

Mechanically Stabilized Earth Wall Study

Client:

National Cooperative
Highway Research Program
(NCHRP)

Location:

Various

Services Provided:

- Provided measurements of strain, water pressure, and temperature
- Provided warnings of stability concerns

Value Provided:

- Embedded sensor technology provided the ability to identify the effects that environmental conditions have on the performance of MSE walls

Background & Project Challenges

The monitoring system developed for the test wall is a combination of electronic sensors, optical deformation monitoring and manual readings. Overall response of the wall face and structure are recorded using Automated Motorized Total

Stations (AMTS) and high-precision reflective prisms. The total stations are robotic and programmable to record 3-dimensional deformations on hundreds of targets on the wall face during construction and over the longer-term. Internal wall performance (i.e. strains on reinforcement, water pressures, temperature) is recorded electronically using Geocomp's *iSite*™ data logging system.

Appropriate warning levels for each instrument (prismatic target or electronic sensor) have been developed from the numerical modeling of the wall construction. When sensors record change exceeding the warning level, electronic notices will be sent to key personnel indicating that deformations are occurring at that instrument.

The instruments/sensors are read as often as required, with data relayed periodically or in real-time to Geocomp's *iSiteCentral*™ web-based reporting service by cell phone-modem. All data is accessible through any WEB browser to authorized users and will provide the project team with up-to-date process readings plotted in engineering units at any time from any location with WEB access. Manual verifications readings are also made, including periodic inclinometer measurements to provide redundant deformation measurements of the wall face.

The benefit of this extensive monitoring program is to identify the effects of environmental changes, such as temperature and rainfall on the performance of the wall to a degree of detail not previously possible.



Geocomp Role & Accomplishments

Geocomp developed selection guidelines, soil parameters, testing methods, and construction specifications that will allow the use of a wider range of backfill materials within the reinforced zone of mechanically stabilized earth (MSE) retaining walls. Geocomp designed, instrumented, and monitored full-scale field test MSE walls.

Our survey of MSE wall practice indicated that there are records of both successful and failed walls constructed using "high fines" and/or "high plasticity" soils in the reinforced zone. Those walls with stability problems appeared to have high water pressures in the reinforced zone that led to excessive deformation or collapse.

Geocomp concluded that a higher quantity of fines could be safely allowed in the reinforced fill provided the properties of the materials are well defined; and controls are established to address the design issues and limit the development of positive pore water pressures in the reinforced fill.