KTMR-14 METHOD OF TEST FOR DETERMINATION OF VOLUME CHANGE OF SOILS (Kansas Central Lab Test KT-MR14)

a. SCOPE

This method describes the procedure to be followed in the testing of soil, soil mixed with admixtures, soil-aggregate mixtures or any desired (See c) fraction of soil-aggregate mixtures, to determine the volume change caused by the absorption of water.

b. APPARATUS

The apparatus shall consist of the following:

b.1. Molding and volume change apparatus (see Figures 1, 2 and 3) consisting of mold (A) with an inside diameter of 4 in and a height of approximately 6 1/2 in; a removable perforated base (B); a molding piston (C) with an adjustable gauge screw (H); a loading piston* (D) which fits loosely in the mold; 4 in discs of blotter and filter paper (E); a 2.000 in gauge stock (F); and a mounted dial gauge (G) reading to thousandths of inches.

> NOTE: Lead is added to the Surcharge Piston to obtain a weight of 13.2 lbs. to simulate the weight of nine inches of concrete pavement and four in of granular base.

b.2. A 12-ton capacity Carver Laboratory Press for molding specimens.

b.3. A 5-kilogram capacity balance sensitive to 1 gram.

b.4. Standard No. 4 and 3/8 in sieves.

b.5. A suitable drying oven which will maintain a temperature of 140^{o}F.

b.6. Miscellaneous equipment including a 100 cc graduate, spatulas, trowels, pans, dishes, etc.

c. PROCEDURE

c.1. Unless otherwise specified the test shall be made on the total material with the exception that, due to size of the test specimen, in the case of samples having aggregate retained on the 3/8 in sieve, the plus 3/8 in portion shall be replaced by an equivalent weight of aggregate passing the 3/8 in sieve and retained on the No. 4 sieve. A sample of sufficient size to provide 1,700 grams of oven dried soil shall be selected by quartering or by the use of a sample splitter. The sample shall be dried at 140^{o}F for 24 to 48 hours and the moisture content shall be determined after drying.

c.2. Tests shall be conducted at two different moisture contents and at a predetermined dry density. These moistures and the density shall be selected from data obtained by the Proctor compaction test. The moistures shall be optimum minus 3% and optimum plus 3%, and the density shall be 92% of the dry

density obtained at optimum moisture by the Proctor compaction test. The test specimen shall be 4 in. in diameter and as nearly as practicable shall be 2 in. in height.

c.3. Two portions of soil of 1000 grams each shall be weighed out and mixed with the proper amount of water to give the two moisture contents shown above. The mixing process will be simplified and made more effective if the material is first broken down so that as much as possible will pass the No. 4 sieve before water is added. Each portion shall be placed in a container after mixing, covered to prevent evaporation loss or placed in a moist cabinet, and allowed to cure for a period of 16 to 24 hours to insure uniform distribution of moisture.

c.4. The weight of moist soil required for 92 % of the Proctor density at each selected moisture content shall be computed. The amount shall be that required for a volume of 25. 1328 cu. in. (4.0 in dia x 2.0 in depth). Most of the computations can be eliminated by the use of simple tables which may be made up to show grams of dry soil required for various densities, cc of water required for varying percentages of moisture in 1000 grams of dry soil, etc.

c.5. The test specimen shall be prepared in accordance with the following procedure:

c.5.a. Two discs of filter paper, and the loading piston are placed in the mold and initial reading piston are placed in the mold and an initial reading with the dial gauge is taken on the loading piston using the 2 in gauge stock. This reading and subsequent readings are recorded on a convenient work sheet or data card for later calculations.

c.5.b. The molding piston replaces the loading piston and the adjustable gauge screw (H) is turned down until the point just touches the edge of the mold. The molding piston and the filter papers are then removed, and the filter papers saturated.

c.5.c. One of the portions of moist soil is checked by weight and, if any moisture has been lost, water is added and carefully mixed in to correct the moisture content. The required amount of moist soil to provide the desired density as computed in step **d** is weighed out. A saturated filter disc is placed in the bottom of the mold. The moist soil is carefully placed in the mold and leveled off, followed by a saturated filter disc.

c.5.d. The molding piston is placed in the mold and the moist soil is compacted by use of the Carver Laboratory Press to a height of approximately 2 in $\pm$ .05 in. The correct height of specimen can be controlled by use of the 2 in gauge stock placed on the edge of the mold under the gauge screw, which was previously set at zero for the particular mold in use. When the correct height is reached the load is held constant for 30 seconds and then released. The load required to compact the specimens is recorded.

