

Pershing Hill Elementary School
Fort Meade, MD



Technical Report 3
Alternative Methods Analysis
December 1, 2009

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Executive Summary

This report examines the constructability challenges faced by the project team and how they solved them. This report also looks at possible schedule acceleration scenarios and key areas of value engineering that were implemented on this project. Several problematic features are identified, and four construction management analysis activities are developed.

For the Pershing Hill Elementary School Replacement Project, three constructability challenges were: a burn pit which was found under the building pad (made more difficult since soil is not allowed to be removed from the site), the owner's delay in pulling permits, and the site being located within an active US Army base. The burn pit was undercut, and the soil was stockpiled on site while awaiting a remediation plan between FGGM and the MDE. The time lost in the permitting process was made up by the abatement prime contractor. The special difficulties in site access were addressed in the prime contractors' scope of work.

The critical path of the project includes site work, pouring concrete in the first area, placing CMU block at the foundation level, placing masonry bearing walls in Area A, structural steel erection, hanging ductwork and MEP rough-in, and drywall. All these activities, except for structural steel erection, could be accelerated by bringing in additional labor and working on multiple sections concurrently. The site works is currently being accelerated through the use of lime and overtime work.

There was no formal value engineering process for the Pershing Hill Elementary School Replacement Project. During construction, the construction manager is implementing ideas that correlate with the goals of the owner, including paying the site work contractor for premium time, and for using lime.

In addition to the constructability challenges, there are other problematic features of the Pershing Hill Elementary School Replacement Project. Masonry construction is a labor intensive process, which necessitates additional workers going through a tedious process to gain site access. Owners are moving towards more sustainable buildings, which require additional features not found on this project. While sediment control during construction is a major concern due to the “critical wetlands area” little attention is paid to storm water runoff after construction. Four analysis activities that could address these problems are; a less labor intensive system than masonry, a geothermal energy system, a green roof, and a cost analysis of perusing LEED certification.

Constructability Challenges

There are several constructability challenges in every project. For the Pershing Hill Elementary School Replacement Project, three constructability challenges were: a burn pit which was found under the building pad (made more difficult since soil could not be removed from the site), the owner's delay in pulling permits, and the site being located within an active US Army base.

During site work, a burn pit was found directly under the building pad. This burn pit dated from the 1940's or 50's and contained tree trunks, branches, stumps and other organic debris that had been burned with diesel and buried on the site. This burn pit was 10,000 cubic yards, and took 12 days to undercut. During that time the site contractor was unable to work on the building pad, causing a two week delay, and once excavated there were additional challenges related to the soil removal. The project team built two weeks into the schedule during the planning phase to account for inclement weather over the course of the project. These two weeks are currently being used to offset the additional time associated with the removal of the burn pit. The soil from the burn pit could not be reused on site because of the hydrocarbons and other chemicals that were present (as a result of the organics being burned with diesel).

Removal of soil from the project site is difficult due to the Army base regulations. Prior to bidding Fort George G. Meade (FGGM) informed the construction manager that no soil could be removed from the project site without extreme restrictions, citing high natural soil arsenic levels. FGGM likely does not want to risk the liability of someone receiving toxic dirt. To account for this, the site contractor's scope of work included the following provision:

“The export or removal of any on-site soils from the Pershing Hill ES project site is NOT allowed, as per base requirements. The 2A prime is solely responsible for establishing the 2A bid cut/fill quantities. Should the 2A prime’s cut/fill operations result in a required export of soils, 2A shall notify the CM, and the Civil Engineer will raise the proposed grades at the new ball field at the magnetic east side of the site, as required to allow 2A to balance the site, such that no soils are ever exported off of the Pershing Hill ES project site. Such revision of the proposed ball field grades, in the event of a net export site, is to be assumed by all bidders, so this revision will NOT be construed as a change to the contract when it occurs.”

