PROJECT SUMMARY

Texas Department of Transportation

0-6359: Characterization of Backfill Materials for Prevention of Corrosion MSE Metallic Wall Reinforcement

Background

Mechanically stabilized earth (MSE) walls (Figure 1) are economical to construct and have the potential to exhibit good serviceability over long duration. To prevent premature failure of MSE walls, the corrosive potential of backfills has to be evaluated. Even though Item 423, Retaining Walls, provides reasonable means of evaluating the finer backfills, its applicability to coarser backfill materials needed further evaluation. To that end, the geotechnical, geochemical, electrochemical, and metallurgical aspects of the corrosion of MSE metallic earth reinforcements were studied to recommend new guidelines to the Texas Department of Transportation (TxDOT). The main objectives of this study were the following items:

- Evaluate current practices within Item 423 for coarse backfills.
- Fully characterize and understand the geochemistry of common coarse backfills.
- Propose geochemical methods for more realistically estimating the corrosion potential of coarse backfills.
- Study the corrosion rate of typical metallic reinforcement for typical coarse backfill geochemistry and environmental conditions.

What the Researchers Did

The effectiveness of traditional characterization techniques as reflected in Item 423 for use with coarse aggregates was evaluated by performing extensive geotechnical, geochemical, electrochemical tests using coarse limestone and dolomite aggregates from six representative

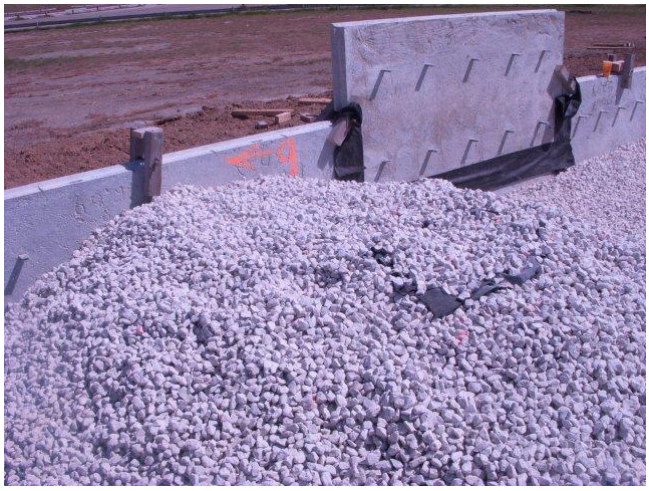

Figure 1. Mechanically Stabilized Earth Walls.

quarries in Texas. The geotechnical aspects of Item 423 in terms of the quality and composition of aggregates, their moisture-density properties, and their water retention and permeability were studied. Electrochemical differences between the coarse aggregates used in the construction of MSE walls and the fine aggregates required for laboratory testing were isolated. Around 80 specimens were prepared with embedded metallic reinforcements and monitored for up to 27 months to relate the electrochemical properties to the rate of corrosion under different moisture regimes (i.e., when the backfill

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is saturated, when it stays dry, or when the water table fluctuates). The metallurgical aspects of the corrosion study consisted of developing realistic models that related the rate of corrosion to the electrochemical properties of backfill. Three MSE walls were also instrumented and monitored for two years to partially validate the results of this study.

What They Found

The findings of this study are as follows:

- The geotechnical aspects of Item 423 are appropriate for coarse-backfilled MSE walls as long as hard aggregates that do not crush during compaction are used.
- The lack of fine aggregates required for traditional resistivity and chloride and sulfate concentration tests may impact the representativeness of electrochemical properties obtained in the lab.
- The U.S. Geological Survey field leach test that uses a more representative gradation is offered as a feasible alternative to current methods.
- The rate of corrosion of the metallic reinforcement is closely related to the conductivity of the soil-fluid mixture that surrounds it.

What This Means

The practical recommendations are as follows:

- The hardness of aggregates should be considered as a primary factor in selecting coarse (Type A or Type D) backfills and should not be waived.
- Current TxDOT specifications for coarse backfills may be conservative.
- With careful consideration, the proposed procedures may open new sources of Type A or Type D backfills to districts.
- If validated by TxDOT, the field leach test may offer a simpler way to characterize backfill materials.

For More Information

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