Florida Method of Test for
AGGREGATE DISTRIBUTION OF HARDENED
SELF-CONSOLIDATING CONCRETE (SCC) USING A
MOCKUP PRODUCT

Designation: FM 5-617

1. SCOPE

1.1. This method covers procedures for determining the aggregate distribution of SCC mixes.

1.2. The SCC used to make the specimens from the mockup shall be sampled after all on-site adjustments have been made to the mixture proportions, including the addition of mix water and admixtures.

1.3. The text of this method references notes and footnotes that provide explanatory information. Notes and footnotes (excluding those in tables and figures) shall not be considered as requirements for this method.

1.4. The values stated in SI units are to be regarded as the method.

1.5. This method does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS

2.1. PCI/FHWA (Precast/Prestressed Concrete Institute/Federal Highway Administration) International Symposium on High Performance Concrete, Orlando, Florida, October 2003.

2.2. AASHTO Standards:
   M 205  Molds for Forming Concrete Test Cylinders Vertically
   R 60   Sampling Freshly Mixed Concrete
   T 22   Compressive Strength of Cylindrical Concrete Specimens
   T 24   Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

2.3. ASTM Standards:
   C 470  Molds for Forming Concrete Test Cylinders Vertically
   C 172  Sampling Freshly Mixed Concrete
   C 39   Compressive Strength of Cylindrical Concrete Specimens
   C 42   Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

2.4. Florida Sampling and Testing Methods:
   T 5-615 Static Segregation of Hardened Self-Consolidating Concrete (SCC) Cylinders.
2.5. Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

3. SIGNIFICANCE AND USE

3.1. This method provides a quantitative assessment of the aggregate distribution of SCC using sawn mockup or core specimens taken from a mockup product.

3.2. If the mockup product is made and cured as specified herein, the aggregate distribution test data may be used for the following purposes:

3.2.1. Acceptance testing for specified static segregation limit;

3.2.2. Checking the adequacy of mixture proportions to resist static segregation and;

3.2.3. Quality control.

4. APPARATUS

4.1. Mockup - Experimental structure to determine the aggregate distribution of concrete.

4.1.1 The base of the mockup may be circular, square or rectangular with a minimum cross section area of 50 square inches and none of the cross section dimensions should be less than 6 inches. The height shall be greater than or equal to 30 inches.

4.1.2 Any other available mold can be used if meets the dimensional requirements, ex. Florida I-beam, pole base molds, etc. The structure must be suitably braced to avoid any overturning or displacement during the pouring operation.

4.2. Tools – Shovel, rake or a hoe.

4.3. Miscellaneous Small Tools - Handheld wood or metal float or trowel, hammer, chisel, metal tape measure, ruler.

4.4. Saw - The saw shall have a diamond or silicon-carbide cutting edge and shall be capable of cutting specimens without excessive heating or shock.

4.5. Core Drill - for obtaining cylindrical core specimens with diamond impregnated bits attached to a core barrel.

4.6. A suitable container for collecting the specimens extracted from the mockup (sawn or cored).

5. SAMPLING HARDENED CONCRETE

5.1. Cored test specimens taken from hardened concrete shall be obtained in accordance with ASTM C 42, except for the following:
5.1.1. Cored test specimens may be taken so that the axis is perpendicular to the concrete mockup major axis as it was originally placed.

5.1.2. Cored test specimens shall have a minimum diameter of 50 mm (2 in.) and 6 inches length to assess extent of aggregate distribution.

5.2. Record the identification of the test specimens with respect to the location of the concrete represented.

6. MOLDING AND CURING MOCKUP PRODUCT OF SCC

6.1. Making Specimens:

6.1.1. The mockup shall be filled in one lift, without vibration, rodding, or tapping. Use a rake or hoe to accommodate the SCC.

6.1.2. Strike off the surface of the SCC level with the top of the mockup using a float or trowel.

6.2. Curing:

6.2.1. Immediately after casting or placing and finishing the mockup, it shall be cured in accordance with Florida DOT Standard Specifications, Section 400.

7. PROCEDURE

7.1. Before subjecting the mockup to sawing or coring, it either shall have a minimum curing period of 24 h or shall attain a minimum compressive strength of 900 PSI (6200 kPa), tested in accordance with ASTM C 39.

