WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

STANDARD METHOD OF MICROSCOPIC DETERMINATION OF AIR-VOID CONTENT

1.0 PURPOSE

1.1 To obtain quantitative information concerning air voids, matrix, fine aggregate, and coarse aggregate in hardened concrete.

2.0 SCOPE

2.1 By using the linear traverse method of point counts, we can determine the relative composition of hardened concrete cylinders or cores on a percentage basis.

3.0 EQUIPMENT

3.1 A large stone saw.

3.2 A lapidary grinding apparatus.

3.3 A linear traveler apparatus.

3.4 A reflecting illumination system.

3.5 A biocular microscope with a cross hair type reticle. (Magnification preferably in the 10x, 30x, and 60x range).

3.6 Miscellaneous: Silicon carbide grinding material, numbers 120, 240, 400 and 600, a set of 4 mechanical specimen counters, a 305 mm ruler and a magic marker.

4.0 PROCEDURE FOR PREPARATION OF CONCRETE SPECIMENS

4.1 The concrete specimens should be cut on the large stone saw so as to bisect the cylinder along its longitudinal dimension. Care should be taken in avoiding, if possible the steel reinforcing bars encountered in bridge deck cores.

4.2 Select the better half of the specimen and make a cut perpendicular to its long axis, 102 mm below the top surface of bridge deck core specimens. If the specimen is a concrete cylinder a 102 mm section from the middle of the cylinder is cut and used for point counting. These operations are done so that the linear traveler specimen holder can accommodate the specimen.

4.3 All portions of the specimen are retained for possible later inspection.

4.4 That portion of the specimen prepared in Section 4.2 is now polished, first using silicon carbide grit number 120, in order to obtain a uniform surface, and subsequent polishing by silicon carbide grit numbers 240, 400 and 600 to obtain a smooth, highly polished surface.

5.0 OPERATIONAL PROCEDURES USING THE LINEAR TRAVELER

5.1 The polished specimen is placed on the specimen holder of the linear traveler.

5.2 After the specimen is centered on the specimen holder, the specimen should be leveled, so as to minimize refocusing.

5.3 A right vertical margin and a left vertical margin should be drawn on the polished surface of the specimen. The placement of each margin is dependent upon the horizontal limits of the linear traveler and the irregularity of the boundaries of the specimen. If an irregularity exists, the corresponding margin is placed along the inner edge of the irregularity.

5.4 A light source should be directed onto the specimen surface for illumination of the visual field.

5.5 The biocular microscope assembly should be positioned so that the technician can observe the entire distance between margins as the linear traveler moves horizontally.

5.6 Horizontal movement of the linear traveler is accomplished by pushing the horizontal motion control switch. The direction of horizontal motion is controlled by the directional selector lever located to the left of the specimen holder and in front of the motor housing.

5.7 Vertical movement of the linear traveler is accomplished by manually cranking the lower left hand wheel located directly beneath the specimen holder.

5.8 By using the controls of the linear traveler, position the specimen while viewing through the microscope at 10x, 30x or 60x magnification, so that the vertical cross hair is on line with one of the vertical margins and the horizontal cross hair is approximately 3.2 mm below the specimen, or 3.2 mm below the deepest penetration of an irregular edge.

5.9 Readjust the light source so as to obtain an adequate field illumination.

5.10 Adjust the directional selector lever so that the technician views that portion of the specimen between the margins as the linear traveler moves horizontally.

5.11 Focus the microscope on the specimen surface (periodic refocusing may be necessary).

5.12 Push the horizontal motion control switch so that the linear traveler moves one unit and stops.

5.13 At the intersection of the cross hairs, decide whether the material is an air void, matrix, fine aggregate (-4.75 mm) or coarse aggregate (+4.75 mm) and record the decision on a mechanical specimen counter properly designated.

5.14 Repeat procedures set forth in Sections 5.12 and 5.13 for the entire width of the specimen between the margins.

5.15 When the vertical cross hair reaches a margin after traversing the specimen, reverse the horizontal direction using the directional selector lever and crank the vertical control wheel two complete revolutions clockwise.

5.16 Repeat procedures set forth in Sections 5.14 and 5.15 until the total number of point counts indicated on the mechanical specimen counter equals 600.

6.0 COMPOSITION PERCENTAGES

6.1 Each category such as air void content, matrix, fine aggregate (-4.75 mm), and coarse aggregate (+4.75 mm), is expressed as a percentage of total number of point counts.

Gary L. Robson, Director
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