This provision made the site work contractor responsible for balancing the site (by raising the elevation of the field) in the event that “extra” soil was present. This solution proved inadequate with respect to the excavated soil from the burn pit, because the chemicals present made it unsuitable for use on the site. The project team stockpiled the soil on the site, while awaiting a remediation plan between FGGM and the MDE.

The Pershing Hill Elementary School Replacement Project involves work next to a “critical wetlands area.” This involves an additional permitting process, greater sediment controls, and additional oversight by the Maryland Department of the Environment (MDE). The additional sediment controls were included in the site contractor’s bid package. It is the owner’s responsibility to acquire the necessary permits on this job, and the owner was 3 ½ weeks late pulling the permits from the MDE. The lost time on the schedule was made up by the abatement prime contractor, who completed his work in between two and a half and three weeks, as opposed to the six weeks that the schedule originally allotted.

FGGM is an active US Army base, which brings several unusual constructability challenges including the possibility of a base lockdown and site access restrictions. The red star on figure 1 represents the schools location; the lightly shaded area is Fort George G. Meade. In the event of a base lockdown, the contractor's equipment could be stuck on site.

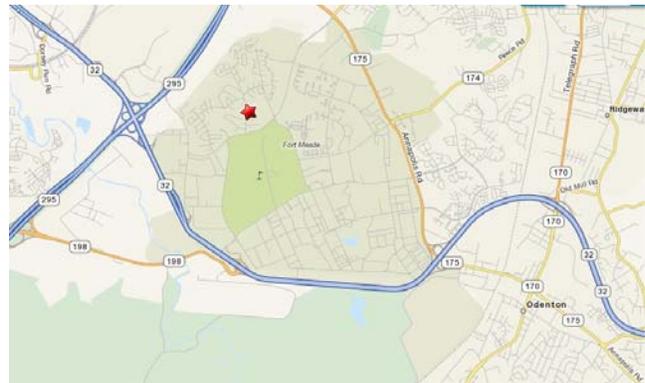


Figure 1 Courtesy of Mapquest

<http://www.mapquest.com>

A challenge for the construction manager is protecting the owner in this event, while not scaring away potential bidders. The construction manager (Jacobs) addressed this in the scope of work for the prime contractors which states:

In the event of an Owner suspension of Work due to a base lockdown, the prime contractors may not be able to access the site to retrieve their equipment. If any base lockdown(s) exceeds five workdays aggregate throughout the total project duration, the Owner will compensate the contractor for the cost of such on-site equipment after the fifth workday, as negotiated with the Construction Manager and approved by the Owner & Architect; such compensation will be limited to monthly, weekly, or daily rental rates (as appropriate per the length of the suspension) as documented by the contractor & approved by the CM, plus contractually allowed overhead, profit & bond markups - the Contractor shall not be compensated for maintenance, fuel, operator labor, escalation, loss of anticipated profits, overhead, extended overhead, extended general conditions, etc. If any such Work suspensions are equal to or less than five workdays

aggregate throughout the total project duration, the Owner will not compensate the contractor for the cost of such on-site equipment.

As a result, if there is a base lockdown for more than five days the owner will compensate the contractors for any equipment that is on site. This prevents potential bidders from being scared away by the potential of an indefinite lockdown, while protecting the owner from shorter lockdown periods.

Because the site is located on an army base, there are additional site restrictions. The workers need low level security clearance in order to get access badges. The process for obtaining access was explained in the scope of work for the prime contractors (and in Appendix A), and is the responsibility of each prime contractor. The process for obtaining access involved filling out a form that was included in the specifications, and submitting it to the construction manager. The construction manager, in turn submitted the forms to the AACPS liaison to FGGM.

Schedule Acceleration Scenarios

The project is divided into three areas, as explained in Tech 1. The critical path of the project schedule includes pouring concrete in the first area, placing CMU block at the foundation level, placing masonry bearing walls in Area A, erecting structural steel, hanging ductwork and MEP rough-in, and drywall. Any delay along the critical path will delay the completion date of the project.

