.

Another challenge was the existing precast perimeter walls were found to have cracks, which presented waterproofing concerns. The precast panels were water tested and indeed water infiltration was apparent. There needed to be a solution to help this issue without replacing the panels because of owner opinion and time restraint. The construction team is currently proceeding with spot repairs to these cracks, including epoxy injections at each location. This was found to be the best remedial method given the restraints.

Early in construction, the existing windows of the building were experiencing water leakage. According to the initial scope of work for the project, the existing windows were not meant to be replaced. After finding out about this issue, window replacement was a necessity. The construction team is currently proceeding with removing all the existing windows (aluminum mullions and glazing units) and replacing with an entirely new glazing system. This activity was added to the schedule with the substantial completion date and first patient date remaining as originally contracted.

Another waterproofing issue found that was not initially in the scope of work was the existing roof. The roof was experiencing leaking and so replacement was needed. The project team incorporated a complete roof replacement of the existing single ply roof into the scope and schedule. Once again, the completion dates for the project remained so this cause challenges to schedule this additional work and finish on time.

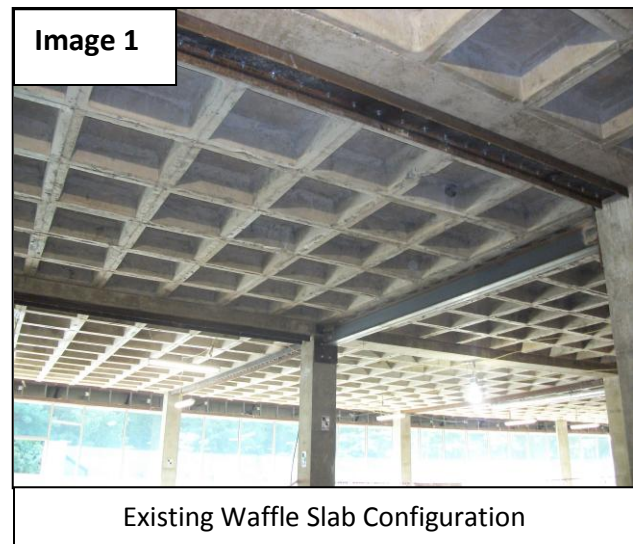
Existing Waffle Slab Configuration

The existing building slab has a waffle configuration as seen in Image 1. This type of slab was difficult to work with throughout the construction process since it is an outdated type of configuration. The challenges associated with this slab were the limited penetration/cutting of structural ribs at waffle units, as recommended by the structural engineer. Since the contract documents were not coordinated between core drill locations (for plumbing and electrical through slab penetrations) and waffle slab rib locations, this presents a coordination issue. In order to mitigate this issue the project team performed an extensive analysis on the slab to configure new drill locations. This analysis started with a laser survey and model of the slab depicting where the drill locations were originally located. Next, recommendations for core drill relocations based on these constraints were made. Lastly, the design team made changes to layout and the partition locations if it was necessary.

