

**KANSAS DEPARTMENT OF TRANSPORTATION  
SPECIAL PROVISION TO THE  
STANDARD SPECIFICATIONS, 2015 EDITION**

**CONSTRUCTION MANUAL - PART V CHANGES/CORRECTIONS**

**Appendix A, sheets 13, 14 and 15:**

Delete the row:

**HMA (Plant Mix)** (continued)  
Sec. 603, 611, 614, & 1103

Replace with:

**HMA (Plant Mix)** (continued)  
Sec. 603, 611 & 1103

**Delete 5.9.73 DENSITY, ABSORPTION AND VOLUME OF PERMEABLE VOIDS IN HARDENED CONCRETE (Kansas Test Method KT-73) and replace with the following:**

5.9.73 DENSITY, ABSORPTION AND VOLUME OF PERMEABLE VOIDS IN HARDENED CONCRETE (Kansas Test Method KT-73)

**1. SCOPE**

This method covers the determinations of density, percent absorption and percent volume of permeable voids in hardened concrete. **KT-73** reflects testing procedures found in **ASTM C 642**.

**2. REFERENCED DOCUMENTS**

**2.1.** Part V, 5.9; Sampling and Test Methods Foreword

**2.2.** KT-22; Making and Curing Compression and Flexural Test Specimens in the Field

**2.3.** KT-49; Method for Obtaining and Testing Drilled Cores

**2.4.** ASTM C 642; Standard Test Method for Density, Absorption, and Voids in Hardened Concrete

**3. APPARATUS**

**3.1.** The balance shall conform to the requirements of **Part V, 5.9.3; Sampling and Test Methods Foreword**, Class G5. The balance shall be equipped with suitable apparatus for suspending the sample container in water from the center of weighing platform or pan of the balance into a bucket with an overflow device to maintain a constant water level.

**3.2.** Forced draft oven capable of maintaining a temperature of  $230 \pm 9$  °F ( $110 \pm 5$  °C).

**3.3.** Container suitable for boiling the immersed specimens with a rack suitable for supporting the specimens a minimum of 1/4" above the bottom of the container. The container must be large enough to keep the specimens covered with boiling water for a period of 5 hours.

**3.4.** Hot plate, stove or other heat source capable of maintaining the water at boiling for 5 hours.

#### **4. TEST SPECIMENS**

**4.1.** Prepare 3 specimens per sample, each to be tested separately. Each specimen shall consist of a 2" thick by 4" diameter piece taken from the top portion of a cast concrete cylinder or core. Remove not more than 3/8" from the top of the cylinder or core and obtain the specimen from the next 2". Each specimen shall be free from observable cracks, fissures, or shattered edges. Cylinders molded and cured in accordance with **KT -22** of this manual shall be used for mix design approval and most verification samples. Cores obtained in accordance with **KT-49** of this manual may be used for verifications on PCCP.

#### **5. PROCEDURE**

**5.1.** Determine the mass of each specimen. Place each specimen on its edge in a forced draft oven directly on the oven rack and dry the specimens at a temperature of  $230 \pm 9$  °F ( $110 \pm 5$  °C) for not less than 24 hours. Do not place the specimens inside a pan or any other container. Do not place the specimens on the flat surface of the cylinder. Allow enough room between specimens for complete airflow around each specimen. After removing each specimen from the oven, allow it to cool in dry air (preferably in a desiccator) to a temperature of  $72 \pm 5$  °F ( $22 \pm 3$  °C) and determine the mass. If the specimen was comparatively dry when its mass was first determined, and the second mass agrees with the first within 0.5%, consider it dry. If the specimen was wet when its mass was first determined, place it in the oven for a second drying treatment of 24 hours and again determine the mass. In case of any doubt, redry the specimen for 24 hour periods until check values of mass are obtained. If the difference between values obtained from two successive values of mass exceeds 0.5% of the lesser value, return the specimens to the oven for an additional 24 hour drying period. Repeat this procedure until the difference between any two successive values is less than 0.5 % of the lowest value obtained. Designate this final mass value **A**.

**5.2.** Immerse the specimen on its edge in water at  $72 \pm 5$ °F ( $22 \pm 3$ °C). Do not place the specimen on the flat surface of the cylinder. Continue soaking the specimen in water for not less than 48 hours and until two successive values of mass of the surface-dried sample at intervals of 24 hours show an increase in mass of less than 0.5% of the larger value. Surface-dry the specimen by removing surface moisture with a towel, and determine the mass. Designate the final surface-dry mass after immersion **B**.

**5.3.** Begin boiling tap water in a suitable container. Verify that the water is rapidly boiling prior to placing the specimens in the water for testing. Place the specimen on its edge on a rack in the boiling water a minimum of 1/4" from the bottom of the container. The water must return to boiling in less than 1 hour. Boil the specimens completely submersed for a minimum of 5 hours. Do not add additional water during boiling. Allow the specimens and water to cool by natural loss of heat for not less than 14 hours to a final temperature of  $72 \pm 5$  °F ( $22 \pm 3$  °C). Continue to store the specimens on their edges in the boiled water until the final two steps are completed.

**5.4.** Suspend the specimen in the bucket at a constant water level by the suitable apparatus and determine the apparent mass of the specimen in water at  $77 \pm 2$  °F ( $25 \pm 1$  °C). Designate this apparent mass **D**.

**5.5.** Remove the specimen from the water. Quickly damp-dry the specimen with a damp absorbent cloth and determine the mass of the specimen. Designate the boiled surface-dried mass **C**.

## 6. CALCULATION

6.1. Using the values for mass determined in accordance with the procedures described in **Section 5** of this test method make the following calculations:

$$\text{Absorption after immersion, \%} = [(B-A)/A] \times 100$$

$$\text{Absorption after immersion and boiling, \%} = [(C-A)/A] \times 100$$

$$\text{Bulk density, dry} = [A/(C-D)] = g_1$$

$$\text{Bulk density after immersion} = [B/(C-D)]$$

$$\text{Bulk density after immersion and boiling} = [C/(C-D)]$$

$$\text{Apparent density} = [A/(A-D)] = g_2$$

$$\text{Volume of permeable voids (pore space), \%} = [(C-A)/(C-D)] \times 100$$

Where:

- A = Mass of oven dried specimen in air
- B = Mass of surface-dry specimen in air after immersion
- C = Mass of surface-dry specimen in air after immersion and boiling
- D = Apparent mass of specimen in water after immersion and boiling
- $g_1$  = Bulk density, dry
- $g_2$  = Apparent density

## 7. REPORT

7.1. Record absorption to the nearest 0.01 %.

7.2. Record densities to the nearest 0.1 lb/ ft<sup>3</sup> (1 kg/m<sup>3</sup>).

7.3. Record the volume of permeable voids (pore space) to the nearest 0.01 % and report to the nearest 0.1%.

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