The construction manager is currently taking steps (discussed in the Value Engineering Topic section) to complete the site work on schedule. Because of the burn pit (discussed in the Constructability Challenges section) the site work was delayed, which could increase the duration of the site work tasks due to bad winter weather. One risk to the project completion date is that the site work will not be completed by winter. This represents a risk because it is difficult to do work, including pouring the footings, once the ground freezes which could delay the project up to four months.

The key areas that have the potential to accelerate the schedule are those on the critical path, particularly those with long durations. The concrete prime contractor can bring in double crews and/or start in two places within the same area to reduce the time needed to pour concrete in Area A. The same methods (starting in multiple areas and bringing in additional laborers) could potentially be used by the masonry prime contractor, mechanical contractor, and general works prime contractor.

The drywall installation represents the largest potential for schedule acceleration, since drywall installation is fully dependent on manpower. There is not a long lead time, allowing it to be accelerated on short notice, and the contractor can simply provide more manpower. This

activity is expected to take between 25 and 30 days, so by accelerating it the construction manager could potentially save two or three weeks.

The structural steel is not a good candidate for schedule acceleration, despite being a long duration item on the critical path. The structural steel must progress in a certain fashion, which makes it difficult to accelerate. The construction manager is unlikely to want to accelerate this item, since they would not get as much “bang for their buck.”

Value Engineering Topics

There was no formal value engineering process for the Pershing Hill Elementary School Replacement Project. The construction manager (Jacobs) performed a constructability review which found over 200 faults in the construction drawings (such as missing dimensions), but did not pursue a value engineering process. During construction, the construction manager is implementing ideas that correlate with the goals of the owner. Two of these ideas include paying the site contractor for premium time, and for using lime.

As discussed in the Schedule Acceleration Scenarios section, the burn pit delayed the site contractor's work which represents a risk to the project completion date. If the site work isn't complete by winter, the project could be delayed much longer due to inclement weather. In addition to this possibility, if the work of the other primes is significantly delayed they could seek additional compensation for price escalation. The current goal is to get the footings poured by December. This correlates with the owner's goal of maintaining the project schedule.

Paying the site contractor for premium time, involves paying his crew to work overtime. The assumption is that because the crew is working additional hours, they will have additional output resulting in the tasks being completed faster. The problem with working overtime, is the workers are paid overtime (which is 1.5 times the normal rate) which normally offsets any additional production. Lime sucks up the excess moisture from the soil which makes it more workable; however, it is an additional cost. Both of these processes add additional expense (around \$20,000) but it is much less expense than the owner is exposed to should the work not be completed before winter. The construction manager hopes to pour footing by December, thanks to these methods. This correlates with the owner's goal of delivering the project at minimal cost.

Problem Identification

There are several problematic features of the Pershing Hill Elementary School Replacement Project that could be pursued through a detailed analysis of the technical building systems and construction methods. Three of these features that were previously discussed are the burn pit, restricted site access, possibility of a base lockdown

The burn pit was an unexpected challenge for the project team. Although the contractors were advised that the eastern end of the site was used as a burn pit, no evidence of it was encountered during the geotechnical investigation. When it was uncovered below the building pad it delayed construction, because the site work contractor had to divert manpower and equipment to removing the 10,000 cubic yards. In addition to the delays from the removal, the soil from the burn pit was unable to be reused on other portions of the site. Reusing soil by adjusting the elevation of the field was the primary way to prevent the removal of soil from the site. Once the burn pit was removed that area will need to be filled with soil from other areas of the site. This will effectively lower the elevation of the field, using only the soil on site.

Because the project is entirely within a US Army Base all contractors working on the site need low level security clearance in order to get access for themselves and their vehicles. Typically this process takes around 30 days, during which time the workers can obtain a temporary badge. If the vehicle that the person is driving is not registered to them, or is a company vehicle, the driver must have an original power of attorney or letter from the vehicle's owner stating the operators' name, dates that permission to use the vehicle is granted, and all vehicle information. It would be interesting to see if this process causes any significant access problems or if the contractors are able to easily follow the process and obtain their security

clearance. The additional time spent on this process represents a potential loss of labor for each worker who must complete this process.