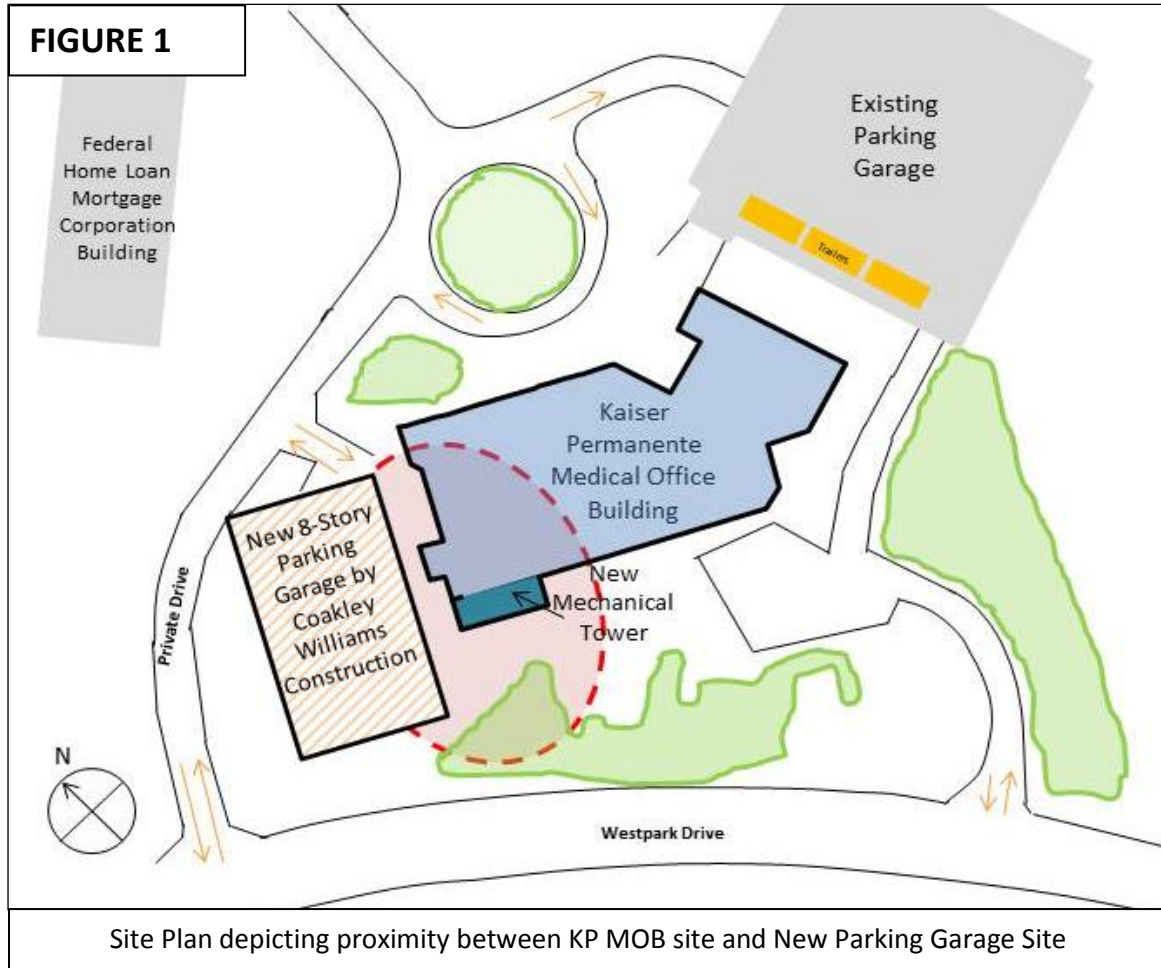
The waffle slab also presented issues concerning erection of structural steel members. Due to the additional loads added from the new building design, structural steel was needed for support under the floor slab. The issue of cutting structural ribs in order to install steel members became a structural design concern well into construction. The project team worked closely and efficiently with the structural engineer to reach a design conclusion that allowed for erection to pursue.

Simultaneous Construction of New Parking Garage

During the construction of the Kaiser Tysons MOB, there is also the simultaneous erection of a new parking garage on site. The parking garage will provide parking for the Kaiser Tysons MOB and is located directly adjacent to the MOB site, as seen in Figure 1 on the following page. This presents coordination challenges with the general contractor in charge of the parking garage project since the projects are in such close proximity. The entrance road use has been a recurring issue since certain deliveries for the parking garage require completely blocking Private Drive. This creates logistic concerns for Kaiser Tysons MOB because there is limited egress for construction traffic. There are also coordination challenges with precast unit deliveries for the parking garage interfering with Kaiser Tysons work. The size of the precast units along with the process of delivering them creates congestion and presents setbacks to the MOB. The construction of the new mechanical tower for the MOB project is right beside the new parking garage site, as seen in Figure 1. The area circled in red in the figure shows the area that congestion between sites is an issue. This area presents problems for both projects to have enough space to work and to create proper boundaries between projects. In order to address



these coordination concerns, the project team maintains constant communication with the parking garage GC. By staying in close contact with the GC and collaborating on all major deliveries, potential problems are mitigated. All activities that take place on a consistent basis are discussed between project teams and known prior to the activity taking place.



Schedule Acceleration Scenarios

Opportunities for schedule acceleration for the Kaiser Tysons site were always considered since there were many design changes made throughout construction. A strict completion date for this project kept the schedule moving and acceleration strategies as a viable option if needed.

Project Critical Path

The critical path of the project schedule is related to achieving key contractual dates (milestones) which include the following: delivery of long lead mechanical and electrical equipment, permanent power available, conditioned air available, MRI suite room ready, TER / TR rooms ready. Other components in the critical path include completion of interior work on all floors, since construction is starting from the top going down. Interior work related to the critical path includes in-wall and above ceiling MEP rough-in work, metal stud framing, and drywall installation.

