Florida Department of Transportation Research

Distribution of Chloride, pH, Resistivity, and Sulfate Levels in Backfill for Mechanically-Stabilized Earth Walls and Implications for Corrosion Testing

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Current Situation

Road construction projects often require mechanically stabilized earth (MSE), earthwork construction in which soil is retained by walls and reinforced with wire mesh, metal strips, and structural geosynthetics (geotextile or geogrid). The fill soil for these projects, as it leaves the source, must meet Florida Department of Transportation (FDOT) standards: it must be nonplastic, have a low liquid limit, low organic matter, and low fine particle content. Fill soil must also be noncorrosive, and it is tested for corrosive properties – pH, minimum resistivity, chloride, and sulfate levels – both at the source and after it is placed and compacted, as a quality assurance measure. However, variability in current sampling and analysis methods can result in delays in accepting or rejecting backfill at a specific work site or in inadvertently accepting corrosive soil, with future, costly maintenance issues.

The black wall (right) is an earthwork, retained by geotextile, which supports a section of I-295 under construction.

Research Objectives

The project goal was to improve quality, speed of completion or reduce risk of MSE wall projects. The first project objective was to assure that testing methods were sufficiently precise so that variability in corrosion properties of soil due to the methods themselves was much lower than the variability in these levels within and between soil sources and types. The second objective was to make sure that the number of soil type samples analyzed prior to acceptance of a backfill was appropriate, based on the expected distribution of corrosion properties within the backfill. The third objective was to assure that the corrosion properties of backfill did not change appreciably over time, especially after placement and over the design lifetime of the MSE wall.

Project Activities

Corrosion properties of soil were tested with Florida Methods (FMs) for pH, minimum resistivity, water-soluble chloride, and water-soluble sulfate. FMs were compared to standard methods from AASHTO, ASTM, and USEPA. Methods were examined carefully to identify steps with significant impact on results and to estimate precision and bias. Samples from one mine were distributed to four laboratories to compare the precision of testing. Also, researchers visited six FDOT laboratories and nine independent laboratories to observe the testing methods and results. Field sampling methods were also studied. Samples were collected from the aggregate bins at FDOT's State Materials Office and at eight sources. Statistical analysis of results led to recommendations for changes to FM protocols.

Project Benefits

MSE is a component of many transportation construction projects. Improved methods of acceptance testing will help assure improved durability of structures involving MSE as well as fewer delays or cost issues related to on-site backfill rejections.

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