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New Jersey Department of Transportation  
Bureau of Research

## Technical Brief



### **Route 22 over Liberty Avenue and Conrail Hillside Township, Union County, Monitoring of Tensar MSE Walls**

*MSE walls on a bridge replacement project on Route 22 in Hillside Township, NJ were constructed with a relatively new product – Tensar polymeric geogrids. To learn more about the performance of this product, two of the walls were instrumented during installation. Performance was analyzed after the end of construction, and re-evaluated with continued data gathering and monitoring six months later.*

#### **Background**

Tensar polymeric geogrids are being used as the reinforcement elements in the construction of mechanically stabilized earth (MSE) walls on the Route 22 over Conrail and Liberty Avenue bridge replacement project in Hillside, NJ. This is a relatively new application of the Tensar product for the NJDOT and it is not on the NJDOT's pre-approved list of allowable MSE walls for walls greater than 20 feet. As such, the Tensar geogrids were monitored with strain gages and tiltmeters. The instrumentation provided valuable data on the performance of the MSE walls during and after construction. The monitoring effort was conducted in collaboration with the Federal Highway Administration's Long Term Bridge Performance Program.



#### **Research Objectives and Approach**

To monitor the performance of the Tensar MSE walls, geogrids at the top, middle, and bottom of two of the walls (walls 1 and 3) were selected for instrumentation. During construction, an array of 18 strain gages was installed, six gages in each of the three instrumented geogrids. In order to capture the maximum tension in the geogrids, the locations of the strain gages were selected such that they are intersected by the theoretical line of maximum tension within the wall which corresponds to the plane of failure assumed in design. The strain gages were positioned at one third of the length of the longitudinal ribs rather than in the middle considering the fact that the width of the ribs is smallest in the middle and largest where they meet the transverse ribs. By doing so, the measured strain would be more representative of

the average strain along the rib. All strain gages were installed at or near the center of the geogrid panel in the transverse direction. Also during construction, two tiltmeters were installed on each instrumented wall. The tiltmeters were mounted on the column panels to which the instrumented geogrids were attached in order to correlate the strain gage and tiltmeter data. Data is gathered automatically through a data logger and transmitted wirelessly to be viewed remotely.

## Findings

The Tensar MSE walls strain data and tiltmeter data was analyzed after construction and led to the following findings:

- The geogrid tension deduced from the quick load-extension tests is less than the long-term design strength (LTDS) divided by the global factor of safety of 1.5, indicating that the geogrid load levels are currently within allowable limits. This is also the case based on the results of finite element analyses.
- The wall facing deformation is typical of MSE wall behavior based on comparison with published empirical data.
- The overall behavior of the two instrumented walls does not indicate overstressing of the geogrid reinforcing elements or excessive facing deformation, which indicates stability of the walls during and after construction until the present time.
- A survey of the optical prisms mounted on the facing of the two walls was performed after construction of the wall and four months later. It was concluded that the wall face displacements are too small to be accurately evaluated with the survey equipment. The maximum measured vertical movement of all prisms for each wall is relatively small - 0.22 inch for Wall 1 and 0.38 inch for Wall 3. The settlement occurring after wall construction may be attributed to compression with time of the fine grained soil layers.

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A final report is available online at: <http://www.state.nj.us/transportation/refdata/research/>. If you would like a copy of the full report, send an e-mail to: [Research.Bureau@dot.state.nj.us](mailto:Research.Bureau@dot.state.nj.us).

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