Risks to the Project Completion Date

There are many risks that could hinder the project completion for this project. One of the risks is the amount of change, directed by the owner and design team, and to some level due to unforeseen conditions. There are currently 65 design bulletins to date that are being implemented on this project and more than 600 RFIs. Major changes include replacement of the glazing systems and roof due to the waterproofing issues described in constructability challenges. Also, due to these water infiltration concerns there was a need for repairs to the precast panels and waterproofing of the building perimeter. These activities require an increase in scope of work although the project completion date still remains.

There have also been multiple changes on MEP systems, which have affected the BIM coordination process and clash detection as well as procurement and construction. The amount of change due to bulletins and these MEP system changes has impacted progress on interior construction, specifically related to completion of specific areas within the building. Generally, the interior overhead rough-in and framing/ drywall coordination has suffered. Another component that has added to this delay has been the design discrepancy for fire-rating the coffers of the existing building which ultimately delayed framing and succeeding trades.

The extensive QA/QC process in place, as required by the owner, has also presented constraints in timely completion of QA/QC and code inspections. At this time, the project schedule is presenting a delay of approximately two months, all related to interior work. The expected (and contractual) substantial completion date is March 16, 2012, and the project is currently trending towards completing in May 2012, assuming that schedule acceleration is not enacted.

Another major risk to project completion is the upcoming perimeter waterproofing work that will take place, which impacts the entire building foundation. It includes excavating around the entire perimeter of the building to a depth of up to 40 feet in some locations. This excavation also requires the need for engineered shoring systems to be designed and installed. The issues related to this activity are access for construction crews and owner vendors around the building perimeter. This waterproofing activity also affects the original scope construction components that cannot be completed because of the activities constraints. These original scope components include hardscaping / landscaping around the building perimeter, completion of metal canopies at the building entrance, and completion of paving at entrance and loading dock areas. Due to the timeframe of cost approval, this work is expected to start in January 2012, and will continue through project substantial completion and through building activation period (March 16 through August 2012). Since the work will start during the winter months, this adds another level of challenge, since application of the waterproofing product requires maintaining a certain temperature. This alone could generate more potential delays, and also creates the need of tenting and providing temporary heat at the ditch (or moat). The challenge will be to make sure the work is complete prior to the opening date of the facility, which is in August 2012.

Potential Schedule Acceleration

The Kaiser Tysons project team has presented a plan to accelerate the schedule if needed. It is based on select overtime for the following crews: mechanical, plumbing, steam fitters, electrical, and metal studs / drywall. This plan would mean work hours would increase to 60 hours per week (two hours overtime on weekdays, and 10 hours of work on Saturdays). This would accelerate work on all MEP rough-ins, and would allow for a faster completion of drywall work. Since interior build-out is the area where major time has been lost, this could help to accelerate the work being done. If this plan was enacted the additional cost of this work is approximately \$1.8 million. Presently, at this time, the plan is not proceeding and is pending owner approval. Acceleration on the perimeter waterproofing work is being addressed as the team reviews the logistics of implementing the work; no final plan of action has been defined yet.

Value Engineering Topics

Opportunities for value engineering on the Kaiser Tysons project mainly dealt with the issue of waterproofing. Considering the age of the existing structure, there was opportunity to replace existing components to add greater value to the new MOB. Many of the value engineering decisions that were made resulted in additional scope of work being added at a later date instead of included in the original scope. DPR had recommended initially replacing the complete exterior skin of the existing building, which included the precast panels and glazing units. This exterior skin would be replaced with a new curtain wall system in order to update the building facade and improve waterproofing quality. After consideration, the owner did not want to follow through with this idea and so the original GMP amount was decided. Further into the project, the waterproofing issues arose and additional work was added to the scope at a later date. This work includes the repair of the precast panels with epoxy and the complete replacement of the glazing. The cost for this work has been added to the original GMP amount.

Another area of value engineering that was utilized on the project was the deletion of cold rolled channel reinforcement within certain partition types. After further design and engineering was implemented, it was determined that the full height (deck to deck stud) partitions did not require reinforcement. This is due to the structural characteristics of the studs already providing sufficient structural support. There was an approximate \$90K deduct from this which provided a decent amount of savings to the owner.

Critical Industry Issues

After attending the 20th Annual PACE Roundtable, many industry issues were addressed and discussed. The three prominent topics of the event were Sustainability/Green Building, Process Innovation, and BIM Services. The two breakout sessions that I attended were *Process Innovation: Assembling/ procuring an integrated team* and *Sustainability/ Green Building: Learning systems for training a sustainable workforce*.

