

## LENGTH CHANGE OF HARDENED CONCRETE DUE TO ALKALI-CARBONATE REACTIVITY

### 1. SCOPE:

- 1.1 This method covers the test to determine the reactivity of aggregate in concrete specimens stored in a highly alkaline environment for a period of 180 days.

### 2. APPARATUS:

- 2.1 Length change comparator accurately reading to the 0.0001 inch is required.
- 2.2 Reference bar.
- 2.3 Water storage tank conforming to ASTM C 511.
- 2.4 Mechanical Concrete Mixer conforming to ASTM C 192.
- 2.5 Slump Apparatus conforming to Kentucky Method 64-302.
- 2.6 Air Content Apparatus conforming to Kentucky Method 64-303.
- 2.7 Stainless steel concrete beam molds conforming to ASTM C 666.
- 2.8 Gauge studs.
- 2.9 Tamping rod with 5/8" diameter and one with 3/8" diameter.
- 2.10 Mallet with rubber head.
- 2.11 4" x 8" Cylinder molds.
- 2.12 Steel bar.
- 2.13 Sieves. #8 or #16 and #200.

### 3. TEST SPECIMENS

- 3.1 Prepare and cure test specimens in accordance with ASTM C 192 with the following exceptions and or modifications.
  - 3.1.1 Subsection 4.1. Specimens shall be 3"x 4"x 16" where the gauge length is 14.75". The gauge length is the innermost length between the gauge studs within a concrete beam.

- 3.1.2 Subsection 5.4. Two concrete beam test specimens shall be made and tested. One concrete 4x8 cylinder shall be made and tested for compressive strength at 28 days.
- 3.1.3 Subsection 6.3. Use coarse aggregate as received, it is not necessary to grade out.
- 3.1.4 Subsection 6.3.1. Fine aggregate shall be natural sand meeting requirements of 804.03 and kept in moist condition. A moisture test shall be run prior to mixing so the weight of the water is factored into the mixing weights. Refer to Table 1 for batch weights.
- 3.1.5 Subsection 6.3.2.2. Batch weight of oven dried coarse aggregate shall be immersed in water approximately 24 hours prior to mix. Excess water is decanted over a #200 sieve to preserve fines. Then all + #200 material is placed in the mixer. Remember to use a larger sieve to protect the #200. Refer to Table 1 for batch weights.
- 3.1.6 Subsection 6.5. Master Builder's MicroAir air entraining admixture shall be used in a quantity sufficient to achieve an acceptable air content.
- 3.1.7 Subsection 7.2. Slump conforming to Kentucky Method 64-302. Air Content conforming to Kentucky Method 64-303. Refer to Table 1 for limits. Yield and Temperature are not required.
- 3.1.8 Subsection 7.4. Method of consolidation shall be rodding.
- 3.1.9 Subsection 7.5. Label the concrete beam specimens by scratching the sample ID into the finished surface. This should be done before the concrete is fully set and avoid disturbing the underlying aggregate.
- 3.1.10 Subsection 8.1. Concrete beams shall be covered with a layer of wet cloth and then with a layer of plastic to prevent rapid evaporation for the first 22 ±2 hours.

#### 4. PROCEDURE

- 4.1 Specimen lengths shall be measured immediately after removal from molds to the nearest 0.0001 inch. This measurement is recorded as the 24 hour length reading.
- 4.2 When obtaining length comparator readings always measure beam in same orientation.
- 4.3 Immediately following the recording of the 24 hour length measurement, place specimens in storage tanks filled with water saturated in calcium hydroxide (hydrated lime) in accordance with ASTM C 511. This needs to be done as quickly as possible to prevent loss of moisture.
- 4.4 Place specimens in the tank in a manner that would not restrict expansion. Do not place any weight on the pins on either end of the beams.

4.5 Specimens shall have a second length measurement taken at 90 days and the third and final length measurement at 180 days.

4.6 Both test specimens must complete the 180 day test for a valid result.

## 5. CALCULATION

5.1 The formula used for this method is as follows:

$$L_C = ((l_2 - l_1) / L_g) \times 100$$

Where:

$L_C$  = length change of the test specimen.

$l_1$  = length comparator reading at 24 hours.

$l_2$  = length comparator reading at 6 months.

$L_g$  = the effective gauge length between the innermost ends of the gauge studs.

5.2 Calculate expansions to the nearest 0.001% and report the average expansion of the sample to the nearest 0.01%

5.3 The effective gauge length shall be 14.75 inches for this method.

## 6. REPORT

6.1 Reports shall contain the following information:

6.1.1 Sample identification

6.1.1.1 Sample ID #

6.1.1.2 Source/Quarry Name

6.1.1.3 Source/Quarry state ID # if applicable

6.1.1.4 Bench and/or Ledge designation

6.1.1.5 Size aggregate used

6.1.2 Dates

6.1.2.1 Aggregate sample date

6.1.2.2 Date sample was mixed into concrete

6.1.2.3 Test completion date

6.1.3 Slump test results for Kentucky Method 64-302

6.1.4 Air content of freshly mixed concrete test results for Kentucky Method 64-303.

6.1.5 24 hour, 90 day, and 180 day length comparator measurements.

6.1.6 90 day and 180 day expansions for each specimen.

6.1.7 Average 180 day expansions for both specimens reported to the nearest 0.01%.

6.1.8 Pass/Fail determination.

APPROVED

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DIRECTOR  
DIVISION OF MATERIALS

DATE

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08/04/14

Attachment

Kentucky Method 64-629-14

Revised 08/04/14

Supersedes KM 64-629-08

Dated 03/13/08

KM62908.doc

TABLE 1

## LIMESTONE SPECIMENS (2 BEAMS)

|                           | Size #57's, 67's & 68's  | Size # 8's, 9m's & 78's  |
|---------------------------|--|--|
| Type 1<br>Cement          | 16.6 lbs.  | 16.6 lbs.  |
| Concrete<br>Sand          | 35.2 x (1.00 + % Moisture of<br>sand in decimal)<br>ex. 3.4% moisture<br>$35.2 \times 1.034 = 36.4$ lbs. | 39.2 x (1.00 + % Moisture of<br>Sand in decimal)<br>ex. 3.4% moisture<br>$39.2 \times 1.034 = 40.5$ lbs. |
| Coarse<br>Aggregate       | 54.6 lbs.  | 50.7 lbs.  |
| % Air<br>KM64-303         | 4-8 %  | 5-9%   |
| Air<br>Entrainment        | 5.0 ml<br>(Adjust As Needed)   | 5.0 ml<br>(Adjust As Needed)   |
| Slump<br>KM64-302         | 2-4 Inches   | 2-4 Inches   |
| Estimated<br>Water (lbs.) | 3.5-4.5 lbs.<br>(Adjust As Needed)   | 3.5-4.5 lbs.<br>(Adjust As Needed)   |