

Peter Dahl
Construction Management Option
Pedestrian Walkback Tunnel,
Finishes Package
Washington Dulles International Airport
Primary Faculty Consultant: Riley
Due Date: Wednesday, October 22nd, 2003



Technical Assignment #2

Project Delivery Evaluation

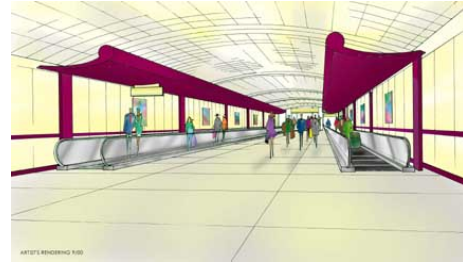
Executive Summary

Every owner, and in turn every project, will require a different combination of requirements for contracts, contractor selection, project staffing, coordination and project controls. This follows with the idea that since each project is unique, the elements for each of these components should be decided on a case-by-case basis.

The Metropolitan Washington Airports Authority chose to use a set of requirements standard for their construction projects, and also one that they have become to feel very comfortable with. This is not to say that the arrangement is perfect. There are always changing conditions and opportunities for improvements. Making a few changes to the structure, the owner could end up with a higher quality project, while acquiring the space sooner and spending less as a whole.

As conditions will always arise on a project which will hinder the successful completion for all parties, those conditions can be minimized by using techniques such as a design-build delivery process. This could allow for increased coordination of key aspects of the project, and also less risk on the part of the owner, which would be an important benefit for a publicly funded project.

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Contracts

The owner, Metropolitan Washington Airports Authority (MWAA), contracts a design consultant, Parsons Management Consultants – Design (PMC-Design), to assist with the selection and administration of the engineer, Earth Tech, for the project. The contract between MWAA and PMC-Design is fee based, whereas the contract between MWAA and Earth Tech is Lump Sum. The reason for this difference is in the role that the organization plays. While Earth Tech has a lump sum contract to design solely the project at hand, PMC-Design will assist with the selection and coordination of all projects within a given time as defined by the contract, thus the need for a fee based contract.

MWAA contracts another firm, Parsons Management Consultants (PMC), to assist with the selection and administration of construction. PMC acts as the owner's agent for construction of the various airport projects. MWAA contracts Hensel Phelps Construction Company (HPCC) as the general contractor for the project through a lump sum agreement. As the general contractor, HPCC is required to perform at least 20% of the value of the contract price. The remaining work is subcontracted in the form of lump sums to other specialty contractors.

MWAA requires that the contractor furnish a performance bond if the base price exceeds \$100,000. This must happen within ten days from the date of the request from MWAA. The same requirements pertain to payment bonds. The actual premium costs for the bonds will be reimbursed by the authority, as long as proof is shown and they appear reasonable and customary to the industry.

MWAA is using an Owner Controlled Wrap-Up Insurance Program (OCWIP) to insure job site work. The contractor is required to enroll in this program, as well as all subcontractors of any tier whom work on the jobsite. The program does not cover any work away from the jobsite. Workers' compensation, employer's liability, commercial general liability, builder's risk, automobile liability, and environmental liability are all provided under the OCWIP.

These contractual agreements are fairly standard given the situation of an owner with little construction staffing and experience. Since MWAA receives a fair amount of federal funding, the requirements are strict for the type of contract to be used.