Process Innovation

The first session about Process Innovation and assembling/ procuring an integrated team was focused on the new Integrated Project Delivery (IPD) wave that is hitting the industry. Since IPD is a fairly new topic, it is not yet clearly defined by the industry. Presently, IPD is a project delivery method that is meant to replace the traditional design-bid-build approach. It differs because it utilizes an integrated project team and focuses on teamwork between the owner, architect, engineers, general contractor and subcontractors. It is meant to have all parties involved working together toward the same goal and having everyone's best interest in mind.

There are many obstacles that IPD has to overcome before it can become a popular project delivery method. In order to implement IPD, a high level of trust needs to be established. Trust was a word that was brought up multiple times during the discussion because it is crucial in order for IPD to work. Through contractual obligation, the IPD team agrees to share the reward of a successful project or share the risk for an unsuccessful project. This means that the team needs to trust each other to perform their share of work and do what needs to be done to have a successful outcome. If one individual part of the team fails, then the money associated with that is a burden to the whole team.

Another topic discussed was the obstacle of getting the owner to buy into IPD. In a traditional project delivery, the risk is typically on the general contractor. Although with IPD, an open mind from the owner and the willingness to take the risk is required. It was said that IPD truly depends on the type of owner and their appetite to engage in the process. The owner needs to be involved and understand the benefits of IPD in order to even consider it. With this in mind, how do we as an industry educate the owner on building smarter? How do we show the owner that IPD is beneficial if successful? How do we help the owner to get out of the traditional design-bid-build mindset? Why should they change the way construction has been for years in order to take a leap of faith? How can we make them see they will get the best building they can get? All these questions were brought up in the discussion or cultivated in my mind as I sat in this session. The issue is the inability to physically show the owner the IPD process and its benefits. For instance an owner wants to know the cost savings, schedule benefits or if the building will be easier or less expensive to maintain. A participant mentioned that IPD is more difficult to implement than the BIM storm hitting the industry because BIM is able to show owners what it can do immediately where as IPD is not instant gratification. I think that a case study is needed to have physical evidence that IPD can be successful. The requirements for this case study to be credible would be that the owner needs to be well

known and has a successful reputation. Also the project needs to have a successful outcome, a complex design and difficult obstacles to get through. If IPD is able to work for this project, I think it could be a credible source for owners to think of when considering IPD as an option. I think an owner that could be open to IPD needs to be young, innovative and a risk taker. They need to not rely on the traditional way things have been built but really buy into IPD and take a chance. I think an owner such as Google could be a great candidate since it is a fairly young, forward thinking company that is growing in popularity and expanding its building locations. They are successful enough that they can afford to take on the risk associated with IPD contracts. If they create a team with a dedicated general contractor and team of subcontractors, they could be a great example for the industry.

An issue that also keeps companies away from IPD is the amount of paperwork associated with it. Though IPD is similar in nature to design-build, IPD differs because contractually it is much more complex. The contract documents are difficult to write because they require detail in order for the wording to clearly disburse risk. The individual responsible for writing these documents acquires a lot of risk just by creating these documents. Since there are no insurance products for IPD, the contracts are simply not being created out of fear. A factor to also recognize is that all projects are different and IPD is still somewhat undefined, so finding the correlation and correct fit is key to implementing IPD. A certain project type is needed to utilize this delivery method because IPD is not made for all projects. The project has to be dedicated from the beginning and stick to the IPD plan. Many projects start out with the initiative to bring in the right people and set the standard of IPD but the idea eventually fades throughout the project lifetime. As the project progresses, day to day issues intervene, scheduled meetings begin to be canceled, and time becomes limited so IPD is lost. I think finding a way to make IPD mandatory is a hard task to enforce although it is the only way that IPD will be used and benefited from. IPD takes dedication from start to finish from all team members in order to be successful.

As I contemplated the questions during and after this PACE session and thought about my own thesis project, I saw some ways in which I could further explore IPD. I see many qualities that IPD is looking for in a project that my project has. For instance, Kaiser Permanente as an owner is becoming a healthcare giant in their field and highly thought of. They are expanding exponentially in their industry and in need of more buildings. DPR as a GC has had Kaiser Permanente as a repeat client and maintains a good relationship with them. As a solid basis for a team, this could be the beginning of an IPD process. Due to the project delivery of design-bid-build, any changes meant change orders and new KP bulletins. This resulted in time lost and inefficiency. I would like to look further into if an IPD approach was utilized on this project and how it could have cost and schedule improvements.

