Introduction

Recognizing the importance of relative density in engineering problems dealing with cohesionless soils and the number of American Society for Testing and Materials standards related to this topic, ASTM Committee D-18 on Soil and Rock for Engineering Purposes considered it desirable to organize and sponsor this symposium. Emphasis was placed on the following four items concerning the evaluation of relative density and its role in geotechnical projects involving cohesionless soils: (1) determination of relative density considering the measurement of maximum, minimum, and *in situ* or sample density as well as the reliability of relative density and the factors influencing it, (2) correlation between relative density and measured performance or properties of granular soils, (3) applications of relative density to geotechnical projects involving cohesionless soils and the usefulness of this concept, and (4) evaluation of the existing ASTM standards concerning relative density with recommendations for improvements in the future.

The symposium was divided into two sessions. The morning session primarily covered the measurement of relative density. The session began with an address by W. G. Holtz which defined relative density and applicable soils, explained the history of the test standards, and discussed the reliability of the concept. One of the highlights of this session was the presentation of F. A. Tavenas of the results of the cooperative testing program carried out by forty-one (41) soil laboratories in the United States and Canada to evaluate the accuracy and precision of relative density measurement. Fifteen papers on the topic of Session I were accepted by the symposium committee. Several of these were selected for presentation to provide further background prior to the panel discussion. Panel members in Session I were: E. T. Selig (moderator), State University of New York at Buffalo; D. F. Griffin, Naval Civil Engineering Laboratory; W. G. Holtz, Consulting Engineer; R. S. Ladd, Woodward-Moorhouse & Associates; R. J. Stephenson, South Atlantic Division Laboratory, U.S. Army Corps of Engineers; F. A. Tavenas, Laval University; and D. A. Tiedemann, U.S. Bureau of Reclamation.

The afternoon session dealt with applications of relative density, including correlation with properties and performance and an assessment of usefulness. The session began with illustrations of applications of relative

density by Yves Lacroix. Twelve papers were accepted on the topic of Session II. Following the presentation of several of these papers, an active discussion was held by the panel as well as persons attending the symposium concerning the reliability of relative density and its usefulness. The panel members for this session were: R. S. Ladd (moderator), Woodward-Moorhouse & Associates; W. G. Holtz, Consulting Engineer; I. Holubec, E. D'Appolonia Consulting Engineers; Yves Lacroix, Director, Woodward-Clyde Consultants; S. J. Poulos, Geotechnical Engineers; E. T. Selig, State University of New York at Buffalo; R. J. Stephenson, South Atlantic Division Laboratory, U.S. Army Corps of Engineers.

The papers have been grouped in these proceedings by session topic following the session keynote address. The final paper evaluates the entire written and oral content of the symposium and, on the basis of this information, summarizes the results and recommends future action by ASTM. It is the hope of the authors and sponsors of this symposium that this ASTM Special Technical Publication will provide a comprehensive enough evaluation of relative density and its role in geotechnical projects to enable practicing engineers to function more effectively on projects involving cohesionless soils. It is also hoped that the accumulated knowledge of test techniques, apparatus, and applications will be used as a basis for improving the many test standards associated with relative density.

E. T. Selig

Associate Professor
Department of Civil Engineering
State University of New York at Buffalo
Buffalo, N. Y.

R. S. Ladd

Laboratory Director
Woodward-Moorhouse & Associates, Inc.
Clifton, N. J.