

## I-78 EASTON ROAD BRIDGE ABUTMENT PROJECT



Project	I-78 EASTON ROAD BRIDGE ABUTMENT PROJECT
Location	Bethlehem PA, USA
Owner	Pennsylvania Department of Transportation, District 5
Client	American Geotechnical and Environmental Services Inc. (AGES)
Duration	One year (2020-2021)

### PROJECT OVERVIEW

The project involves rehabilitation works required for the existing I-78 dual road bridge on Interstate 78 over Easton road near Bethlehem PA. Over the years, inspections

showed settlement and rotation of the MSE walls, which support the bridge as abutments. Separation between MSE walls and the bridge was observed during recent inspections. The bridge was built in 1984 as a dual three-span continuous composite steel multi-girder bridge.

### WHY MONITORING?

Geotechnical instrumentation and monitoring program was planned for the rehabilitation work, which addressed multiple deficiencies and issues mentioned in the maintenance report. The objective was to investigate the movement pattern for both west and east bound of the bridge abutments. The selected geotechnical instrumentation were used to collect sub-surface deformation data as well as the change in pore water pressures under the bridge abutments.



## MONITORING SOLUTION

Rite Geosystems Inc., our USA Company was entrusted to provide complete instrumentation and real time monitoring results for the project.

Scope of works include:

- Supply of geotechnical instruments
- Installation of geotechnical instruments
- Automatic monitoring with compact dataloggers
- Online web-based data management system (WDMS) with pre-set alarms

## INSTRUMENT USED

In-place inclinometers	Used to monitor sub-surface lateral movement i.e. deviation from the vertical in two axis (bi-axial deformation)
Multipoint borehole extensometers	Used to monitor sub-surface deformation (settlement or heave) of the soil/rock layers at various depths within the soil/rock body
Piezometers	Used to monitor pore water pressure and groundwater levels at the location of interest. Multi-level vibrating wire piezometer were installed to monitor pore water pressure at various depths. Any movement within the soil body has an expression on the groundwater and pore water pressures. Thus this reading was important to correlate and understand data.
Datalogger	Automatic compact wireless dataloggers with GSM/GPRS modem to transfer recorded data to a remote server/PC.

Rite Geosystems Inc. also provided complete online cloud based data management solution.

## INSTALLATION CHALLENGES

The site conditions were unfavorable for a clean installation as the ground where installation was taking place (in boreholes) was quite muddy. In addition, since the installation locations were in close vicinity to a busy major highway, heavy salt settled over the area after snowstorms. Also as the locations were on the shoulder, all the installations required special traffic rated utility vault and ABS boxes to house the dataloggers and interface unit for long term protection and correct readings.





The biggest challenge at the site was to keep the boreholes open due to caving in of gravel layers. The outer casing had to be kept in-place while the MPBX connecting rods were fixed. The MPBX head assembly was installed in the last, once the rods were in-place and grouted.

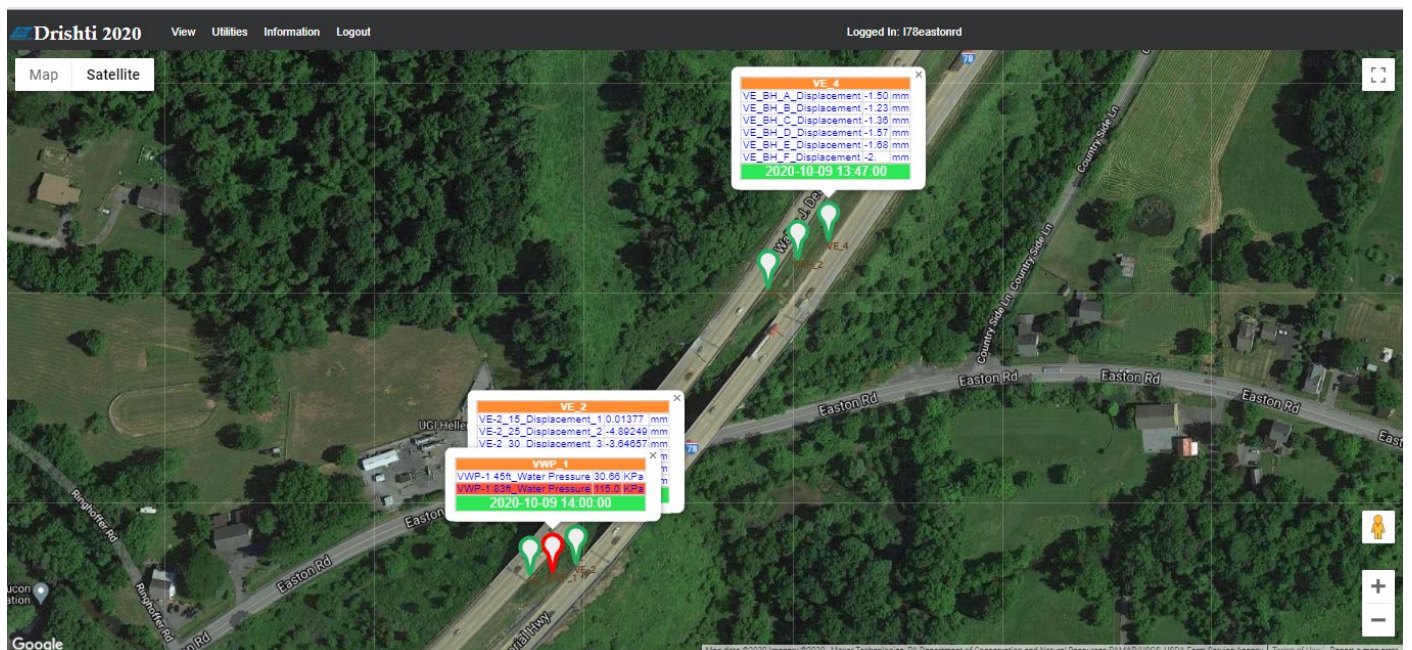
The piezometers were installed at two levels, using fully-grout method. The boreholes seemed dry at the time of the installation.

