Texas Department of Transportation

CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY REPORT

0-7237: Synthesis: Develop Design Guidelines for Applications of Light Weight Aggregate in Embankments and Mechanically Stabilized Earth (MSE) Walls – Evaluate Cost Benefit & Performance

Background

Construction of fill structures such as embankments and MSE walls on soft, compressible soils is challenging and usually requires costly ground improvement, preloading, or staged construction that may significantly impact the construction timeline. The use of alternative lightweight fills in the construction of such structures may largely reduce or limit the use of ground improvement, preloading, or staged construction. Lightweight fills have found a multitude of applications in transportation infrastructure in which conventional select fills pose challenges. Lightweight fills are much lighter than conventional fills, which have made them favorable in projects where excessive vertical and/or lateral stresses are a concern. Lightweight fills induce much smaller vertical stresses than conventional fills when constructed at sites involving soft or compressible soils or when used to backfill above culverts or vulnerable utilities. Lightweight fills have also been used to backfill behind retaining structures to reduce the lateral earth pressure behind retains walls and bridge abutments and other vertical structures that may be vulnerable to lateral thrusts from conventional fills. The use of lightweight fills, however, remains somewhat limited due to their prohibitive material and transportation costs, limited contractors experience, and limited availability of design and construction guidance.

What the Researchers Did

The research team conducted a thorough synthesis of the state of the practice of using lightweight fills in transportation infrastructure. This synthesis was accomplished through a review of the published literature, a survey of state DOT practices, an evaluation of case studies involving the use of various lightweight fills inside and outside Texas, and a review of material costs. Based on the synthesized information, the research team prepared a set of design and construction guidelines that can be adopted by TxDOT for projects in Texas.

What They Found

The research team found that lightweight fills have widely been used across the nation. A growing interest was recorded in promoting the use of lightweight fills in transportation infrastructure, particularly in light of emerging fill types that are new to the US market. The research team found that the engineering properties of many lightweight fills are reported not to be well established, especially in light of longevity. This is attributed to the lack of long-term performance data. While the use of recycled and sustainable materials in the construction of transportation infrastructure has always been encouraged by transportation agencies, their use should not compromise the intended infrastructure performance. Accordingly,

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further research and demonstration projects on the performance of lightweight materials are necessary to ensure the suitability and longevity of lightweight fills in the various infrastructure applications.

What This Means

The extensive synthesis conducted by the research team provides valuable information on the state of the practices of using lightweight fills in transportation infrastructure. The research team also provides potential recommendations for TxDOT to inform design and construction guidelines for projects involving lightweight fills. The project's findings yielded the following benefits:

1. Guidance on the design parameters for lightweight fills and their ranges.

2. Guidance on the design aspects of using lightweight fills in transportation infrastructure.

3. Guidance on the construction aspects of using lightweight fills in transportation infrastructure.

4. Guidance on the limitations involved with using lightweight fills.

5. Guidance on the material costs of lightweight fills.

For More Information

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