7.2. If a specimen cannot be satisfactorily cored or sawn smooth due to lack of curing, then the remaining specimen(s) shall remain undisturbed for an additional minimum curing period of 24 h before being subjected to sawing.

7.3. Mark the mockup column into three equal parts with respect to its height.

7.4. Select four locations along the lateral surface of the mockup and designate them as U₁, U₂, B₁, and B₂. Locate U₁ and U₂ on the upper third, and B₁ and B₂ at the bottom third of the elevation view of the mockup, as indicated in Figure 1.

7.5. The aggregate distribution test may be performed by measuring the aggregate content of the concrete directly at each of the selected areas if the mockup is cut with a saw from top to bottom and the cut completely crosses one of the dimensions of the cross section, as indicated in Figure 1. In this case, for each test location, select an area of about 8 inches x 8 inches to perform the measurements.
7.6. Another option is to obtain core samples from four locations of these selected areas of the mockup product. The core samples may be taken from saw-cut section or uncut areas, as indicated in Figure 2.

7.7. If the mockup is cored, then cores shall be sawn lengthwise down the center. Coarse aggregate measurement shall be taken along the length of the core sample, as indicated in Figure 3.
7.8. Draw two straight horizontal lines along the surface of the selected area (red dotted lines in figure 4).

7.8.1. Lines will be placed approximately 2.5 inches, equidistant each other in the sawn specimens with area of about 8 inches x 8 inches.

7.8.2. When cores are used, the lines will be drawn to a third of the diameter.

7.9. Make a lengthwise assessment of the cut planes of the core or sawn specimen. The cut planes shall be wetted to facilitate measurements.

7.10. For location U₁ (see figure 2), after drawing the straight horizontal line along the surface of the selected saw cut area, the line should be designated as U₁-a.

7.11. By placing the ruler on line U₁-a, measure the size of each piece of aggregate, along the line, greater than or equal to 0.1 inch.

7.12. Determine the total length of the aggregates along the straight line U₁-a by summing
the measured sizes of all pieces.

7.13. Determine the coarse aggregate ratio (C.A.) content of \( U_{1-a} \) (percent), along the straight line by calculating the ratio of the total length of aggregates along the line to the length of the drawn line.

\[
C.A. = \left( \frac{\text{Total Length of aggregates}}{\text{Length of the drawn line}} \right) \times 100
\]

7.14. The second parallel line shall be identified as \( U_{1-b} \), and proceed as described in items (7.11.) through (7.13.).

7.15. Report the C.A. ratio of the location, \( U_1 \), by averaging the results of the C.A. content of \( U_{1-a} \), and \( U_{1-b} \).

7.16. Follow the same procedure as described in Item numbers (7.11.) through (7.15.) for locations \( U_2 \), \( B_1 \), and \( B_2 \).

7.17. Calculate the average C.A. content of the upper part of the mockup (C.A. Average Upper) by considering specimens \( U_1 \), and \( U_2 \).

7.18. Calculate the average C.A. content of the bottom part of the mockup (C.A. Average Bottom) by considering specimens \( B_1 \), and \( B_2 \).

7.19. Report the C.A. contents in percent, each as a whole number.

Table 1—Coarse Aggregate Index (C.A.I)

C.A.I. = \( \text{ABS} (\text{C.A. Average Bottom} - \text{C.A. Average Upper}) \)

If the absolute value of C.A.I. exceeds 15 percent a segregation problem exists.

8. REPORT

8.1. Report the following information:

8.1.1. Mix design number; production facility code and DOT District number.

8.1.2. Date and time of molding the mockup, and when the C.A.I. was performed.

8.1.3. C.A. for each specimen with the location of concrete represented; and

8.1.4. C.A.I.

9. ANNEX
The results can be tabulated as follows:

<table>
<thead>
<tr>
<th>Position</th>
<th>Sizes of coarse aggregate ≥ 0.1 in. along the drawn line (mm)</th>
<th>Total length of coarse aggregates (mm)</th>
<th>Coarse Aggregate Ratio (%)</th>
<th>C.A. Average (%)</th>
<th>Coarse Aggregate Index (%)</th>
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</thead>
<tbody>
<tr>
<td>Upper</td>
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<td></td>
<td>U</td>
<td>ABS (B – U)</td>
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