c.5.e. Remove the molding piston and replace it with the surcharge piston. Take a reading with the dial gauge. This reading should be the same as the reading taken under **c.5.a**. if the height of the specimen is exactly 2 in. These readings may, however, differ by several thousandths due to instantaneous rebound when the load is removed.

c.5.f. Set the mold containing the compacted specimen in a galvanized iron pan about 4 in high and of dimensions to accommodate all or a convenient part of the units in use. These pans shall be placed so that they will not be subject to vibration, jarring, bumping or other outside influences, which might affect the results of the test.

c.5.g. Repeat the following foregoing procedure with all samples, which are to be, included in a given run of volume change tests.

c.6. The volume change measurements shall be made in accordance with the following procedure:

c.6.a. Permit the samples prepared on one day to stand until the following morning before adding water, thus allowing for full rebound. Take and record a reading with the dial gauge. This reading is used in determining the initial height of sample on which volume change is based.

c.6.b. Fill the pan with water to a height approximately equivalent to the height of the top of the sample inside the mold.

c.6.c. Take and record readings at the end of the first day, and once a day thereafter for a total period of not less than 96 hours, making sure that a reading is taken at 96 hours.

c.7. After readings have been completed, remove the molds from the water, remove loading pistons, bases and blotters. Push the compacted specimens from the molds into numbered dishes of known tare weights. Weigh and record the wet weights of soil plus dish.

c.8. Dry the soil specimen to constant weight at a temperature of 230^{o}F, then weigh and record the dry weight of soil plus dish. Subtract the tare weight of the dish and compute the final moisture content based on the final dry weight.

c.9. Using the weight of moist soil as calculated in step c.3. and the final dry weight of soil from step c.8., compute the actual initial moisture content.

c.10. Divide the increase in height at 96 hours (c.6.c.) by the initial height of specimen (c.6.a.) to determine the percent of volume increase due to absorption of water.

c.11. Plot the percents of volume change at the end of 96 hours as ordinates and each of the two moisture contents at which the test was conducted as abscissa on a convenient report form similar to the sample attached.

c.12. Connect the two points thus plotted by a straight line, thereby providing a volume change index for the soil in question.

c.13. The percent volume change of the soil is the volume change corresponding to the optimum moisture content of the soil.