Industry members within the session also offered areas they would like to see further analysis on for IPD. These topics included looking into the benefits of having an engineer hand off the design early to a project team. Also focusing on a specific challenge a project may have faced and how it could have been improved if an IPD approach were to be used. Items to remember throughout this research that were mentioned were to neglect owner driven

changes and focus on real changes due to design. Also, since many factors would change if IPD were used, it may be more beneficial to focus just on the time improvements or just the cost improvements.

The key contacts that I met for further information on this topic included Matt Hedrick, who was the industry member I had the chance to sit down with individually. Matt is a project engineer at DPR and gave some great feedback on IPD. He offered some ways that I could apply IPD to my project and how to research the topic more. The details I would like to look into for this topic will be further outlined in the Problem Identification and Analysis portion. Matt also offered some further contacts at DPR that are knowledgeable about IPD that I could contact for reference. Another contact that could be helpful with IPD is Penn State's OPP, which is trying to push IPD on Penn State projects. Also, Massaro Construction and Bill Moyer from Davis Construction had great ideas about IPD that I found interesting during the discussion. I also found that the AE grad students are studying and doing research for IPD, which would be a beneficial source for my analysis.

Sustainability/ Green Building

The second session I attended was learning systems for training a sustainable workforce. This session discussed various topics dealing with the fundamentals of a sustainable workforce. Many participants shared that they attended this session simply to learn more about *what* a sustainable workforce is. This was the first topic of discussion in order to understand this idea. Ideas that were mentioned were that a sustainable workforce is a lean process; it is a way to work with the minimal amount of waste. This waste may be time, materials, money, etc. Taking this idea of lean and applying it to a workforce could be workers installing green roofs, solar panels, etc. They must learn these new techniques to install these systems and this will promote sustainability in the industry. A sustainable workforce values continuous learning of these new practices and is an ongoing educational system. The members of a sustainable workforce are not limited to just the workers but also include the owner, design team, GC, and maintenance team. It is a collaborative effort from all parties involved to ensure that sustainable ideas are created and promoted. A sustainable workforce does not just end its work at the construction phase but continues through the life of the building, including the upkeep and maintenance. An interesting point made was that sustainability does not only include Green building initiatives or environmental practices that make the building sustainable but also the people of the workforce. The wellbeing of the workforce must be strong and positive. A happy and healthy workforce is one that will remain successful because they will have a higher quality of work. When people look forward to going to work, this creates a higher standard of work from the beginning and an enduring workforce.

Some of the issues surrounding the idea of creating a sustainable workforce are finding resources to train people to be sustainable and enact these practices. Since the topic is somewhat undefined, there is not a large demand for it. There are not definite rules to create a sustainable workforce or specific guidelines to get there. Being sustainable is more of a

behavior then a technique. Also, from the standpoint of a contractor hiring workers to be qualified tradesmen, there is a current lack of these individuals. Presently in the industry a gap exists because older tradesmen are ready to retire and the younger generation is enrolling into school and higher education rather than pursuing trade schools. This makes the search for forming a sustainable, quality workforce even more difficult.

The next topic discussed was how to improve a sustainable workforce. Mainly, this all comes down to the behaviors of the workforce. There is a need to identify good behaviors and migrate away from old behaviors of the past. The construction industry traditionally has used a command and control mentality in order to delegate task and complete work. This method can create animosity and superiority in the workplace that results in negative results. A sustainable workforce can be improved by trending toward the collaboration and teamwork approach to accomplish work. The key idea is to work on communication and relationships between people in order to build a stronger foundation. With a positive base already set for the team, this will create the desire for the team members to individually want to do better. Overall, if members feel that their wellbeing is considered by their team, they will feel appreciated and work harder. It is important to define common goals that everyone can work toward. In a command and control environment, there is the idea that everyone is supposed to buy into the superior person's goal. This produces negative results because the team members will never want to give a higher quality of work for a goal they do not support. As a result each member only focuses on their self-interest and causes a detachment within the team. Instead, communication can be used so everyone can share their personal goals and determine a unified goal to work toward. Another strategy to improve the workforce is identifying barriers (internally) and outside stakeholders (externally) in order to find the strengths and weaknesses of the team. This will help to unify the team and determine what is impeding the success of the team.

Some of the benefits and reasons to follow through with the sustainable workforce approach became more apparent throughout the discussion. Initially I was unclear of the definite benefits of a sustainable workforce but one interesting statement made was that you have to be sustainable in order to be successful in this industry. It is important to be creative in this industry in order to survive and differentiate from others. This industry is about people and is service based, meaning that your job is to please people and the owner. In order to achieve this, having a sustainable workforce will show passion. In order to be successful, it is important to have relationships and good connections with people. These relationships include within the team and with the client. Sustainability is propelled by the idea of enjoyment and wanting to get out of bed in the morning to go to work. With this quality instilled in the values of the company, the company will be successful.