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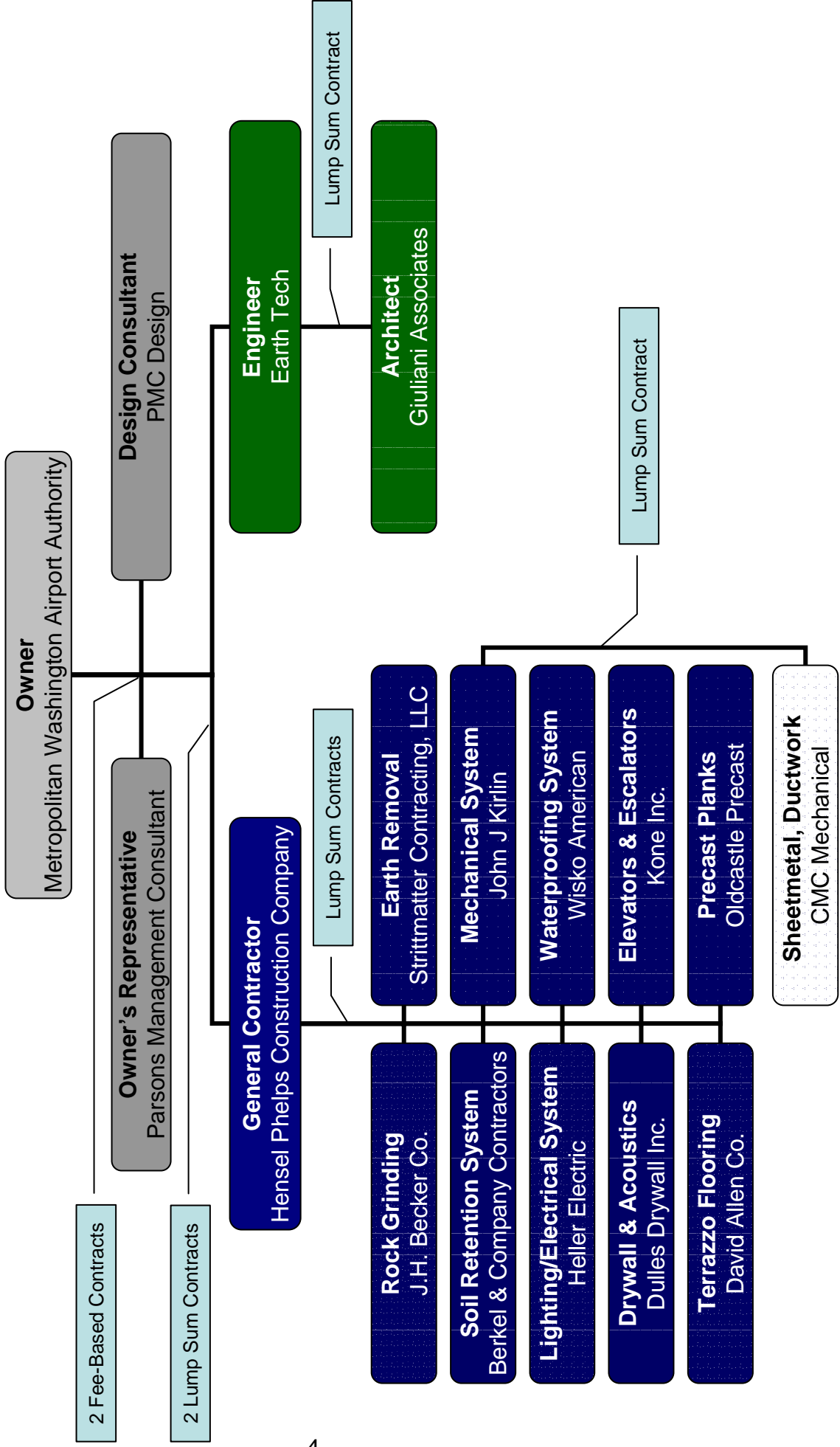


Contracts Continued

Delivery methods are also influenced by this aspect. Design-Build would have been an excellent delivery method due to the many variables involved in the design and construction of the tunnel, and two dissimilar buildings Connector “A” and “B”. A Design-Build method could have reduced costs and duration by hastening the design process and contracting all construction under one contract. However due to circumstances outside of the owner’s control, a traditional design-bid-build method must be used.

Project Organizational Chart

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Contractor Selection

Due to the owner being a public entity, the award of the project was determined primarily on cost, however safety is another big concern for MWA. HPCC has an impeccable safety record and a strong safety program implemented companywide and will be discussed in more detail in project controls. HPCC has also done projects for MWA in the past, including the Midfield Concourse “B”, adjacent to the Pedestrian Walkback Tunnel’s Connector “B”.

