INSTRUMENTATION AND MONITORING OF TIEBACK WALL ON SUM82 AT BTECKSVILLE

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EXECUTIVE SUMMARY

The instrumentation, monitoring, and analysis of a tieback wall located on the western side of the Cuyahoga valley National Recreation Area (CVNRA) Valley railroad in the vicinity of the State Route 82 bridge over the railroad and the Cuyahoga River, Brecksville, Ohio constitutes the main work of this project. Slope movements on the western wall of the Cuyahoga River valley were noticed, extending excessively to the north and south of the State Route 82 bridge centerline. Slope movements were also occurring within the 80 feet wide bridge right-of-way portion of the embankment. ODOT has conducted an independent investigation of this area and developed plans using tieback walls to stabilize the slope movements.

The objectives of this study were to: (a) develop and carry out an instrumentation and monitoring plan for the tieback wall to be constructed on the state Rt. 82, in Brecksville, Ohio (Project No. SUM-82-0.00), (b) plan and carry out load test of tiebacks in shale to determine the load-carrying capacity, load transfer mechanism, and the water effect, (c) plan and carry out creep tests of tiebacks to gain better insight on the time-dependent creep and stress relaxation behavior of tiebacks installed in shale, (d) document the construction sequence and the measured tieback wall responses, (e) monitor tieback wall performance at least for a year after the wall construction is complete, (f) perform a detailed analysis of measured data from the load test results and the monitoring data of instrumented walls, (g) investigate the interrelationships among the magnitude and distribution of the earth pressures, the tieback lock-off loads, the friction between the wall and the backfill, the pile hearing, and the magnitude and nature of ground movements, and (h) to provide recommendations for improved design methods for tieback walls with permanent anchors in shale.

All the elements of the studied tieback wall were provided with instrumentation including strain gages, inclinometers, load cells, and peizometers. The data gathered from all sensors and gages were analyzed, and utilized to validate the developed tieback computer program, and evaluate the present analysis methods.

Based on the comparisons of the existing "Earth Pressure Diagram" analysis methods, it was found that these methods result in considerable discrepancies with measured diagrams. The moments measured along the soldier pile were best fitted when a moment was introduced at the anchor-pile point.

A Finite Element Method (FEM) program, PLAXIS, was employed to perform a numerical simulation of the construction of the tieback walls utilizing the inclinometers' readings in the early stage of construction. Then the deduced soil parameters were fixed in the subsequent analysis of various construction stages to accommodate the stress-path dependency of the soil response. The close agreements between the measured and the simulation lend strong support to the validity of the FEM analysis techniques.

Finally, a finite element program developed for the purpose of tieback wall analysis and design was introduced. This program was shown to provide a good predictive and analytic tool for analyzing the structural behavior of the tieback wall, accommodating for the combined effects of construction stage and anchor prestressing. This program is also capable of simulating the anchor-soil response. The anchor-soil model was described and verified and shown to be powerful in both forward and backward calculations encountered in the anchor-soil system.