Florida Department of Transportation Research

Development of Statistical Models to Predict the Compressibility of Florida's Soils

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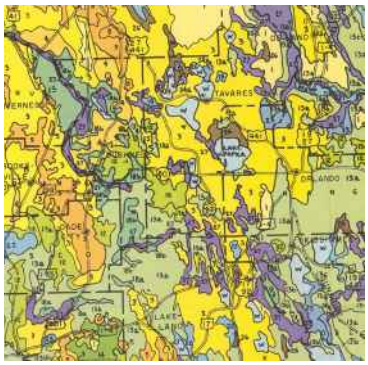
Project Manager
David Horhota
FDOT Materials Office

Principal Investigator
Boo Hyun Nam
University of Central Florida

Current Situation

Designing and building transportation structures relies on the consistency and uniformity of well-characterized materials. But the most common material encountered in construction, soil, is often widely variable across a site. Geotechnical soil properties have been studied extensively, providing much information to designers, including long-term settlement response of foundation soils, or consolidation. This is related to soil compressibility, which is measurable, but not easily. So, predictive models are often used, based on other soil index tests, which are easier and performed more often. Current models are not based on Florida soils, leaving designers with tools whose underlying data and interpretation may make them poorly suited for Florida.



This soil map of central Florida shows the area's wide variety of soils.

Research Objectives

University of Central Florida researchers identified statistical models best suited for predicting compressibility parameters of Florida soils based on basic soil index parameters obtained during a geotechnical site investigation. For these models, they identified critical soil index properties to correlate compressibility parameters with laboratory consolidation test results as well as a common field test, the cone penetration test (CPT).

Project Activities

A thorough literature review provided the researchers with many models that predict soil compressibility. The most accurate models were identified by evaluation against a database of hundreds of consolidation laboratory tests of soils collected across Florida. A statewide survey of design professionals showed that the most common model, while well established in the literature, was not the most accurate model for Florida.

The project goal was to develop models based specifically on Florida soil data. The researchers examined the correlation between soil compressibility parameters and measurable soil properties, such as effective overburden pressure, wet density, fines content, and several others. These properties were then ranked, and the top three were identified for use in creating models.

Statistical prediction models for Florida soils were constructed through machine learning, specialized software which classified the models and measured their accuracy in predicting compressibility. Models were developed for six Florida soils types: high and low plasticity clays, high plasticity silt, high and low plasticity organic soils, and peat.

In a final task, the researchers investigated the correlation between CPT data and soil compressibility. CPT is more complex that the standard penetration test (SPT), but it is becoming more common, due to its higher accuracy for highly compressible soils and other advantages.

Project Benefits

By providing more accurate soil parameters and better settlement estimates, Florida-specific soil compressibility models can support more reliable designs and structures that require less maintenance. More accurate correlations can be used with a project's sampling and testing program to obtain more consolidation parameters on the project site to better assess soil variability and optimize the site's soil characterization, leading to cost savings by reducing the number of undisturbed samples and laboratory consolidation tests that are normally required.

For more information, please see www.fdot.gov/research/.