The award of the contract to HPCC was based on their bid being the lowest; this is due to the same strict requirements outlined in the previous section. In contrast, a project recently awarded at BWI airport was based on “best value”, giving the owner better flexibility in determining the best contractor for the job.

Selection of subcontractors is fairly straightforward. All subcontracts are lump sum and the lowest bidder was awarded the contract, just as in the original bid. Most subcontractors selected have worked with HPCC before, and a solid relationship exists. This can be very beneficial if the project encounters problems and HPCC needs to ask subcontractors to be somewhat flexible. Some of the major problems encountered on site so far have been from contractors with little previous experience with Hensel Phelps.

In a specific example, the award of the contracts for rock grinding, excavation and soil retention are a debatable issue. HPCC chose to have three different subcontractors perform the three different activities, as opposed to one of those subcontractors performing all of the activities. The reasoning behind this was cost, but while the budget may have benefited in the short run, it has been detrimental to the schedule in the long run. The coordination of three subcontractors is certainly going to be more complicated than the coordination of one, but just how much more complex is unknown until the activity is already underway.

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Staffing Plan

The staffing schedule on the next page shows the planned use of Hensel Phelps Construction Company personnel on the project. Staff is staggered to provide increased support once the project is fully started up, and phased back towards the finish to allow for a slow decline of work.

The organizational chart following the staffing schedule shows the field and teams developed for managing construction. It is typical for most HPCC projects, allowing each member to have clearly defined functions.

Executive time, the operations manager, will be fairly limited on this project, due to the structure of the project manager position. The project manager will undertake this project, as well as several other projects, therefore the need for a strong project engineer is essential for times when the project manager is offsite.

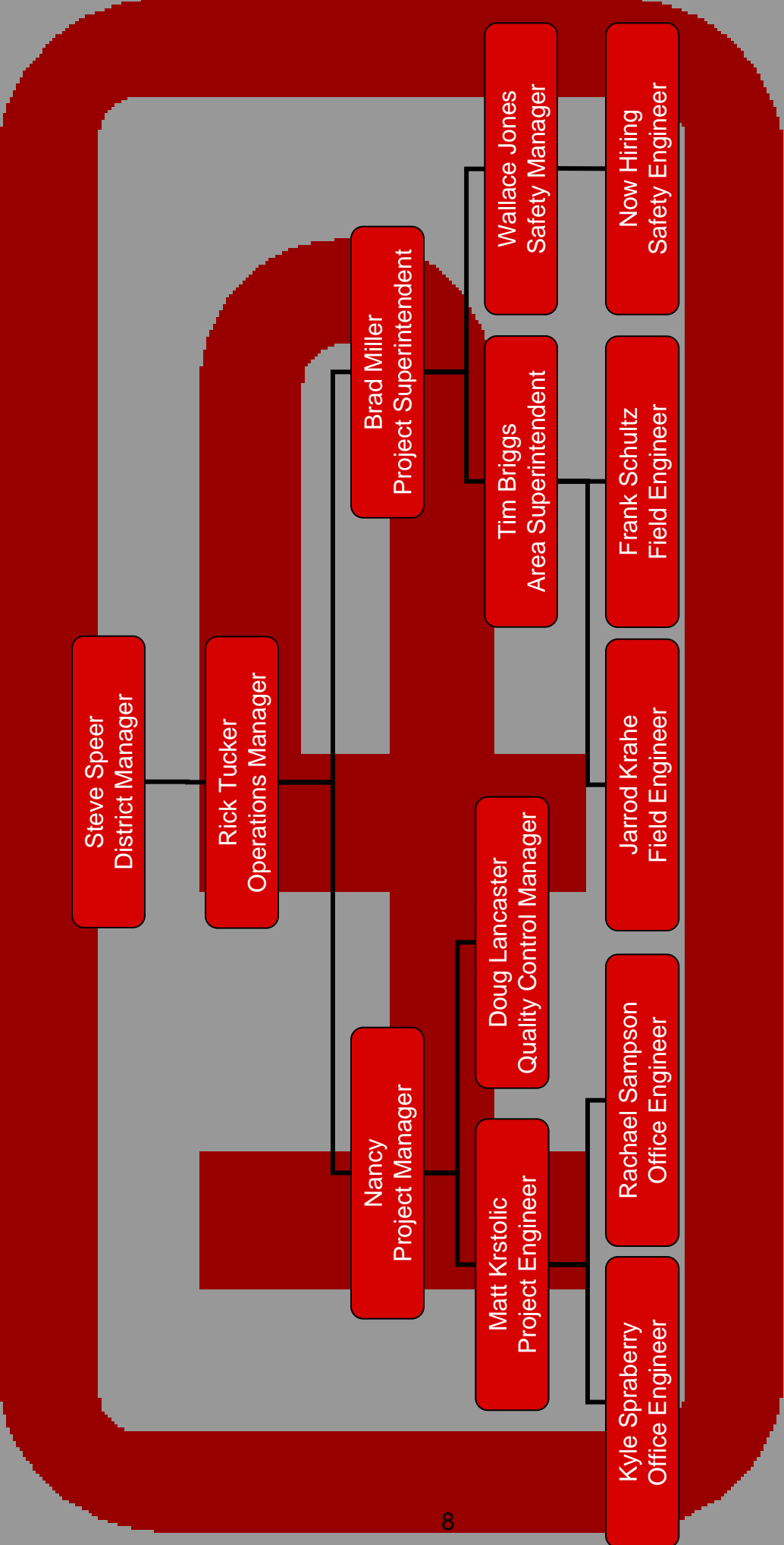
The contract requires certain personnel for the project. A superintendent, is required at all times during the performance of the work and until the building is completed and accepted by the owner. The superintendent must be competent and satisfactory to the contracting officer and must have the authority to act for the contractor.

