

METHOD OF DETERMINING EFFECTIVE (AS RECEIVED) AND  
DRY UNIT WEIGHTS AND TOTAL POROSITY OF ROCK CORES

1. Scope and Definition

1.1 This method covers the procedure for determining the effective unit weight, dry unit weight, and porosity of rock cores as defined in RTH 101. (This method covers determination of "total" porosity of a rock sample. Porosity calculated from the bulk volume and grain volume using the pulverization method is termed "total" since the pore volume obtained includes that of all closed pores. Other techniques give "effective" porosity since they measure the volume of interconnected pores only.)

2. Apparatus

2.1 The apparatus shall consist of the following:

(a) Balance having a capacity of 5 kg or more and sensitive and accurate to 0.5 g or 0.05 percent of the sample mass. Balances with capacities less than 5-kg shall be sensitive and accurate to 0.1 g.

(b) Wire basket of 4.75-mm (No. 4) mesh, diameter at least 50.8 mm (2 in.) greater than that of the core to be tested, walls at least one-half the height of the cylinder, and bail clearing the top the core by at least 25.4 mm (1 in.) at all points.

(c) Watertight container in which the wire basket may be suspended with a constant-level overflow spout at such a height that the wire basket, when suspended below the spout, will be at least 25.4 mm (1 in.) from the bottom of the container.

(d) Suspending apparatus suitable for suspending the wire basket in the container from the center of the balance platform or pan so that the basket will hang completely below the overflow spout and not be less than 25.4 mm (1 in.) from the bottom of the container.

(e) Thermometer, range 0 to 50 °C, graduated to 0.1 °C.

(f) Caliper or suitable measuring device capable of measuring lengths and diameters of test cores to the nearest 0.1 mm.

(g) Oven of the forced draft type, automatically controlled to maintain a uniform temperature  $110 \pm 5$  °C throughout.

3. Sample

3.1 Select representative samples from the population and identify each sample. Individual sample mass should not exceed 5 kg.

4. Effective Unit Weight (As Received)

4.1 The test procedure for determining the effective unit weight of rock cores shall consist of the following steps:

(a) Determine the mass of the core (as received) to the nearest gram (0.1 g for 76.2-mm (3-in.) and smaller cores) ( $W_a$ ) and the temperature in the working area near the core surface.

(b) Determine the bulk volume of the core in cubic centimetres by one of the following two methods:

(1) Determine the average length and diameter of the core from measurements of each of these dimensions at evenly spaced intervals covering the surface of the specimen. These measurements should be made to the nearest 0.1 mm. Calculate the volume using the formula  $V = \frac{\pi}{4} d^2 L$ , where  $V$  = volume,  $d$  = diameter of the core, and  $L$  = length of the core. (Note 1)

NOTE 1--If this method is used, the specimen should be sawed and machined to conform closely to the shape of a right cylinder or prism prior to determining its mass as in 4.1(a) above.

(2) Coat the surface of the core with wax or other suitable coating until it is watertight, making sure that the coating material does not measurably penetrate the pores of the core. Determine the mass of the specimen, after coating, to the nearest gram (or 0.1 g). The density of the coating material shall be determined. The volume of the coating on the core shall be determined by dividing the mass of coating by the density of the coating. Determine the volume of the coated core in cubic centimetres by liquid displacement. Subtract the volume of the coating material from the volume of the coated core to obtain the volume of the core ( $V$ ) in cubic centimetres.

(c) Calculate the effective unit weight of the core from the following formula:

$$\gamma_e = \frac{W_a}{V}$$

where

$\gamma_e$  = effective unit weight of the core, as received

$W_a$  = mass of the core, in grams, as received

$V$  = volume of the core, in cubic centimetres

#### 5. Dry Unit Weight

5.1 The test procedure for determining the dry unit weight of rock cores shall consist of the following steps:

(a) If a coating was utilized to waterproof the specimen as in 4.1(b)(2), remove it and, if applicable, brush to remove dust or elements of the coating. Then determine the mass of the core. (Note 2)

NOTE 2--If there is no mass loss in stripping or loss or gain in moisture, this mass should equal  $W_a$ .

(b) Crush the sample until it all passes a No. 4 sieve, taking care not to lose any material.

(c) Oven-dry the crushed material to constant mass  $W_b$  (constant mass is achieved when the mass loss is less than 0.1 percent of the sample mass during any 4-hour drying period), cool to room temperature, then record the mass and room temperature in the area of the test on the data sheet.

(d) Calculate the dry unit weight of the core from the following formula:

$$\gamma_d = \frac{W_b}{V}$$

where

$\gamma_d$  = dry unit weight of the core

$W_b$  = mass of the crushed, dried core, in grams

V = volume of the core, in cubic centimetres

6. Porosity

6.1 The total porosity,  $n$ , may be determined from the dry unit weight and the gram unit weight of a sample. Determine the density of the solids,  $P_s$ , according to RTH 108.

Determine the total porosity by the expression:

$$n = \frac{(1 - W_b)}{P_s V} 100$$

where

$n$  = total porosity, %

$W_b$  = mass of crushed, dried core, g

$V$  = volume of the core, cc

$P_s$  = density of the solids, g/cc

( as determined by RTH - 108)