

# PROJECT PROFILE

## SOIL MIXING USED FOR SOLIDIFICATION OF FINE COAL REFUSE

Planning by the Pennsylvania Turnpike Commission called for routing the new Mon-Fayette Expressway over a portion of a Western Pennsylvania coal refuse slurry impoundment. An in-situ soil mixing solidification alternative was developed by D'Appolonia after the general contractor recognized the potential for scheduling delays related to complexities associated with the original plan for subgrade stabilization. The original plan involved construction of a temporary earthen cofferdam, solidification of fine coal refuse (FCR) to allow excavation, and disposal of the excavated FCR. The alternative design saved about approximately six months of subgrade preparation.

D'Appolonia reviewed the original design, provided permitting services for implementing the alternative, and performed construction monitoring of subgrade preparation for the highway and construction of a dam that isolated the slurry impoundment from the highway.

The alternative in-situ soil mixing progressed out from the edge of the slurry pond over increasing depths of solidified FCR. Shallow soil mixing was performed along the slurry pond edge

within the proposed highway/dam embankment footprint. Mixing was accomplished by injecting cement-flyash grout into a custom backhoe bucket equipped with grout injection nozzles with three rotating augers mounted in the bucket. The mixing action of dragging the bucket through the impoundment blended the grout mix with the FCR. The shallow soil mixing was effective in treating approximately 100 percent of the FCR volume to a depth of 10 feet.

In-situ deep soil mixing was accomplished from a working platform utilizing a 300-ton crane with mounted triple 5-foot-diameter soil mixing tools. The in-situ mixing layout and estimated depth for each stroke was predetermined from available mapping information and resulted in treating about 80 percent of the FCR volume below a depth of 10 feet. In practice, the solidified columns slumped slightly, compressing un-



*Deep soil mixing with triple five-foot-diameter augers.*

treated material and resulting in even greater stabilization.

The deep soil mixing augers consisted of both auger flight and mixing paddle sections for breaking up the FCR and blending it with the grout mix. The mixing action of the augers blended, circulated and kneaded the FCR over the length of the column while mixing it in-place with grout.

The average production rate was approximately 500 cubic yards per rig-shift and the total volume of FCR solidified was approximately 250,000 cubic yards. After solidification, grading with a bulldozer was employed to form the working platform for embankment and dam construction.

The design alternative was implemented successfully, allowing the contractor to avoid complications associated with treatment, excavation and disposal of FCR and associated schedule delays.



*Fine coal refuse that was present in right-of-way of Mon-Fayette Expressway.*