In order to understand the overall topic of a sustainable workforce it is important to know the skills that are needed. The discussion brought up characteristics such as: being a good listener, communication, optimism, creativity, passion, teamwork, empathy, and integrity. There is a need for both hands on people and theory based people in order to have a well-rounded, successful sustainable workforce.

Issues that were offered from the industry members for areas of further thesis research were to develop specific strategies to maintain a sustainable workforce, even at times when issues arise. They wanted to see a way how a team atmosphere and regular meetings could somehow be maintained throughout a project. Usually there are times in the project when people revert away from the team atmosphere and go into different silos. They try to handle issues individually if the project is becoming chaotic in order to avoid interacting and tackling the problem together. Other ideas included how the collaborative process could be improved and if asking questions such as, "What are your goals?" helpful to keeping a sustainable workforce. This could be applied to Kaiser Tysons if I were to analyze the sustainable workforce ideas of the project team and their goals. It would be interesting to see if the goals of the team members align or if there is room for improvement.

The contacts that could be helpful in my research on sustainable workforces were many of the industry members that participated in the discussion. I found the ideas from Kurt Maldovan of Balfour Beatty interesting and knowledgeable, which could be a great contact. Also, Mark Kosin of Southland and Richard Fiore of Fiore Construction mentioned beneficial comments to the discussion.

Problem Identification

Considering the research conducted on the constructability challenges, schedule acceleration scenarios, value engineering topics and industry issues, there are identifiable areas that the Kaiser Permanente project can improve. The following problems reflected represent areas for cost and energy savings, integration of sustainable features and project schedule acceleration.

Existing Waffle Slab

The waffle slab of the existing structure presents many issues for this project. As previously described in constructability challenges section, there was a problem with drill locations for MEP connections in the waffle slab. The slab configuration also caused problems with fire rating and insulating the coffers of the waffle slab. The original engineered design was not appropriate and did not pass the QA/QC inspection according to the owner's standards. Therefore, the design was taken back to the engineers for review, redesign and resubmission. Due to more discrepancy with the design and delay in design approval, the final design was received very late. At this point in time, work had already begun for interior build-out. This change in design resulted in reconfiguring phasing of above ceiling rough-in and the inability to hang the track for the framing studs. This in turn created a chain reaction and affected other trades that were to continue or begin work in these areas. This design issue contributed to the 2 month schedule delay of interior build-out, which ultimately affected other activities. As always, time is money, so this delay in schedule affected the subcontractors for having to pay laborers for work days that were spent without work to be done.

Potential Analysis:

This issue concerning slab configuration and the time delay caused by the design process offers a great opportunity for analysis. I would like to take the design assist project delivery method and apply it to this project. I would like to see how this delivery method would help with having the correct design earlier in the project and could mitigate the laborious task of re-submitting and approving designs. If this were a design assist project then the owner, design team, engineers, GC, etc.; could have all been involved and collaborated from the beginning on this coffer detail. Any issues with the design would have been recognized before the design was complete and work already starting.

In order to create a credible analysis, I would need to find the costs associated with this issue and the money lost by parties involved. Also, I would need to find the duration that this particular issue set back interior build-out and how that affected other trades work. I could compare these findings with the initial cost and time for if design assist was applied. The findings of this analysis could impact other delayed issues the project faced throughout construction and how design assist could have alleviated some of these issues. The results of the analysis could act as a pro and con report of the design assist process for this project. From these results a proposal to the owner, Kaiser Permanente, could be created as to why they

should utilize design assist. If design assist seems like a viable option, the opportunity to go a step further and pursue IPD with the GC and subcontractors on the project could also be proposed to Kaiser. As discussed in the critical industry issues section, The Kaiser Tysons Corner project could be used as a successful case study for the industry if this analysis shows effective results.

Waterproofing the Building Perimeter

The waterproofing issues relating to this project posed many challenges throughout construction, as previously discussed in this report. Unfortunately, the largest issue regarding the foundation wall leaking around the entire perimeter of the building was not accounted for in the initial scope of work. The waterproofing work includes excavation around the perimeter of the building, removing existing waterproofing and replacing it. Due to the extensive amount of work associated with this, it adds a lot of time to the schedule and money to the owner. Also, this work delays a lot of other work around the building because it limits access to the building due to the shoring needed for excavation.

