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Railroad Ballast Testing and Properties

STP 1605

Editors:

Timothy D. Stark

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Foreword

THIS COMPILATION OF Selected Technical Papers, STP1605, *Railroad Ballast Testing and Properties*, contains peer-reviewed papers that were presented at a symposium held January 24, 2018, in New Orleans, Louisiana, USA. The symposium was sponsored by ASTM International Committee D18 on Soil and Rock, Subcommittee D18.02 on Sampling and Related Field Testing for Soil Evaluations, and Subcommittee C09.20 on aggregates.

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Overview

The International Symposium on Railroad Ballast Testing and Properties, sponsored by ASTM Committees D18 (Soil and Rock) and C09 (Concrete and Concrete Aggregates), was held in two sessions on 24 January 2018, in New Orleans, Louisiana. Of the almost 100 symposia sponsored by Committee D18 since 1947, this is the first symposium dedicated to the study of the properties and behavior of railroad ballast. This symposium addresses the best practices for field and laboratory ballast testing including ballast sampling, sample transportation and reconstitution, field testing, laboratory gradation testing, direct shear testing, triaxial compression testing, and large shear box testing. The ideas and test methods presented and debated will be used to develop ASTM standards tailored for field representative ballast sampling and laboratory testing. Field techniques for testing ballast, for example, ground-penetrating radar and the use of smart rocks, were also discussed in an effort to standardize this testing too.

The symposium opened with a memorial tribute to Professor Ernest T. Selig, III, by Professor Theodore R. Sussmann, Jr. of the University of Hartford. Professor Selig passed away in August 2016, leaving a legacy of his distinguished work and the many accomplishments of his students who are continuing his life's work. Professor Selig wrote the pioneering book titled *Railway Geotechnology and Substructure Management* that introduced the benefits of ballast testing and the resulting engineering behavior and properties. A keynote presentation by Buddhima Indraratna of the University of Wollongong in Australia followed the memorial tribute. Professor Indraratna presented two decades of research on the development of large-scale ballast testing equipment at the University of Wollongong and how the test results and research outcomes have contributed to transforming railways (tracks) in the Australian heavy haul and commuter networks with regards to the strength, deformation, and degradation of railroad ballast.

The remainder of the symposium was presented in two sessions. The first session discussed field testing of railway ballast and the second session discussed laboratory testing of railway ballast. The symposium ended with a panel discussion moderated by Professor Timothy D. Stark, which developed a list of Ballast Research and Test Method Needs. The program format and participants are given as follows:

Ernest T. Selig Memorial by T. Sussman, University of Hartford

Keynote Presentation: "Two Decades of Advancement in Process Simulation Testing of Ballast Strength, Deformation, and Degradation" by B. Indraratna, University of Wollongong

Session 1: Field Testing

“Methods to Assess the Impact of Ballast Condition on Track Structure” by T. Sussmann, University of Hartford

“A Review of Methods for Estimating Ballast Degradation Using Ground-Penetrating Radar” by K. Scanlan, University of Alberta

“Man-Portable Real-Time Ballast Inspection Device Using Ground-Penetrating Radar” by C. Oden, ESS, LLC

“Evaluating Ballast Stabilization during Initial Compaction Phase” by H. Huang, Penn State–Altoona

“Field Validation of Polyurethane Technology in Remediating Rail Substructure and Enhancing Rail Freight Capacity” by J. Tinjum, University of Wisconsin

Session 2: Laboratory Testing

“Large-Scale Triaxial Tests on Railway Embankment Material” by R. Dyvik, Norwegian Geotechnical Institute

“Large Direct Shear Tests Performed with Fresh Ballast” by J. Estaire and M. Santana, CEDEX Track Box, Laboratorio de Geotecnia, Madrid, Spain

“Large-Scale Testing Box: A Tool to Evaluate the Structural Performance of Railway Tracks” by M. Sol-Sánchez, University of Granada

“Evaluation of Ballast Particle Movement Using SmartRocks for Track Transitions” by Y. Gao, Transportation Technology Center, Inc.

“Large-Scale Laboratory Testing of the Lateral Resistance of a Timber Tie” by C. Mulhall and M. Hendry, University of Alberta

Panel Discussion: “Sampling, Reconstituting, and Gradation Testing of Railroad Ballast” moderated by T. Stark, University of Illinois

The contributions made by these participants are gratefully acknowledged. The papers submitted to the symposium were divided into the two sessions and were examined, evaluated, and discussed as part of each session’s presentation. The papers in this STP are organized for the most part as they were presented in each session. However, this STP does include two additional papers that were not presented during the symposium due to time constraints. The addition of these two papers has altered the organization of some of the papers. The first paper, entitled “Sampling, Reconstituting, and Gradation Testing of Railroad Ballast,” investigates ballast sampling methods and sizes, reconstitution, splitting, and gradation testing for appropriate characterization of in-track ballast. The second paper, entitled “Review of Size and Loading Conditions for Large-Scale Triaxial Testing,” investigates the advantages and disadvantages of large-scale triaxial compression testing of ballast and how triaxial compression testing can be used to represent field ballast conditions and presents typical results. The editors of the STP felt that the addition of these two papers provided additional useful information towards the goal of the symposium and STP to develop ASTM standards tailored for field representative ballast sampling and laboratory testing.

Finally, the symposium chairs and co-editors would like to thank the authors, co-authors, peer reviewers, and ASTM personnel for their time and effort in bringing this international symposium and publication to fruition.

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