In addition to basic project management, the contract requires a full-time construction safety manager for the duration. For the safety manager to be qualified, they must have a minimum of 10 years experience in construction safety on large projects, and also have 5 years of tunnel experience – a difficult requirement for most general contractors.

The contract also requires a full time on-site quality control representative whose sole responsibility is to ensure the work conforms to the contract documents. The quality control representative must have 10 years of experience in a quality control supervisory position, a registered engineer or graduate engineer with 5 years of experience in quality control is also considered eligible.

Key personnel in the staffing for this project can not be changed without prior notice to the contracting officer. In such a case, the contractor must show that the qualifications are equal to or exceed that of the staff being replaced.

Supplemental specialty inspectors are required during operations such as forming, concrete placement, steel erection, mechanical and electrical testing and coordination. The inspector must be a registered or graduate engineer, or can be a technician with certification in the appropriate discipline.



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Staffing Plan Continued

Extensive geotechnical monitoring is required for the excavation phase of Connector “B” due to the close proximity of the tunnel shell, Midfield Concourse B, and operational airline gates on both sides of the project. Monitoring points vary in nature ranging from surface monitoring, support of excavation monitoring, column monitoring, subsurface monitoring, and fuel line monitoring. While it is required for the duration of the project, it is most intensive during the excavation phase. By the end of this phase, there will be nearly a hundred different points, most needing to be checked daily. While a professional surveyor is not required, a field engineer or intern performing this task will take most of a day. An additional person will be needed near this phase of the project due to this requirement.

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Design Coordination

The contract requires the contractor to coordinate construction activities if they fall under one of the following categories:

1. Where installation of work is dependent (either before or after) on installation of other components of the project. An example of this may be the rock grinding/excavation/soil retention operations, or framing/MEP rough-in/drywall operations.
2. Where availability of space is limited, such as within the plenum spaces and walls. It is also noted that where dimensions are not listed on schematics, the contractor has the responsibility of determining the best installation to maximize performance and accessibility. An example of this would be the mechanical and electrical systems.
3. Where a component requires a delayed installation, the contractor must make adequate provisions to allow for this. An example might be air handling units, elevators or moving walkways.