Potential Analysis:

When considering this issue, it is apparent that there is a definite need to waterproof the building perimeter due to the age and condition of the foundation. Since the task must be performed in order to provide better quality to the building, an analysis can be done to investigate adding this activity to the initial schedule would have helped. The task posed a problem mainly because of the hectic time it was added as an additional scope of work. An analysis could incorporate the waterproofing activity into the initial project schedule. This would allow for consideration of site logistics, since coordinating with other project tasks was not executed because the waterproofing needed to take place immediately. Also, having the knowledge of this need for waterproofing from the start of the project could allow for weather considerations to be taken into account. Performing waterproofing in the winter prolongs the activity since protection of the area and maintaining a certain temperature need to be considered. This analysis could compare the benefits associated with performing this activity in warmer weather and convey to the owner that initial testing from project start should have been considered. Factors such as project duration and cost from having waterproofing initially incorporated as compared to the costs and schedule associated with adding this work to the scope will also be investigated.



Existing Foundation Waterproofing

Cracks in Existing Precast Panels

The existing precast panels on the exterior of the building caused issues with water leaks due to cracks in the panels. There was not any work originally associated with the panels besides power-washing them since they are to remain as the permanent building enclosure. After testing the panels for water infiltration, they failed the testing and cracks were found in many of the panels. After potential solutions were given, the owner decided to not replace the panels but instead spot treat the cracks with an epoxy injection, as described earlier. This remedial effort is acceptable although potentially could cause problems in the future with water infiltration. Since this is a medical facility, this future problem could produce many serious issues and inevitably shutting down the facility for repairs. From a value perspective of the building, there are better solutions that could have been utilized instead of a quick fix the existing panels.

Potential Analysis:

If not only for the aesthetic benefit but also for the water infiltration issue, replacing the existing precast panel system is a great opportunity. I am interested in analyzing other options for a building enclosure for this project to both remediate the water issue and for aesthetic appeal. The precast panel system that exists fundamentally is a credible system to use although due to the cracks, I would like to analyze an alternative Curtin wall system instead. If a Curtin wall system were to be used, it would consist of all one unit that would be hung on the structure's frame. This one unit system would include enclosure and glazing, which would eliminate the need for replacing the existing glazing separately. By utilizing a Curtin wall, both water infiltration problems associated with the panels and glazing could be solved. The time for installation of a Curtin Wall system can be compared to the additional time added to the schedule for precast panel repair and glazing replacement. Also, the overall cost of a Curtin Wall can be compared to the cost associated with the epoxy fill and glazing replacement of the project. Aside from looking into the cost and time factors, the structural impacts and feasibility of this system would need to be reviewed as well. The building's structural frame would need to be assessed to confirm if a Curtin Wall could be supported and if connection of the system is a reasonable task.

Time associated with Interior Build-out

A reoccurring problem for this project was the delay of interior build-out due to many contributing factors. This issue was interrelated with other items that were mentioned earlier as well as having too many trades in one area, the strict process of drywall inspection, and re-design of fire-rating/ insulating the coffers. Because of these factors, a delay in one trade caused a ripple effect to succeeding trades and an overall delay in schedule. Since there are 7 floors of the existing building that all require interior build-out, this is a large part of the schedule to suffer from a delay. A more efficient method needs to be utilized for build-out

while keeping in mind the project constraints. Due to the extensive amount of MEP rough-in needed for a medical facility including large ductwork, medical gas pipes, and telecommunication lines, space for work is very limited. Methods such as increasing the labor force for interior build-out is challenging because the amount of work going on in one area would actually be in-effective with too many laborers. A solution needs to be reached in order to decrease time associated with this activity since it is a critical path item and to allow for the additional work that was added in the 65 bulletins to be complete.

Potential Analysis:

In order to address the issue of the time taken to complete the interior build-out of the existing structure, prefabrication will be looked into as a plausible solution. Prefabricating parts of repetitive rooms within the building including drywall and MEP units can be explored to accelerate the schedule. By pre-fabricating repetitive units on each floor, it will utilize space off site to complete the units and allow for delivery of the units as needed. In order to enact this solution, factors to consider include techniques available for prefabrication, time to prefabricate the units, locations for prefabrication, verifying the modules will fit into existing structure, the weight of the modules, transportation and vibrating effects on the units, crane type and location, which building areas will be prefabricated, and more. Although there are many issues to consider, prefabrication can have successful results and a lot more benefits to the owner other than accelerating the schedule. These benefits include reducing the labor costs. Since everything will be prefabbed off site it will reduce labor costs since they are not directly on the job. DPR utilizes union workers for their self-perform drywall team, which means that certain time and labor restrictions apply. These restrictions can be avoided by performing a lot of the work offsite to assemble the units. If the prefabrication of these units was concisely timed to be delivered as needed, the interior build-out could utilize a production line effect and increase efficiency.

