SUMMARY REPORT 99-2(S)

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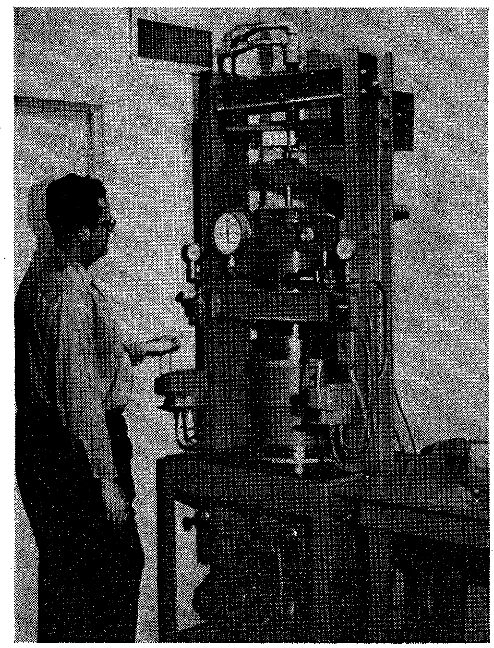

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# A Gyratory Compactor for Molding Large Diameter Triaxial Specimens of Granular Materials

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Continuing increases in traffic volumes and in the weights and tire pressures of commercial vehicles have placed heavy demands on the load carrying capacities of modern highways. In particular, the near surface layers of flexible pavements (the granular base course materials) have been affected, shear failures and settlement caused by traffic compaction are not uncommon.

The factors influencing the performance of granular base course materials are usually surmised from observation of field test sections or model pavements. Laboratory investigations where the variables could be more closely controlled than in the field have been severely restricted due to the difficulty of fabricating representative specimens of these materials in the laboratory.

One objective of this study was to develop a suitable method of fabricating large size triaxial specimens of granular materials which would meet the following requirements:

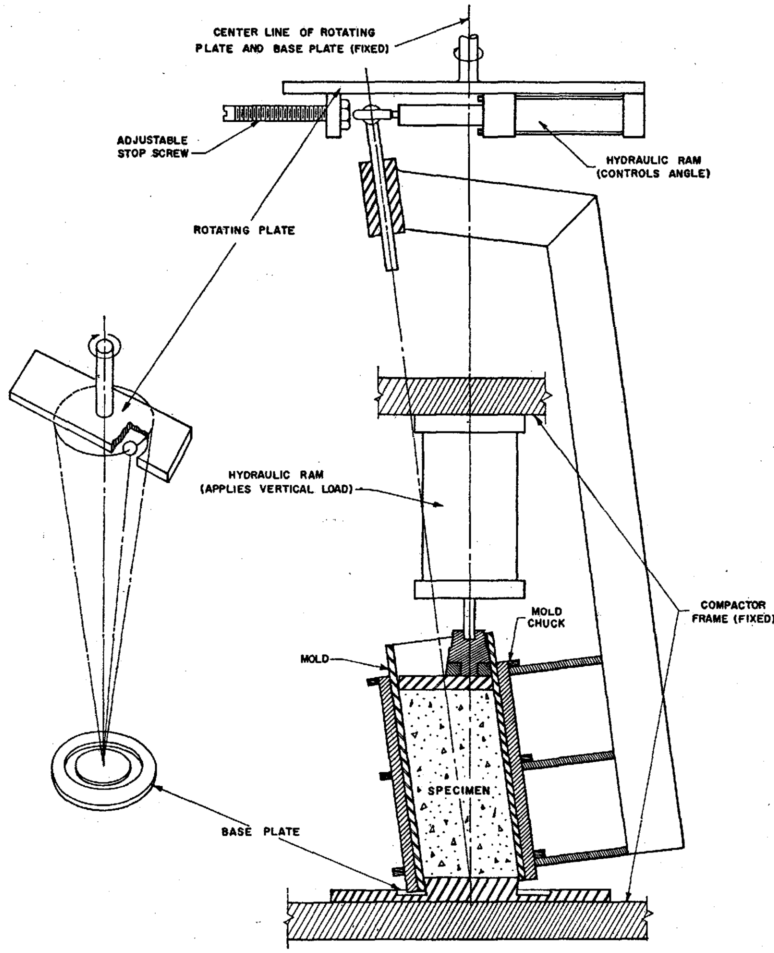
(a) Be reproducible from specimen to specimen.

(b) Be uniform throughout the specimen length insofar as density, moisture content, and gradation are concerned.

(c) Be capable of being molded at in-situ moisture contents, densities, and gradations.

Before an attempt was made to develop a piece of equipment, an extensive review of research on compaction processes was made. Indications were that the gyratory principle of compaction would be most appropriate. A search for a commercially available gyratory compactor that could compact large specimens of granular materials proved fruitless and the decision was made to design and construct a compactor.

In principle, the compactor which was developed operates similar to other gyratory compactors, in that a hydraulic ram maintains a vertical load on the specimen while the mold is gyrated.




**Schematic of gyratory compactor.**

The compactor, however, employs several unique features, one of which is the ability to maintain close control on four main compactor variables. These variables, listed below, can be altered to produce a specimen having a desired combination of density and moisture content.

1. The **vertical pressure** can be regulated from 0 to 500 psi.
2. The **gyratory angle** can be varied up to a maximum of four degrees and then returned to zero to level up the specimen. Also the angle can be changed at any time during gyration.

3. The **speed of gryation** can be adjusted up to a maximum of 25 gyrations per minute.

4. The **number of revolutions** can be controlled by a preset predetermined counter.

Another important feature of the compactor is the special compaction mold which has an interior that is coated with a teflon impregnated ceramic lining to reduce friction between the walls of the mold and the soil particles. Such a reduction of friction allows the entire specimen to be compacted at once, thereby eliminating the need for layers. In addition the mold is split longitudinally to facilitate easy removal of the compacted specimen.

Measurement of the effort required to compact a specimen has been accomplished by detecting and recording the torque required to gyrate the specimen. In addition, an instantaneous recording of specimen height is obtained by the use of a linear potentiometer.

Another potentially important feature of the compactor is its ability to perform as a variable strain apparatus. Such an application allows the specimen to freely decrease its gyratory angle by overcoming the force exerted by the angle generating mechanism. Such use could prove useful in evaluating strength characteristics under repeated shear.

The compactor also provides for control of the rate at which the vertical load is applied and the rate at which the sample is leveled to produce a right circular cylinder.

**Conclusions**

Although the test results are limited at present, the compactor appears capable of achieving its design requirements as stated earlier. The compactor has several variables which can be altered to produce a desired combination of dry unit weight and moisture content. A detailed investigation is now in progress to determine the influence of each of these variables on the compaction characteristics of granular material.

A complete set of plans and parts list which include component trade names are available to interested parties upon request. Also available on a loan basis is a 12-minute, color movie of the compactor.