In the event of a base lockdown, it is foreseeable that the contractor's equipment would be left on site. This problem was addressed by compensating the contractors in the event that the base lockdown(s) last more than five days. An additional problem with the base lockdown that this does not address is the effect on the project schedule. While the base is in lockdown the contractors will be unable to enter, making it impossible for them to complete their work and delaying the project.

In addition there are some problematic features of the Pershing Hill Elementary School Replacement Project that have not been previously discussed in this paper. These include: masonry construction is a labor intensive process; buildings have to become more energy efficient, and less attention is paid to storm water runoff after construction.

Masonry construction is a labor intensive process. This project contains a large amount of masonry work (the masonry bid package was over \$1.7 million), which necessitates a large number of workers. Site access problems have already been discussed, and a large number of workers would exacerbate any problems with obtaining security clearance. Alternate systems to the masonry walls that are less labor intensive would require fewer workers and would minimize any problems with the security clearance process.

Many buildings are becoming more sustainable, due to increased awareness of owners. The air handling units with energy recovery that are used in this project are an example of how the owner is addressing this concern. However, there are other school projects where the owners are pursuing alternate energy sources, including geothermal as discussed in Tech 2, to make the

building even more environmentally friendly. Geothermal systems also help schools that are seeking to achieve LEED certification, which this project is not. Although this project is not pursuing LEED certification, many schools are starting to as was discussed in Tech 2. Since schools are moving towards LEED certification, it is beneficial to include features that aid in achieving LEED certification so that the owner can become familiar with the features and to minimize the difficulty of a transition to LEED certified projects.

Storm water runoff is monitored carefully during construction, and for this project two sediment control ponds have been installed. However, little attention is paid to storm water management once construction is complete. The Pershing Hill Elementary School Replacement Project requires additional sediment controls during construction, as discussed in the Constructability Challenges section, because of its proximity to a “critical wetlands area.” The “critical wetlands area” will be preserved through construction, but following construction of the building one of the sediment control ponds will be demolished to build the parking lot. The parking lot, and the school, will reduce the amount of green space, which will increase the amount of storm water runoff after construction.

Technical Analysis Methods

Four analysis activities that could address these problems are; a less labor intensive system than masonry, a geothermal energy system, a green roof, and perusing LEED certification. A less labor intensive system than masonry would help to minimize lost productivity due to the site access process. Many schools are moving towards geothermal energy systems and LEED accreditation, as mentioned at the PACE Roundtable, which helps the buildings become more sustainable. A green roof would help reduce storm water runoff after construction and could possibly aid in balancing the site, which would help mitigate the difficulties involved with soil removal on the Pershing Hill Elementary School Replacement Project.

A less labor intensive system than masonry could be selected and investigated. Several systems would have to be researched in order to find a less labor intensive alternative. Once an alternative is selected, I would investigate the effect of that system on the project cost and schedule. The site access procedure would be investigated, through interviews with the project team, to determine an approximate amount of time that is spent per worker in that process. Finally a cost analysis could be performed between the two systems, including the lost labor from the site access procedure, to determine if a less labor intensive system would have been a better solution.

A geothermal system would make the school more energy efficient, and would help if the owner chose to peruse LEED accreditation. Before a cost analysis could be performed I would need to research the impacts of geothermal systems on the construction schedule and cost. I would also need to research the federal and state incentives that may be applicable, which would

help offset the initial cost. With those factors taken into account, a lifecycle cost analysis could be performed to determine if a geothermal system would be suitable for the Pershing Hill Elementary School Replacement project.