VOLUME CHANGE MOLD

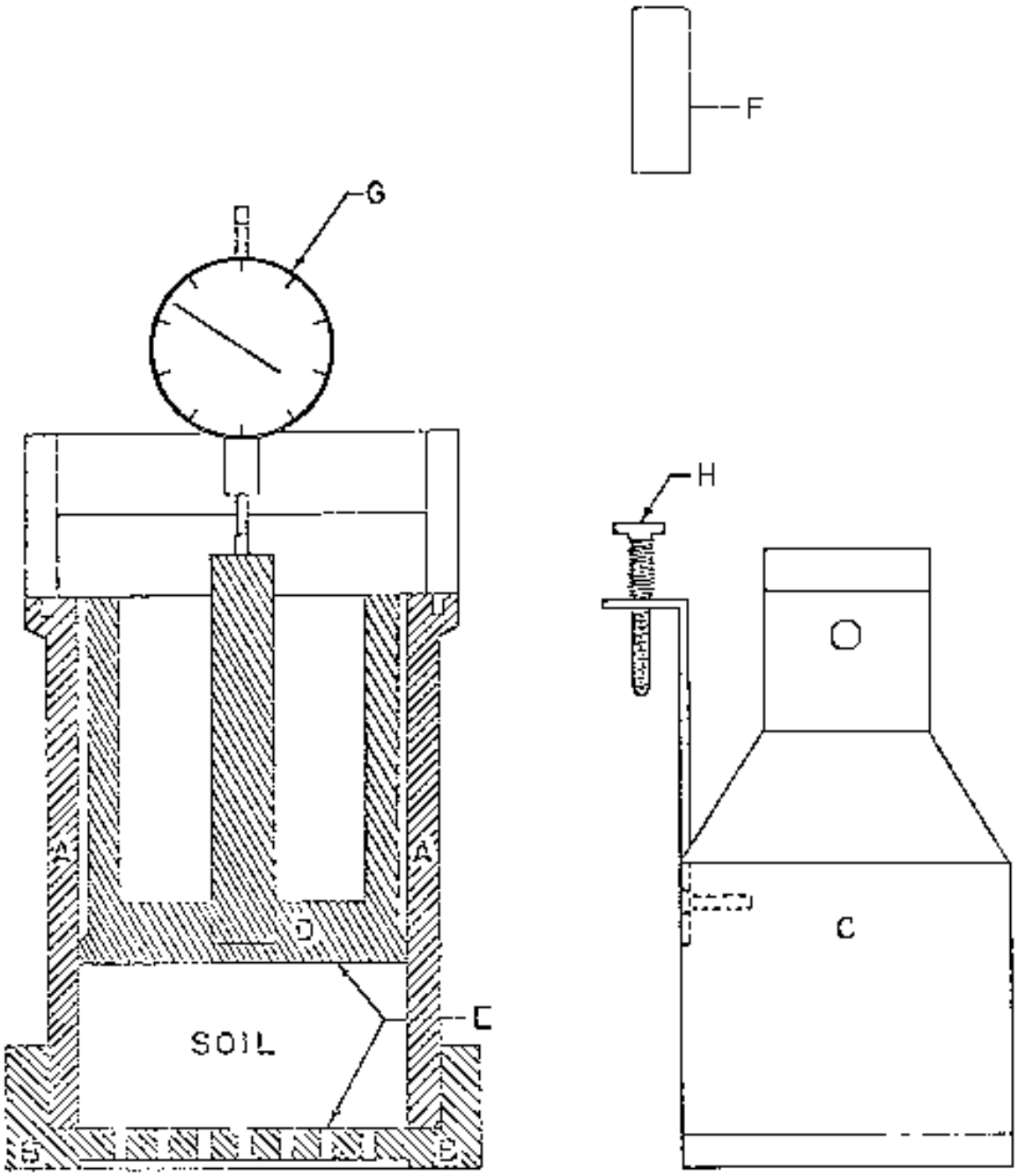

FIGURE 1

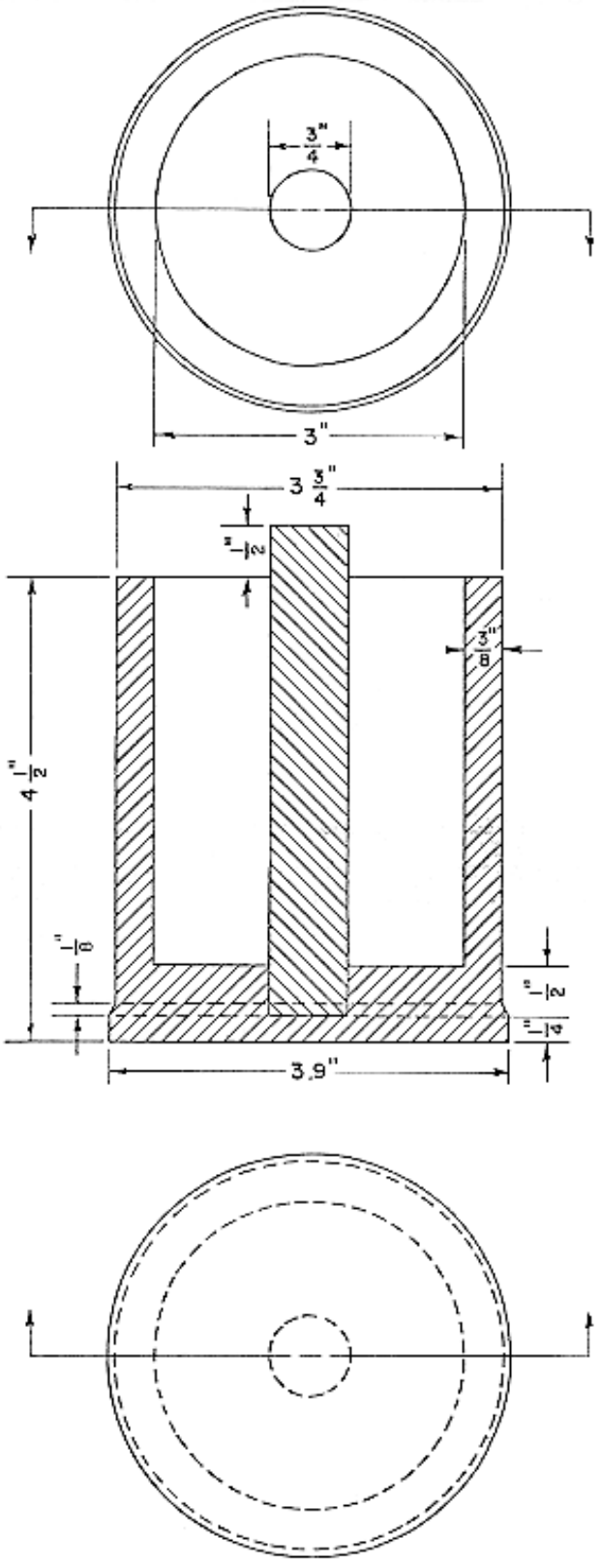

FIGURE 2

