

Technical Report 3

Twin Rivers Elementary & Intermediate School

McKeesport, PA

This Technical Report will provide an overview of the construction of the Twin Rivers Elementary & Intermediate School construction project. Included will be an analysis of schedule acceleration, value engineering and a review of critical industry issues discussed at this year's PACE Roundtable.

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Executive Summary

The purpose of this technical report is to analyze and evaluate potential schedule acceleration scenarios and value engineering issues that the McKeesport Elementary/Intermediate School construction project team are facing. A review of some topics discussed at this year's PACE Roundtable is also included in this report. The applications of current critical industry issues are studied in this report as well.

In the report, several schedule risks and schedule acceleration scenarios were identified and studied. The addition of scope of sediment control posed the largest potential for delays in the schedule. To minimize the risk, it is proposed to concurrent the additional work with the interior fit-out; since they can be done without any conflict. It is also proposed the prefabrication and coordination of repetitive work could accelerate the project schedule. Thoughtful planning and the collaboration of the project team are essential to the success of these scenarios.

The owner, the project team and the designer worked together to implement value engineering to the construction of McKeesport Elementary/Intermediate School. The areas of value engineering implementation include update material and equipment and update design. The key elements of each area are identified in the report. The ideas for value engineering that was considered but not implemented were identified as well.

After analyzing the value engineering of the project, the 22nd Annual Partnership for Achieving Construction Excellence Roundtable was reviewed. During the conference, there will be open forums discussion in which topics selected by the advisory board were discussed by students and industry practitioner. The topics of this year include sustainability, information technology and integrated processes. The two specific discussion sessions that will be noted in this report are Information Management for the Workforce and Criteria and Drivers for Effective Multi-trade Prefabrication and Modularization. A few current critical industrial issues from the Roundtable that could be a great benefit to the McKeesport Elementary will be highlighted in the report as well. Interaction and discussion with industry members was noted in the report.

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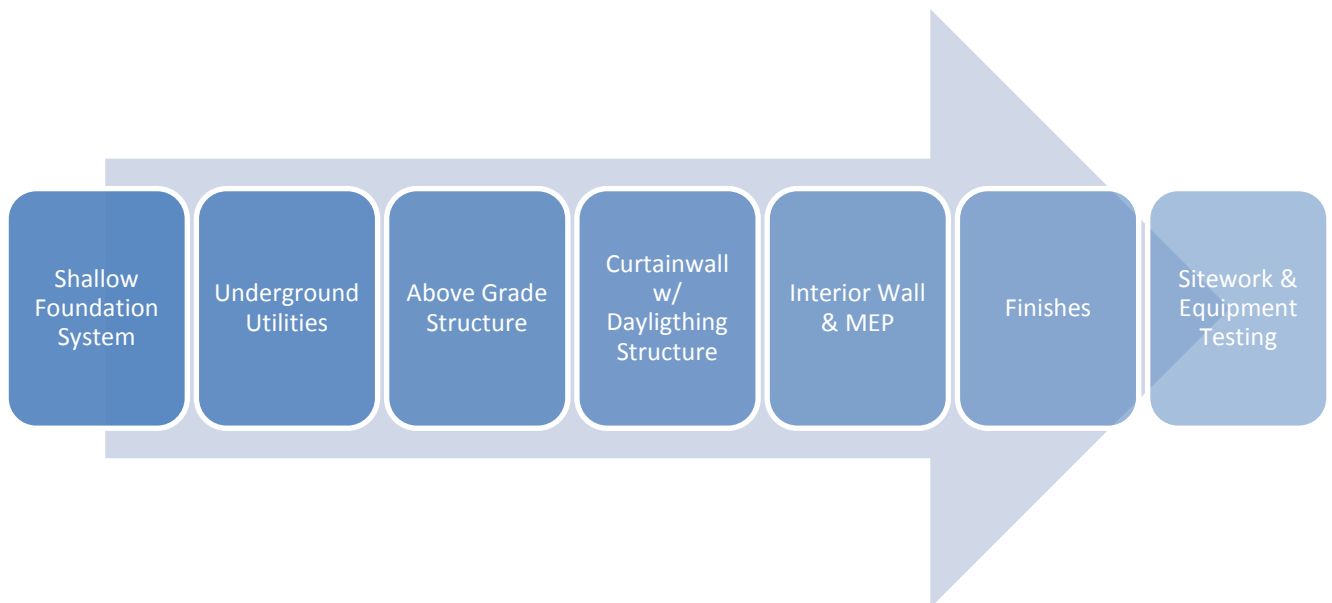
Schedule Acceleration Scenarios

The McKeesport Elementary/Intermediate is a combination of an elementary school and an intermediate school each takes one wing of the structure and a shared the common core area. Due to this project is the construction of a public school, the substantial completion date was extremely important to the owner, the McKeesport School District, so that the school can start on time. The following section outlines the critical path and potential ways to accelerate the project schedules.

Critical Path

One of the features of this project that controls the critical path is the LEED Implementation. After completion, this facility will not only serve as an elementary school and an intermediate school; but will also serve as a science educational facility for the whole school district. This school construction project is aiming for an USGBC LEED Gold Certificate. Also the structure of this project only has three stories above ground; there are a lot of actives and design involve with LEED implementation and require more thoughtful planning of the critical path.

The diagram below outlines the critical path of each zone of the project construction process. As disused in the previous technical report, the phasing of the construction is divided into four similar square footage zones due to the relative symmetry of the building.