Green roofs have been utilized in other school projects (such as the Walker Jones School in Washington DC), and provide many benefits including controlling storm water runoff, and providing points towards LEED accreditation. A green roof would help preserve the “critical wetlands area” after construction, by aiding in the control of storm water runoff from the site. Research could be performed to determine how effective green roofs are in controlling storm water runoff, and what other benefits one would provide on this project. It would also be interesting to investigate if the green roof could use soil from the site, in order to aid in balancing the site, due to the difficulties involved with soil removal on the Pershing Hill Elementary School Replacement Project. The additional benefits of the green roof system, compared to the current system, could be analyzed in a lifecycle cost analysis and schedule analysis to determine if a green roof would be suitable.

Many school systems are starting to move towards LEED certification, as was mentioned at the PACE Roundtable meeting. A geothermal system and green roof would provide additional points towards LEED certification. Other requirements for LEED certification are already being met on this project, due to other outside requirements (for example, the additional sediment controls that are required due to the “critical wetlands area”). It would be interesting to analyze the effect these features would have, should the owner choose to pursue LEED certification, on the level of LEED they could achieve, and the cost of pursuing LEED certification on the Pershing Hill Elementary School Replacement Project.

Appendix A

Process for Prime Contractors to Obtain Site Access

This process is taken from an email conversation with Senior Project Manager Andrew Locke, and was included in the scope of work for the prime contractors.

The Contract Work is being performed within the Fort George G. Meade US Army Base (FortMeade). As such, all prime contractors are contractually required to adhere to FortMeade's rules and regulations, including base access requirements. Below you will find summarized site access requirements to FortMeade as determined by the Construction Manager via emails and telephone conversations with the Bert Rice (Fort Meade Privatization Officer) and Eugene Wallace (Fort Meade Installation Access Control Officer). The access requirements below do not entail all of FortMeade's policies in regards to accessing the base and it shall be the sole responsibility of each contractor to get your employees, materials, and equipment onto the base at no additional cost to the Owner. Prime contractors will not be compensated by the Owner for lost time or additional costs due to the failure of the prime contractors, or any of their sub-tier contractors/vendors, to follow the mandatory base access requirements. Mandatory prime contractor base access requirements are as follows:

- a) In order obtain permanent 30 day, 180 day, or 1 year badge/pass access onto Fort Meade, all contractor employees must complete DES Form 109-RE-1 in its entirety (attached at the end of Specification Section 01-10-10 along with further base access requirements). The forms will be submitted to the Construction Manager who in turn will submit to the AACPS Liaison to FortMeade. Each prime contractor must request from the Construction Manager an electronic MS Word version of DES Form 109-RE-1, and it will be emailed to the prime, who will then follow these instructions: (1) Open form – copy and paste form to a new page for each person requesting access to FGGM - rename and save the entire document as one file; (2) fill out all information requested – no information may be left blank (note to check or uncheck a block, right click mouse, select properties, click appropriate block); (3) return the entire file to the Construction Manager via e-mail for fastest approvals. Your employees can apply for 30 day, 180 day, or 1 year badge/passes for access for the employee, along with a corresponding decal for the employee or company vehicle. It will take a minimum 30 days after submittal to obtain approval; if “security levels” are heightened – this time may increase, and/or the access form/requirements may change. Once approval is granted, FortMeade will notify the AACPS Liaison and Construction Manager and each individual person will have two weeks to pick up their badges/passes, at the Visitor Control Center (VCC) located at the Reese Road gate. Each person must have a picture form of

identification (i.e. drivers license, state ID, or passport) to pick up your access badge. If your employees fail to obtain their badges within the two weeks, they will have to re-submit the DES Form 109-RE-1.