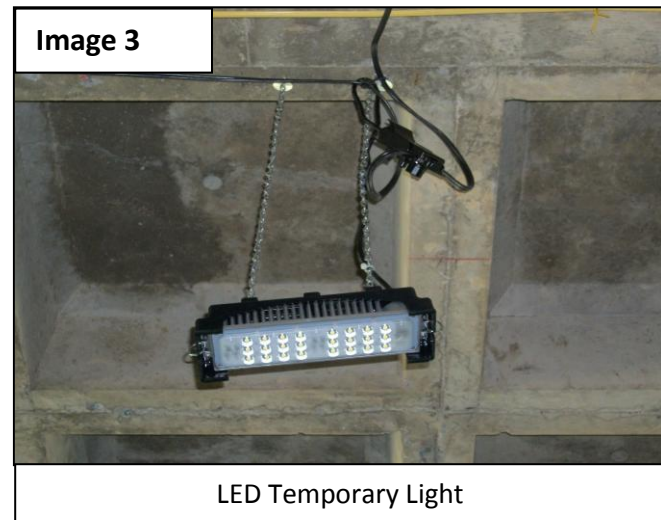
Sustainability

The Kaiser Tysons Project attempted to incorporate sustainable practices into the construction of the building by utilizing a paperless jobsite, recycling, and enacting a waste management plan. However the building is not LEED certified and has many opportunities to incorporate more Green components into its design that can be taken advantage of. Since the industry is trending into sustainable construction becoming the norm and typical buildings reaching at least a LEED certified rating, this is an area that the Kaiser Tysons project can improve. With the extensive amount of medical equipment and high demand for energy, the maintenance costs and energy consumption of this building can result in staggering numbers. The lifecycle costs and carbon footprint of the building can potentially be a problem in the future if not addressed during design. As discussed during PACE as a critical industry issue, sustainability is becoming a popular topic and opportunities are increasing. Though sustainable features tend to demand a high upfront cost, the future benefits over the course of the building are rewarding when considering lifecycle costs. Also, in order to ensure this building has a long lifecycle, it needs to stay current with the industry standards. This means that in order to

ensure a timeless building design, the Kaiser Tysons Project needs to explore further sustainable practices.

Potential Analysis:

In order to address the lack of sustainable practices and building components of this project, there are areas that can be improved. I would like to improve upon a potential energy savings system that this project began to utilize during construction. The majority of the temporary lighting used in the building was the typical fluorescent lighting. The only exception was on the first floor which had a single circuit of 15 temporary LED lights. These LED temporary lights are a new product that use a lot less energy and could potentially lead to cost savings versus usual fluorescent lights. A small study was started on this system by simply tracking the energy consumption of the fluorescent versus LED system. I would like to take this study further and apply it to the entire building. I would be eager to see the amount of energy that could be saved during the construction timeframe just by converting to these temporary LED lights. I could further explore a cost analysis for this product by finding the payback period as well as considering the initial upfront cost versus the money saved from energy savings. These costs can be compared to the standard fluorescent temporary light system to understand the magnitude of savings and benefits incurred.



I had the opportunity to speak with a representative for the LED product in California and he would serve as a great contact for my analysis. I think this could be a great opportunity for Kaiser Permanente to start using this product on all their projects and decrease their energy costs. It could become a part of a new industry trend to explore better ways to sustain the building during the construction process. This would also add to the sustainability initiatives and earn LEED points to further increase the value of the project.

Along with the LED energy savings, the building can also increase its sustainable features by adding a green roof. Since the roof of the existing building needs to be replaced due to water infiltration, this could be an opportunity for Kaiser to earn more LEED points. It can be seen in Image 4 below that the area of the roof is fairly open and will not house mechanical equipment due to the construction of the mechanical tower. With these factors considered, it leaves open space to utilize a green roof. The different types of green roofs could be researched and compared to see which would apply best for a medical facility. Also, the cost could be

compared to the cost of the original roof replacement and see how this could potentially benefit the owner. In order to consider this option, a thorough structural analysis would need to be developed in order to ensure the building can support the load of a green roof. Maintenance costs would also need to be factored into this option since a green roof would require more upkeep than a traditional roof.

