Summary of Final Report, BB890
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LABORATORY SIMULATION OF FIELD COMPACTION CHARACTERISTICS, PHASE II

PROBLEM STATEMENT

Due to the development of much heavier earth moving and vibratory roller compaction equipment, densities in the field are reaching levels that are not attainable in the laboratory using the current "moisture-density" standards. Higher compaction efforts, routinely seen in the field, not only result in higher unit weights but also lower optimum moisture contents than those found by the modified Proctor test. The optimum moisture content (OMC) obtained in the laboratory is often higher than that in the field compaction. Consequently, in the field compaction, the maximum density compacted using the laboratory OMC will be lower than that obtained using the field OMC. In addition, the impact compaction method does not work well with pure sandy soils.

Suitable revisions to the compaction test procedure are evidently needed, ones which will produce laboratory densities compatible with those being obtained under field compaction and traffic in actual pavements and one that will work well for the cohesionless A-3 soil.

OBJECTIVES

The objective of this project was to further the Phase I study, which was undertaken to investigate the potential of other types of compaction tests, such as using gyratory compaction for field simulation. The objectives include examination of the effects of the gyratory compaction variables on laboratory-compacted specimens, comparison with other compaction methods such as impact and vibratory compaction, and correlation of these data from the gyratory, impact, and vibratory compaction to the results from field tests. Several laboratory compaction procedures were evaluated to determine which would best replicate the field compaction effort.

FINDINGS AND CONCLUSIONS

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

1. The study showed that higher field compaction efforts resulted in higher unit weights and lower optimum moisture content than those obtained by the modified Proctor compaction test.

2. Gyratory compaction seems to be more comparable to the field test results than does impact compaction when fine sands were compacted in the laboratory.

3. For the gyratory compaction test, using vertical stress as a means of increasing the dry unit weight was not effective when the vertical stress was higher than 200 kPa. The 200 kPa stress level was within the range of peak vertical soil stresses measured during the field compaction tests.

4. The gyration angle had some effect on the dry unit weight when the soil had lower percent of fines, and when the number of gyrations was higher. When the soil became more silty (with more than 6% fines), the influence of the gyration angle on the dry unit weight became less significant.

5. When the number of gyrations was increased, there was a continuous increase of dry unit weight, which needed to be adjusted to get the desired dry unit weight.

6. The gyratory test procedure conducted with 200 kPa vertical pressure, 1.25 degree gyration angle, 90 gyrations, and 20 gyrations per minute showed considerable promise for replicating field compaction characteristics.

7. Vibratory compaction also seems to be more comparable to the filed test results than impact compaction when fine sands were compacted in the laboratory.

BENEFITS

While density requirements are addressed in the compaction specifications, moisture content requirements are not. This research confirms that the level of moisture content attained during the maximum density determination in the laboratory may not be a suitable indicator in the field due to the lower moisture contents attained by heavier earth moving and vibratory roller compaction equipment typically used nowadays. There is a need to pay attention to moisture content and to allow field work to be done at lower moisture contents to attain acceptable densities, which, in turn, will save time and money for the owner and contractor.

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