- b) While waiting for approval of the DES Form 109-RE-1, your employees can get a temporary 30 day badge from the Visitor Control Center (VCC) located at the Reese Road gate. This temporary 30 day badge will only be issued one time for each person. To obtain the temporary 30 day badge, the AACPS Liaison or Construction Manager must sponsor each person, which requires their presence at the Visitor Control Center (VCC) when the employee requests their 30 day badge. Notification must be provided to Construction Manager at least one business day before new employees arrive to the VCC to obtain the temporary 30 day badge, to schedule a time for the Construction Manager to meet the employee(s). Employees will NOT be granted a temporary 30 day badge unless that employee has already submitted DES Form 109-RE-1 for a permanent badge. All people with the temporary 30 day badge must enter FortMeade at the Reese Road gate.
- c) One day visitors must go through the Reese Road gate and will need to state their destination as PershingHillElementary School, have their drivers' license, and have current registration and vehicle insurance. The base will turn employees away at the gate if the employee is recognized as someone who is utilizing multiple one day visitor entries in lieu of obtaining temporary or permanent passes/badges. Delivery personnel are considered by FortMeade to be one day visitors in most instances.
- d) Each person that drives onto FortMeade must have their drivers' license, and have current registration & vehicle insurance with their name listed on the title of the vehicle. If your vehicle is not registered in your name or you are driving a company vehicle, the driver of the vehicle must have an ORIGINAL power of attorney (signed & sealed by public notary) or letter from the vehicles owner (signed & sealed by public notary) stating the operators' name, date permission is granted through, and all vehicle information (VIN#, make, model, year, license plate number, and issuing state). Attached at the end of Specification Section 01-10-10 is a blank Power of Attorney Form with further base instructions & requirements. This power of attorney requirement also applies to all prime contractor employees that are driving company vehicles. If your company employs a full time truck driver who drives several different company vehicles, that operator must have an ORIGINAL power of attorney stating their name in each vehicle that person drives.
- e) For carpoolers, the driver of the vehicle needs to have their **Error! Hyperlink reference not valid..** Anybody driving a company vehicle will need the Power of Attorney for each company vehicle they drive.

- f) Contractors with permanent 30 day, 180 day, and 1 year badges/passes should enter FortMeade via the Rockenbach Road gate, as it is the closest gate to the PershingHillElementary School site. All people with the temporary 1 day or 30 day badges must enter FortMeade at the Reese Road gate, or they will not be allowed entrance onto the base.
- g) At least 2 months prior to mobilization onto the site, prime contractors are encouraged to submit completed forms DES Form 109-RE-1 requesting 1 year badges for ANY of their employees who might ever require access to the project site. Primes are also encouraged to have any fleet vehicles decaled, and to have any of their employees obtain a decal for their vehicle.
- h) One day visitors making deliveries may access the base through any gate, but all deliveries must be accompanied by a bill of lading stating its destination, PershingHillElementary School. Again, all truck drivers will need their drivers license, registration, insurance, and power of attorney (if necessary), and the occupants of the vehicle will need a form of picture ID and/or their temporary/permanent badge. Non-hazardous material deliveries (concrete, wood, drywall, pipe, general supplies, etc.) and equipment deliveries that are fully visible on open sided trailers should access FortMeade through the Rockenbach Road gate, as it is closest to the school site. Non-hazardous material deliveries (concrete, wood, drywall, pipe, general supplies, etc.) and equipment deliveries that are NOT fully visible (i.e. on closed trailers, in box trucks, etc.) and ALL deliveries containing hazardous materials, fuel trucks, equipment maintenance trucks, etc. MUST use the delivery gate off of Maryland Route 32 to pass through the security inspection checkpoint. Random delivery trucks or other vehicles entering at any gate may be re-directed by base personnel to the delivery gate off of Maryland Route 32 to pass through the security inspection checkpoint.
- i) Work hours will be from 7:30am to 5:30pm Monday thru Saturday. Contractors will be allowed to arrive earlier and stay later than the times noted but no actual work that creates noise is permitted until the allotted time (i.e. starting equipment to warm up or mix mortar/grout must wait until 7:30AM).
- j) In the event that the base is locked down due to terrorist attack or high security alerts, only mission essential personnel will be allowed on base. If the lockdown occurs while contractors are onsite, there is a loud siren/speaker that makes announcements notifying those on base to leave the base. If the base is trying to contain something on base, no one will be allowed to leave the base. Also, contractors will not be able to remove equipment from the site until the base lockdown is lifted.