Monday 3/13/2017

12:15–1:45 p.m.

Roadway Materials, Monitoring and Testing 2

Chairs: Burak Tanyu, George Mason University; Bora Cetin, Iowa State University

Performance Assessment of Geocell-reinforced Subballast: Modeling and Design Implications

Trung Ngo and Buddhima Indraratna, University of Wollongong; Michael M. Biabani, Coffey Geotechnics Pty. Ltd., Australia

This paper presents a study of the load-deformation behavior of geocell-stabilised subballast subjected to cyclic loads using a large-scale track process simulation apparatus and numerical modelling. The tests and numerical simulations were conducted to mimic the actual track conditions. Subjected to a given frequency and cyclic loads the predicted load-deformation behavior of the subballast with and without geocell inclusions match reasonably with those measured in the laboratory, and show that geocell could effectively decrease the lateral and axial deformations of the reinforced subballast. The results also provide an insight to design of rail tracks capturing the roles of geocell in decreasing lateral deformation of subballast. Additionally, the numerical modelling carried out in this study can be applied in the preliminary design of track substructure where a wide range of subballast aggregates and geocell mattresses with varying strengths and stiffness can be considered.

Comparison of Laboratory and Field Test Results for Granular Bases

Prajwol Tamrakar and Soheil Nazarian, University of Texas at El Paso

The performance of a flexible pavement depends, to a large extent, on the mechanical characteristics such as stiffness and deformation resistance of its base layer. The laboratory static triaxial compression tests are common to estimate these mechanical characteristics. The resilient modulus tests are the other laboratory tests that are also gaining popularity. These laboratory tests are usually augmented with field tests such as the plate load, lightweight deflectometer or dynamic cone penetration tests. Since the methods of compaction and testing are different, one can anticipate that the mechanical characteristics measured in the laboratory and in the field are different even at the same moisture content and density. In this paper, the relationships among the laboratory and field mechanical characteristics of a common base with different fines contents and moisture contents are evaluated, reported and discussed.

Laboratory Investigation of Mechanical Stability of Unbound Permeable Aggregate Base Materials: Preliminary Direct Shear Test Results

Daiqi Lv, Yuanjie Xiao, Liuxin Chen, and Zhen Zhang, Central South University

Unbound permeable aggregate base (UPAB), due to its relatively high porosity and permeability, is considered as an alternative to traditional impervious (e.g., dense-graded) bases for controlling subsurface drainage and pavement longevity in an economical and environment-friendly way. The UPAB layer is normally made of open-graded unbound aggregates and thus tends to suffer from insufficient structural strength (or stability). Aimed at further validating a new gradation concept for enhanced structural strength, this paper presented preliminary findings from a series of laboratory tests conducted to evaluate various gradation designs of UPAB materials in relation to mechanical stability. Five representative gradations were selected according to the current UPAB gradation band, and the

effects of different UPAB gradation designs on the shear strength properties were investigated using a large-scale direct shear test device. Based on the experimental results, the optimum aggregate gradation design recommended by the new gradation concept for enhanced stability was consequently validated. The use of such optimal gradation is expected to achieve cost-effective UPAB design for long-life concrete pavements.

The Rapid Soils Analysis Kit—Enabling Contingency Construction Anywhere

Ernest Berney and William Myers, U.S. Army Corps of Engineers Research and Development Center

As horizontal construction extends into regions of the world with fewer technical resources, simple and compact technologies for remote soil assessment become necessary to reduce risk while increasing durability. To provide the capability to rapidly evaluate and improve soil materials for horizontal construction, a wash-based soil classification and engineering system, named the Rapid Soils Analysis Kit (RSAK), was developed. Physically, the wash based RSAK (W-RSAK) consists of a suite of scaled down laboratory soil test equipment packaged in a man portable case including software for predictive analysis. Processing 500 grams of soil material through the W-RSAK guided by an intuitive software user interface can be completed in 60 minutes by a single user. The resulting software output from the W-RSAK consists of a Unified Soil Classification, Atterberg limits, and prediction of the optimum moisture content and maximum dry density. It also includes the complete moisture-density curves at both standard and modified proctor compaction energy and the resultant soaked and unsoaked California Bearing Ratio curves to predict bearing capacity. The W-RSAK procedure was validated through a set of experiments on 14 varying soil types comparing classification and compaction to traditional laboratory and an earlier generation dry-based RSAK procedure. It was demonstrated that the W-RSAK procedure significantly improves classification estimations and is a potential solution to fill engineering gaps in soil design for contingency construction.