

Analysis and Design of Micropile-Supported Wall to Resist Lateral Deflection of Existing Railroad Bridge Abutment

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Abstract

As part of the PHX Sky Train™ project at Phoenix Sky Harbor International Airport in Phoenix, Arizona, the existing traffic lanes at the 44th Street underpass below the Union Pacific Railroad (UPRR) Bridge will be shifted to accommodate the people mover guideway. The proposed reconfiguration and reconstruction of 44th Street required the utilization of micropiles and permeation grouting to resist the lateral forces induced by cutting into the slope below the existing bridge abutment footing. This paper discusses the evaluation of the existing bridge abutment, including analysis of the original foundation system, and design, installation and testing of a new micropile-supported retaining wall to support the cut slope below the existing bridge abutment foundation. A monitoring program was implemented during construction to evaluate the short- and long-term performance of the bridge abutment. Instrumentation included survey monitoring points, inclinometers, tiltmeters, and crack gauges. A micropile load-testing program was conducted to verify design assumptions concerning micropile axial and lateral loading. Numerical analyses (using PLAXIS software) were performed to predict the short- and long-term behavior of both the abutment wall and the bridge foundations. Movement data collected from the monitoring program indicate that the wall and bridge foundations are performing satisfactorily and within the general bounds of predicted movements. The results from the numerical modeling using PLAXIS software showed that the proposed solution is deemed adequate to provide the needed global stability with an acceptable factor of safety, along with acceptable deformation.

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