Florida Department of Transportation Research

Soil Mixing Design Methods and Construction Techniques for Use in High Organic Soils, Phase 2

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Current Situation

The soils which serve as foundations for construction projects may be roughly classified as inorganic or organic. Inorganic soils vary in firmness and suitability for construction. Soft or loose inorganic soils may be stabilized using cement or similar binders. This method, called soil mixing, yields effective and predictable results, allowing the Federal Highway Administration (FHWA) to publish a comprehensive design manual for soil mixing in inorganic soils. However, organic soils, often highly compressible and often found with high water tables, have not been addressed to the same extent.

A soil-mixing operation in progress. An auger drills down to mix soil with binder, creating supporting columns.

Research Objectives

University of South Florida researchers sought to clearly identify the mechanisms producing excessive settlement of organic soil and field techniques that can be used to effectively stabilize organic deposits for roadway applications.

Project Activities

Soil-mixing stabilization was tested in the laboratory to assess the effect of cementitious binder type, binder content, mixing method, organic content, and curing time on strength gain. Over 700 tests were conducted, and in every case where organic content was higher than approximately 10%, much more cement was required to achieve the same strength gain than was needed for inorganic or low organic content samples.

Following the bench-scale tests, a tenth-scale test bed was built in which soil containing approximately 60% organics was placed and conditioned with rain water. The bed was divided into three equal testing regions: dry soil mixing (binder + soil), wet soil mixing (binder + water + soil), and no treatment (soil only). A simulated roadway was placed on each section of the test bed, left in place for several weeks, and monitored for movement. Results showed marked improvement for the soil-mixed sections relative to untreated; dry or wet methods, using identical amounts of cement per volume, showed nearly identical results.

Field evaluation of past and on-going soil mixing programs was conducted concurrently with bench- and tenth-scale testing. The sites, which included wet and dry mixing, demonstrated a range of effectiveness of soil mixing. For most sites, soil mixing was largely successful. However, two sites, a rural road and bridge over organic and/or soft soil, experienced continued subsidence.

Project Benefits

Organic soils are frequently encountered in Florida. Effective and predictable construction methods for these soils will facilitate construction and reduce repair and replacement costs.

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