Risks

The biggest risks to the project completion date is that half way through the construction, the project team received a request of change of design from Pennsylvania's Department of Environmental Protection due to the deficiency of design in sediment and erosion control after weeks of continuous rainy weather. After collaboration of the owner, the construction team and the designer, the approved change of order ended up with a value of \$156,275.00. The detail changes include work on construction access road, update the site work finishing grade, the storm drainage system for the garden area and also include the addition of sediment traps. This is a rather big addition of value to the scope of the project. Lead times of the material, redesign of the sediment trap and the approval of submittal could cause an approximate delay of 4-5 weeks. Luckily most of the addition of the work scope can be completed concurrent with the interior fit-out. As a school, the interior finishing phase of this project is relatively longer. This allows for a "catch-up" period for the landscaping and sediment trap upgrade for the success of completing the project before the substantial completion.

Potential Acceleration

The symmetry of the building structure and similar design of the two wings create the opportunity for several schedule acceleration techniques. Since the two wings of the building are almost identical, it creates an opportunity for the project construction team to assign several crews to specific tasks, working from one zone to another to increase the efficiency and consequently speedup the schedule. The concept of SIPS schedule can be used to help with the schedule acceleration. Prefabricating some of the MEP system components can also facilitate the schedule acceleration. Thoughtful planning and the collaboration of the project team are essential to the success of these scenarios.

Value Engineering

The owner, the project team and the designer worked together to implement value engineering to the construction of McKeesport Elementary/Intermediate School. The areas of value engineering implementation include update material and equipment and update design.

The material changes on this project include changing the conduits from EMT to MC Cable, changing the hand dryers to high efficiency models, changing the drywall framing material, updating the audio visual cable in classroom, updating the acoustic ceiling tiles, changing the gymnasium facilities and so on.

The update of design include the change of steel support of the clearstory level, the modification of rain water capture system over the music room and the metal decking over the library room towards the west corner of the core of the project.

The value engineering implementation on this project all correlate with the owner's goal to construction and effective education facility for the school district within the project budget. The update on building material will increase the project value and the project overall quality. The upgrade of design will facilitate the pursuit of LEED Certificate of the project and helps to achieve the owner's goal.

However, due to the funding limitation, there are also some value engineering ideas that were talked about but never implemented. Such ideas including updating the metal mesh material for day lighting into automatic day lighting panels.

Critical Industry Issues

The 22nd Annual Partnership for Achieving Construction Excellence Roundtable was focused around whole project delivery. The conference was held on November 6th and 7th at the Penn State Conference Center Hotel at Penn State University. An open forum discussion in which key topics including sustainability, information technology and integrated processes selected by the advisory board were discussed by students and industry practitioner. The two specific discussion topics that will be discussed in this report are Information Management for the Workforce and Criteria and Drivers for Effective Multi-trade Prefabrication and Modularization. A few current critical industrial issues from the Roundtable that could be a great benefit to the McKeesport Elementary will be highlighted in the report as well.

Information Management for the Workforce Session

Penn State AE Department Professor, Professor John Messner, led the discussion of the implementation of information management systems and technologies nowadays in the industry. The topics covered included standardization of the information management system, ownership and access to the central “model” and information system, diversity and synchronization of programs and tools for information management, the cost and benefits of customization of information management systems among the leading industry members, the delivery approach among different trades and so on.

On the McKeesport Elementary/Intermediate School Project, there is a lot of waste of time when the project team, the owner and the designer are trying to communicate and collaborate due the issue of the ownership of the model and information. This problem was pointed out to be rather common in the industry. Possible solution proposed by the industry member and students in attendance are to develop mutual agreement on the ownership of the drawings and model to minimize the inconvenience.

During the session, the group analyzed these common issues and concerns, and agreed that the implementation of BIM or IPD on projects will be more mature in the near future not only with the help of evolving technology but also along with cultural shift into the electronic delivery for the field trades .

Criteria and Drivers for Effective Multi-trade Prefabrication and Modularization Session

Penn State AE Department Professor, Professor John Messner, led the discussion of the criteria and drivers for effective multi-trade prefabrication and modularization. Industry members from Truland System, Burns Group and Southland led the discussion about the current conditions of prefabrication implementation. They pointed out a large majority of prefabrication and modularization is performed by the MEP trades. The topics discussed during the session included logistics involved with multi-trade prefabrication, risk and ownership of the multi-trade prefabricated units, quality control of the units, the advantages of multi-trade prefabrication and modularization including schedule gains and safety and so on. The coordination tolerance was also debated during the session.

The concern of the quality control of the equipment/units when manufactured by different supplier was raised. To address the concern, the industry members suggested possibly solution of having testing agency on board for major equipment to assure the quality of the units before installation. Despite the concerns, the group agreed there would be great future for multi-trade prefabrication in the industry with the technology and the industry member's grown experience working with prefabrication material and units.

Feedback from Industry Roundtable

After the breakout session, the industry member Mr. Patrick Harrison from SYSTRA helped with the study of possible ways to implement and improve of information system and prefabrication and modularization on McKeesport Elementary/Intermediate School Construction Project. He suggested that more research could be done on possible prefabrication implementation of mechanical component on the McKeesport School Project. He agreed that the ownership of multi-trade prefabrication unit should be discussed early on during the construction of a project. Mr. Harrison also pointed out that BIM implementation on project need to clear the responsibility of changes and efforts as well.

When Mr. Harrison learnt that McKeesport School project is the construction of a public school, he pointed out that this project might experience some more obstacles when implementing the IPD since the owner is the school district. The decision making time tends to be longer than normal and the ownership of the drawings, the model and the information about the project tends to be more complicated to manage.