The contractor is required to perform administrative procedures to avoid conflicts and ensure an orderly progress of the project. Administrative activities required by the contractor are: preparation of schedules; installation and removal of temporary facilities; delivery and processing of submittals; progress meetings, start-up, check-out and final acceptance of systems; and project closeout activities.

Coordination drawings will be prepared and submitted to the Contracting Officer's Technical Representative (COTR) when applicable. An example of such activities in need of coordination drawings are the integration of MEP systems. The drawings will show the interrelationship of the components, all dimensions of components making note of conflicts, minimum clearance requirements, amounts of equipment and material to be installed, and required installation sequences.

This process of coordination will begin with the mechanical contractor drawing ductwork into the plans paying careful attention to avoid lighting fixtures. Once complete, he will hand it off to the fire protection subcontractor to draw in the sprinkler lines and mains. Since the electrical system is the most flexible of the three, it will be drawn in last. Once all systems are drawn in, the coordination drawings will be submitted to the architect to ensure the light fixtures are in proper locations, and the aesthetics are maintained in the spaces where systems are exposed.

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Design Coordination Continued

Areas of the project which will require the greatest coordination will involve the MEP systems in the tunnel and Connector “B”. As MEP is always a high priority in coordinating, it is especially significant on this project due to the nature of the use of the space. By square footage, most of Connector “B” is made up of mechanical or electrical rooms, requiring a lot of ductwork and conduit running through floor slabs and walls.

Another concern is the moving walkways and escalators which must have proper tolerances set in concrete far in advance of their arrival and installation onsite. Conduit, framing and bearing plates are all inflexible components of the systems. These custom designed and built systems are procured over a year ahead of the actual delivery of the components. Coincidentally, at the same time the dimensions of the systems are being specified, the concrete curb walls (which support the walkways) are being planned for forming and pouring. This allows any changes to be evaluated in both the walls and the systems decreasing the chance of mistakes occurring. Due to this early coordination, field modifications can not be made due to the precise dimensions already used in fabrication of the systems.

The flow of work will need careful planning in the tunnel due to only one usable entrance/exit. Trades will need to be sequenced much like a slow “parade of trades” in order to keep work moving efficiently. Working from one end of the tunnel towards the portal near two-thirds point will allow for trades to have zones to work in and an effective work space.

Due to the construction of Connector “A” far ahead of the tunnel finishes phase (which includes MEP work), there have been a few problems arising. A cast-in-place slab above the tunnel level will need to be x-rayed and saw cut in order to provide access for a return duct for the tunnel exhaust.

As mentioned in the staffing plan, the contractor is required to provide a special inspector for inspections of prepared fill, foundations, masonry, concrete and steel construction (this list is not exhaustive, see 1996 USBC code section 1705). All certificates, tests and inspections are monitored closely by HPCC’s quality control representative. Some of the main systems which require inspections are mechanical, plumbing, electrical, security, and fire protection.

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Project Controls

The project's overall costs are monitored through Hensel Phelps Construction Company's (HPCC's) cost control system. A simple accounting program allows the senior estimator and project manager to enter cost data from the original estimate immediately after award of the project. This database is updated monthly over the course of the project and is a useful tool for HPCC to examine project progress and success.

The scheduling system used for this project is Primavera. A detailed schedule is updated monthly. A three week look-ahead schedule is updated weekly for use in meetings with subcontractors, project staff, and the owner's representative. This short-term schedule allows for more detailed scheduling and coordination, as well as an efficient communication and management tool to get subcontractors to commit to an agreement.

In addition to having a fulltime quality control representative onsite, HPCC has a Continuous Improvement Process (CIP) which allows hourly and salaried employees as well as other subcontractors to submit suggestions for improvement around the jobsite. Ideas from new file formats, to innovative labor techniques are suggested and implemented. Since HPCC is a nationwide contractor, the ideas are shared nationwide. Suggestions for improvement in quality of work are used on a project in California and in turn on a project in Washington, D.C.