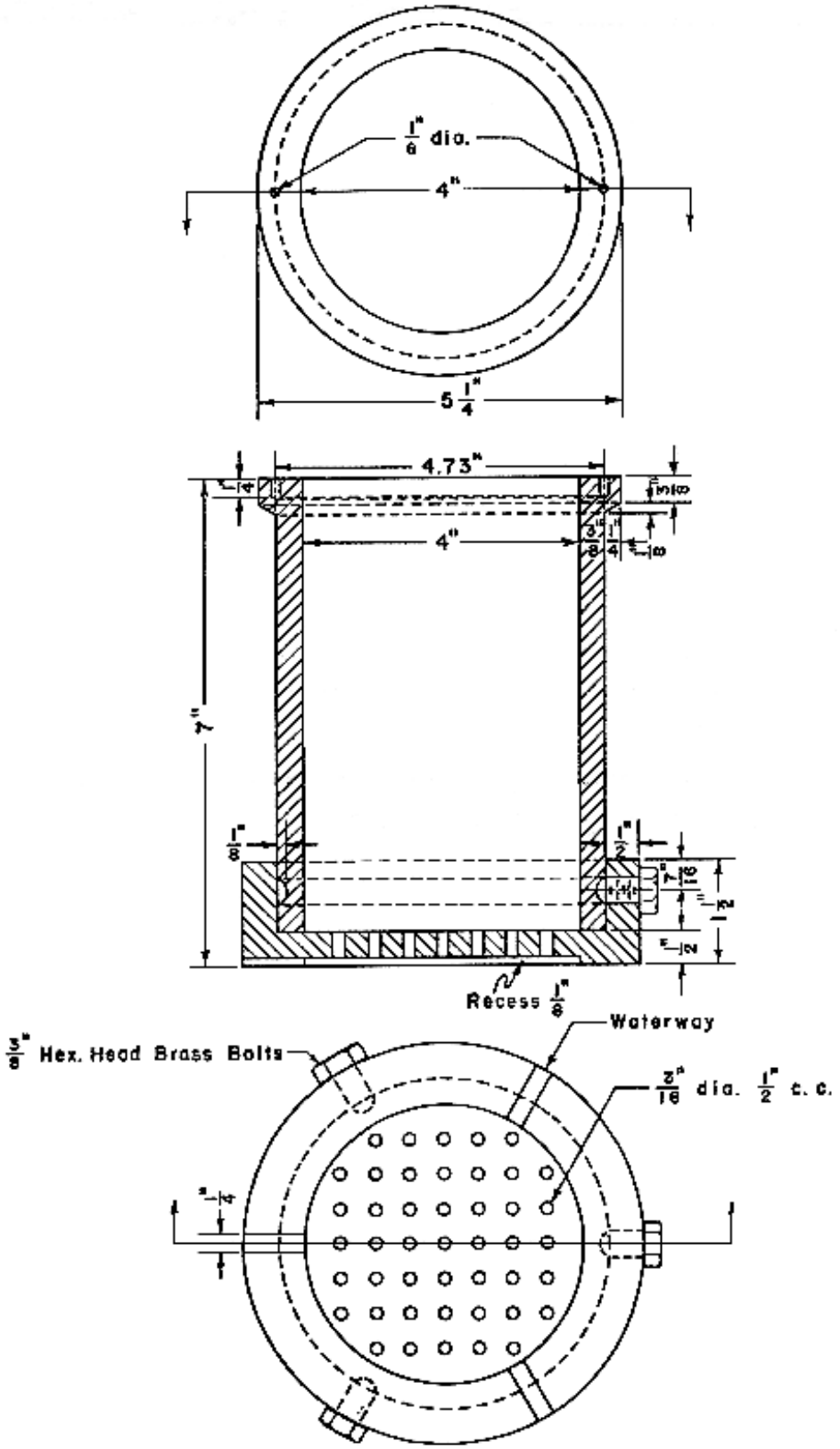
1" dia.
4"
5 1/4"
4.73"
4"
7"
Recess 1"
Waterway
3/8" Hex. Head Brass Bolts
2" dia. 1" c. c.

FIGURE 3