Replacement of Alexander Road Bridge over Amtrak

New Jersey

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PROJECT NAME
Alexander Road Over Amtrak

PROJECT OWNER
New Jersey Department of Transportation

PROJECT CLIENT
Urban Engineers, Inc.

START/END DATES
2003 – 2004

PROJECT DESCRIPTION

The scope of this project involved construction of the replacement Alexander Road Bridge over Amtrak on a new alignment just to the west of the existing structure; **construction of new approach roadway embankments, including retained earth embankments,** to the north and the south of the new bridge; and re-aligned of an existing roadway

KS Engineers, P.C. (KSE) was responsible for the development of the subsurface investigation program and preparation of a geotechnical engineering report. The subsurface investigation involved 24-35 foot deep borings, including rock samples, split spoon samples, and undisturbed samples. The geotechnical engineering report examined alternate methods of embankment placed because of significant fill (22± feet) for the new roadway and bridge alignment. Methods examined included lightweight fill, vibro-columns, and installation of wick drains to reduce the overburdened pressure on the underlying clay layer encountered. The use of pipe piles socketed into rock was ultimately decided upon. A cost-benefit ratio, including time to construct, was prepared.

The project required construction of an approximately 22-foot-high approach embankment between the south abutment and the proposed rotary at the intersection with North Post Road. Our analyses indicated that the proposed placement of approximately 22 feet of the approach embankment fill over the existing soft clay layer would result in deep-seated shear failure in this stratum. Therefore, for the safe construction of the embankment, it would be necessary to either remove and replace the in-situ soft soils, or install piles or vibro-columns to transmit the embankment loads to the underlying, more competent, soil strata, or increase the shear strength of the in-situ soft soils. Accordingly, the following alternatives were considered for this project:

Excavation and Replacement: Under this alternative it would have been required to excavate the underlying soft compressible soil and replace it with control compacted granular fill. Since the area underlain by the soft soils is located in the immediate vicinity of the Amtrak ROW, installation of braced sheeting and groundwater control measures would have been required to minimize the adverse impact of the proposed construction on the railroad operations. This alternative was not recommended for this project due to the additional costs associated with the installation of the sheeting, the groundwater control, and the excavation and disposal of the soft in-situ material.

Vibro-Columns: In this alternative, the two-foot diameter stone columns would be installed to a depth of approximately 25 feet. The columns would have been installed under the footprint of the proposed embankment in a four-foot grid pattern and a high strength geotextile fabric would be placed over the top to support the placement of conventional fill above to transfer the loads from the 21-foot high embankment to the very stiff/dense residual soils underlying the soft compressible clay layer. Due to the relatively

small scope of stone column work under this project, this alternative was not recommended, based upon cost considerations

Lightweight Fill: This alternative entails the excavation of the existing soil and placement of lightweight fill. The amount of material excavated would be determined by the specific weight of the soil being excavated and the specific weight of the lightweight soil being placed in order to not increase the overburden pressure on the underlying clay layer. Since the area underlain by the soft soils is located in the immediate vicinity of the Amtrak ROW, installation of braced sheeting and groundwater control measures would be required to minimize the adverse impact of the proposed construction on the railroad operations. This alternative was not recommended for this project due to the additional costs associated with the installation of the sheeting, the groundwater control, the lightweight fill, and the excavation and disposal of the soft in-situ material.

Staged Construction: The placement of approximately 21 feet of the approach embankment fill over the soft clay layer would result in deep-seated shear failure in this stratum, unless the shear strength of the in-situ soft clays is gradually increased as the embankment is being built up. This was achieved by building up the embankment in stages such that the fill in each successive stage is placed only after primary consolidation and consequent shear strength gain is achieved under the previous loading stage. Accordingly, the embankment was placed in three stages of eight-foot, eight-foot, and 6-foot heights, accounting for the additional height for settlement.