## RESULTS

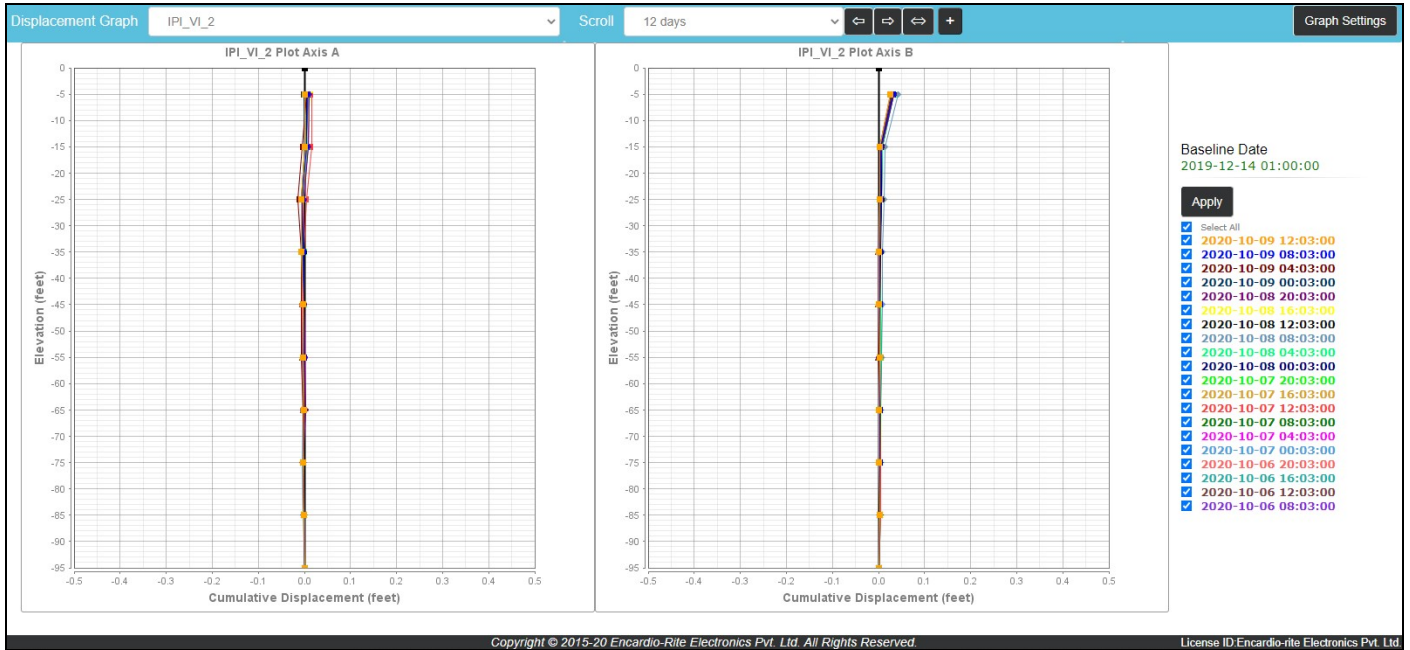
Installation of all the instruments was executed successfully, giving the client necessary information required for smooth progress of the project. The wireless datalogger collected the data from the instruments a required frequency and transferred it to a remote server/PC to be easily accessed by stakeholders.

The real-time data from the instruments were continuously accessible to the consultant/contractor at their desk, during works. The data management software had the provision to give alarms by SMS/email in case any data crosses the pre-set review and alert levels.

The near real-time data helped in the smooth and cost effective progress of construction works. Few screenshot from the online database management system are given below.



Google map view of the I-78 Bridge from our database management system, showing location of installed sensors



In-place Inclinometer data



Multipoint Borehole Extensometer data

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