With safety being a high priority for HPCC, the company has implemented the STOP program. Adapted from DuPont, the STOP program is a non-punitive system which allows, and requires, all employees to deal with unsafe acts. The program is based on the fact that most of accidents and unsafe conditions on site can be prevented. A safe site is an efficient site.

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Building Systems Analysis

Soil Retention System (SRS)

The drawings and specifications did not specify a particular SRS to be used. The civil engineer's original design incorporated piles and lagging and also shotcrete with tiebacks. Upon consultation with Berkel & Company Contractors, Hensel Phelps Construction Company (HPCC) elected to use an SRS made up solely of shotcrete and tiebacks, abandoning the use of piles and lagging. This system was chosen based on the rocky sub-grade conditions and desire for a waterproofed excavation.

Problems were encountered within the first 15' of excavation with fractured rock caving into the excavation before the shotcrete wall could be established. To prevent further cave-ins, piles were driven in the localized area. As excavation continued, the rock remained very fractured with veins of organic soils only perpetuating more cave-ins.

These problems have created a many delays in the project, through no fault of any project team member. Upon reflection, an SRS made up of solely piles and lagging may have been a better alternative. This would prevent some of the delays for the rock grinder, and the tiebacks would protect the excavation from failure.

An SRS made up of piles and lagging could be cheaper than the shotcrete and less variables would be seen upon excavation. The actual process of excavation would be delayed initially compared to the shotcrete system, however this delay would have little impact on the overall time savings of this different system.

Driving piles onsite would pose some different problems. The thick concrete slab for the apron still needs to be demolished, however before excavation begins, piles need to be driven to the full depth of the excavation, nearly 60 feet in most places. Below grade, the site is mostly rock, however it is rock of very poor quality. This may be an issue in the driving of the piles, but should not prevent the piles from being driven to the required depth. Another issue arises due to the amount of water needing to be removed from the current excavation. Extreme amounts of rain in the summer of 2003 have required dewatering nonstop for weeks. As mentioned previously, all water removed from site is contaminated and must be filtered, a slow and costly process. With lagging instead of shotcrete, even more water would be able to enter the excavation between the wooden lagging, requiring more resources for dewatering.

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Building Systems Analysis Continued

Structural System

In making this modification to the soil retention system, it may also be beneficial to change the walls below grade from concrete to steel. Cast-in-place walls 4'-3" thick are very difficult to pour when only one-sided forms can be used. Being on an airport, timely concrete deliveries are difficult to coordinate, and can ruin a well-planned pour. Even though Washington, D.C. is traditionally a concrete oriented city, steel may be a better structure due to the nature of this unique project.

The project is already incorporating steel into the design of the building as the superstructure on the two stories above grade, therefore it should not be difficult to change the lower half of the structure to steel. One aspect to keep in mind is the future construction of the IAPM tunnel adjacent to the west side of Connector "B". The existing concrete structure is designed to ease the eventual construction of the IAPM project, the steel structure should ideally do the same.

Increased site storage would be required for a steel structure due to the great increase in the number of steel deliveries. An alternative would be to use the contractor staging area to store the steel and even preassemble if logistically possible.

Mechanical System

The mechanical system for the project uses both a variable air volume (VAV) system and a single-zone system. Both of these air handling units (AHUs) use an economizer however this may not be the best choice for the security concerns of an airport.

With recent events, the authority may be interested in using a flat plate heat exchanger as the heat recovery system. The flat plate heat exchanger will prevent contaminants from being recirculated through the conditioned spaces, decreasing the impact of a disastrous event. This may increase the resistance in the system, requiring a higher overall capacity or even a complete redesign.

Another concern is the location of the outside air for the system. If the intake was relocated to a more secure location, rather than outside above the concrete apron, the air would not only be cleaner being away from the airplane exhaust, but also less at risk for biological contaminants.

An ideal relocation for this would be at the top of the vent shaft on the east side of Connector "B". Architecturally, this idea may be vetoed due to the nearby air traffic control tower and main terminal, both areas from which Connector "B" can be seen.