Summary of Final Report, BB890
March 2003

LABORATORY SIMULATION OF FIELD COMPACTION CHARACTERISTICS, PHASE I

PROBLEM STATEMENT

Fill materials are used in almost all roadway construction projects. When fill materials are used, the engineering properties of the soil need to be improved by compacting it. The direct consequence of soil compaction is densification, which, in turn, results in higher strength, lower compressibility, and lower permeability. Most construction specifications for fill materials are based on laboratory compaction tests. These laboratory compaction tests are designed to represent the highest degree of compaction that can be reasonably be achieved in the field. The most common of these laboratory tests are the standard and modified Proctor tests. Both of these tests utilize impact compaction, although impact compaction shows no resemblance to any type of field compaction and is relatively ineffective for granular soils. Since the development of the Proctor tests, there have been dramatic advances in field compaction equipment. Therefore, there is a need to study the current effectiveness of the Proctor tests and, if a need exists, to update the normal laboratory determination of "Maximum Density."

OBJECTIVES

The primary objectives of this project included a survey of current field compaction equipment, laboratory investigation of compaction characteristics, field study of compaction characteristics, and laboratory simulation of field compaction characteristics. The findings from the laboratory and compaction programs will be used to review the present laboratory compaction procedures.

FINDINGS AND CONCLUSIONS

The findings and conclusions based on the analysis of this experimental study are summarized below:

1. Numerous tests have shown that impact compaction is not an adequate procedure for compacting pure sands in the laboratory. The standard and modified Proctor test procedures, AASHTO T99 and T180, respectively, were not developed for use with cohesionless soils but have been used for them and all other soils.

2. Dry unit weights substantially greater than the modified AASHTO maximum dry density were achieved in the field with a reasonable number of passes when using conventional vibratory compaction equipment on sandy soils when the in-place moisture content was less than or equal to the optimum moisture content corresponding to the field compactive effort.

3. The optimum moisture content corresponding to the field compact effort was likely less than the modified AASHTO optimum moisture content when sand fill was compacted by more than 3 passes of a conventional vibratory compactor.

4. In the field, compaction after 8 passes of conventional vibratory compaction equipment has little effect on the dry unit weight.

5. Gyratory compaction was more reliable than impact compaction when compacting pure sands in the laboratory.

BENEFITS

Preliminary to final project results. See Phase II.

This project was conducted by Virgil Ping, Ph.D., P.E. of the Florida A & M University—Florida State University College of Engineering. For additional information, contact Sastry Putcha, Ph.D., P.E., Project Manager, at (850) 414-4148, sastry.putcha@dot.state.fl.us