Woodrow Wilson Bridge

Geocomp Corporation

Technologies to manage risk for infrastructure

Background

Located in the Washington D.C. Metropolitan Area, the Woodrow Wilson Bridge is approximately at the mid-point of I-95, one of the busiest east coast interstate highways. The original bridge – a draw bridge – was constructed in 1961, and was designed to carry up to 75,000 vehicles a day; today it carries nearly 200,000 vehicles a day.

Traffic congestion is exaggerated by one of the worst bottlenecks in the U.S. where the eight-lane Capital Beltway narrows to six lanes, and the fact that the bridge is raised for river traffic 260 times each year. The new 12-lane box girder bascule draw bridge project area covers 7.5-miles and involves constructing a replacement draw bridge and improving 4 major interchanges to increase traffic flow. Raising of the new bridge will be reduced to 60 times each year.

Challenges for New Construction

Rosalie Island Pre-Consolidation, part of the improvements to the I-295 interchange and approach ramp to the new bridge, includes mass grading, pre-consolidation of existing soft soils, and construction of retaining walls (both permanent and temporary).

The work includes installation of thousands of wick drains, placement of earth surcharges at various elevations, and installation of multiple layers of high strength geotextile fabrics. The retaining walls are mechanically stabilized earth structures varying in height from 10 to 40 feet and are constructed in several stages.

The underlying soils are extremely soft and the construction of the new retaining structures required monitoring to validate stability and performance. Geocomp Corporation was chosen by J. Driggs Corp. as their instrumentation subcontractor, and awarded an $800K contract to install instruments and operate the automated monitoring system.

Pre-consolidation of soft foundation soils with earth surcharges and prefabricated vertical drains

Strain gauges & rod extensometers being prepared on high strength geotextile fabric

The Instrumentation Solution

Geocomp installed a wireless network of 25 data loggers in April and May 2002 to collect and transmit data from piezometers in the soft soils, and from strain gauge and rod extensometer instruments mounted on the reinforcing geotextiles at the embankment base.

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These automated instruments are complemented by manually-read inclinometers, probe extensometers, and settlement plates used to monitor vertical and horizontal movements. The auto-logged data are collected automatically through two cellular modems on site, using Geocomp's iSiteCentral™ web-based data management service. The results are available to all relevant parties in near-to real time.

Value to Project

The strain gauges were mounted on the high strength geotextile area under the main 30 ft. high mechanically stabilized earth wall. The placement of fill was halted, and added costs and delays due to a potential wall failure were avoided. The design of the wall in this area was revised and additional instrumentation was installed to monitor more closely the wall response. The piezometers showed that excess pore pressures in the soft clay layers dissipated much more rapidly than anticipated.

Instrument Reliability

Geocomp installed 110 strain gauges, 27 geotextile mounted rod extensometers, 31 inclinometers, 33 settlement plates, 30 vibrating wire piezometers, 9 probe

Wireless data loggers during installation

extensometers and 2 open standpipe piezometers over a six-month period. After one year of operation, all devices worked. After two years of operation, five strain gauges had strained beyond their working range and were abandoned, while the remainder of the instruments continued in service. All automated data logging and reporting functions have worked for the client without interruption.

Benefits and cost savings for implementing an automated wireless monitoring system

Installation of a network of wireless automated data loggers systems saved valuable time and money by eliminating the need to trench wires long distances across the site. The elimination of trenching wires also increased the longevity and reliability of the instruments.

No power or hard-wired communication connections were required at the site – this would have been extremely costly to provide and install.

Once the system was installed and operational, monitoring the performance of the structure and the behavior of the subsurface was done remotely. This saved the costly overhead associated with employment of field personnel to collect and process data.

Automated data logging allowed multiple daily readings in critical areas of construction at no additional cost to the project. The ability to increase reading frequencies also aided in validating the instrument responses. For example, it was demonstrated that the piezometers were functioning by increasing the data collection frequency and showing the engineer that daily tidal fluctuations were being recorded on nearly all sensors.