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DIVISION OF ENGINEERING SERVICES
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METHOD OF TEST FOR RELATIVE COMPACTION OF POLYMER CONCRETE UTILIZING NUCLEAR GAGES

A. SCOPE

This test method describes a simple procedure to determine the relative compaction of a polymer concrete overlay. It describes a procedure to obtain "standard density" and "in-place density" of compacted polymer concrete.

B. REFERENCES

California Test 231 - Relative Compaction of Untreated and Treated Soils and Aggregates Using Nuclear Gage

C. APPARATUS AND MATERIALS

1. A nuclear gage and standardizing blocks are required in accordance with California Test 231.

2. A rigid test frame shall provide a square test area, approximately 18 in. × 18 in. It shall be constructed from angle iron or similar metal. The height of the test frame shall be the nominal thickness of the overlay.

3. A wooden strike-off block shall conform to the following dimensions: approximately 1½ in. × 3½ in. × 24 in.

4. A trowel is required.

5. A metal shovel or large scoop is required to place the material in the rigid test frame.

6. Plastic containers (1 to 5 gal) are used to transport materials and clean equipment.

7. A rubber-headed mallet shall weigh 1¼ lb ± ½ lb.

8. Square polyethylene sheets, approximately 18 in. × 18 in. with a thickness between 0.003 in. and 0.010 in. are required.

CI. STANDARDIZATION OF THE NUCLEAR GAGE

Standardize the nuclear gage in accordance with California Test 231.

E. STANDARD DENSITY TEST

1. Secure the rigid test frame to the prepared surface to be overlaid (one method is to place a heavy mass on top of each side extension). See Figure 1. Immediately after final mixing of the polymer concrete, obtain a representative sample from the mixer and place it at the center of the rigid test frame. The sample must completely fill the 18 in. × 18 in. test area from the base to the top of the frame. Use dry, clean

equipment (plastic containers and metal shovel or large scoop) to transport the polymer concrete from the mixer to the rigid test frame.

2. Use the wooden block to strike off the fresh polymer concrete. Place the block on top of the test area, with its 3½ in. width touching the polymer concrete surface and its ends extending beyond the rigid frame. Strike the top of the block with the mallet at various locations. Move the block, and restrike as needed, to achieve uniform consolidation throughout the test area. The rigid frame must remain in full contact with the surface to be overlaid during the consolidation process. After consolidation, flushed resin should be evenly distributed throughout the surface of the polymer concrete.

3. Remove the wooden block from the test area and place a sheet of polyethylene on top of the polymer concrete. Gently place the nuclear gage on top of the plastic sheet at the center of the test area. Take a 1 min reading with the nuclear gage in the AC Backscatter Mode. Turn the nuclear gage 180 degrees and obtain an additional 1 min reading. Average the two readings. Calculate the count ratio by dividing the count value by the average of the two readings. Use the calibration chart for the nuclear gage to determine the in-place density for one day's use. If there is significant change in the resin content, the depth of the overlay, the aggregate source, or aggregate gradation, then a new standard must be determined.

4. For a valid test, the following items must be completed within a 7 min period: sampling the polymer concrete, filling the rigid frame with material, compacting the polymer concrete, and obtaining the nuclear gage readings.

NOTE 1: Immediately after all nuclear gage readings are recorded, quickly clean the rigid test frame and all equipment with cleaning solvent before the polymer concrete gels. Properly dispose of all polymer concrete materials used in the compaction test.

F. IN-PLACE DENSITY TEST

1. The relative compaction test must be taken immediately after the polymer concrete has been placed and finished, and before any surface sanding or texturing. Place a sheet of polyethylene on the polymer concrete surface and gently place the nuclear gage on the polyethylene sheet. Take a 1 min reading with the nuclear gage in the AC Backscatter Mode. Calculate the in-place density and the relative compaction of the material at the site. The formula to calculate the percent relative compaction is:

$$\% \text{ Relative Compaction} = \frac{\text{(In-Place Density)}}{\text{(Standard Density)}} \times 100$$

2. The % relative compaction is rounded to the nearest whole number.

NOTE 2: If a relative compaction value is less than specified by the contract, the Resident Engineer should be notified immediately. To date, some polymer concrete overlays have failed due to insufficient compaction of the material at the time of placement. Factors that cause inadequate compaction include:

- Insufficient resin in the polymer concrete mixture, insufficient quantities of catalysts and/or out-dated polymer materials
- Insufficient or incomplete mixing (dry spots in the mix)
- Polymerization of the material prior to the compaction efforts

- The finishing machine moved too quickly to achieve adequate compaction
- Malfunctioning vibrators on the finishing machine
- Inadequate compaction effort attempted

G. REPORTING RESULTS

1. Record relative compaction values for each test area. (Do not average relative compaction values from two or more test areas.)

2. Record the operator's name, the CHC number of the nuclear gage, date of test, and time of test.

3. Sketch the location of each test area (record the mile post or station and distance left or right of centerline).

H. PRECAUTIONS

Several types of polymer materials may be considered for overlay use. Testers are required to read the Safety Data Sheets for the applicable polymer type specified.

Prior to sampling, handling, or testing, Caltrans personnel are required to read the Laboratory Safety Manual. Requirements for general safety principles, standard operating procedures, protective apparel and how to handle spills, accidents, and emergencies are discussed in the above reference.

Prior to the anticipated work, testers should be fitted for respiratory equipment according to the procedures outlined in Chapter 15 of the Caltrans Safety Manual. Prior to handling polymer materials in poorly ventilated areas, testers are required to use appropriate respiratory equipment.

When handling polymer concrete materials, use suitable protective clothing and eye protection.

Polymer resins and catalysts should always be mixed using guidelines and proportions recommended by the manufacturer. Polymer materials can be susceptible to burning prior to polymerization. Do not place these materials near an open flame or extreme heat.

This method involves hazardous materials, and extreme care must be used when performing the tests.

I. HEALTH AND SAFETY

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf

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(California Test 552 contains 4 Pages)

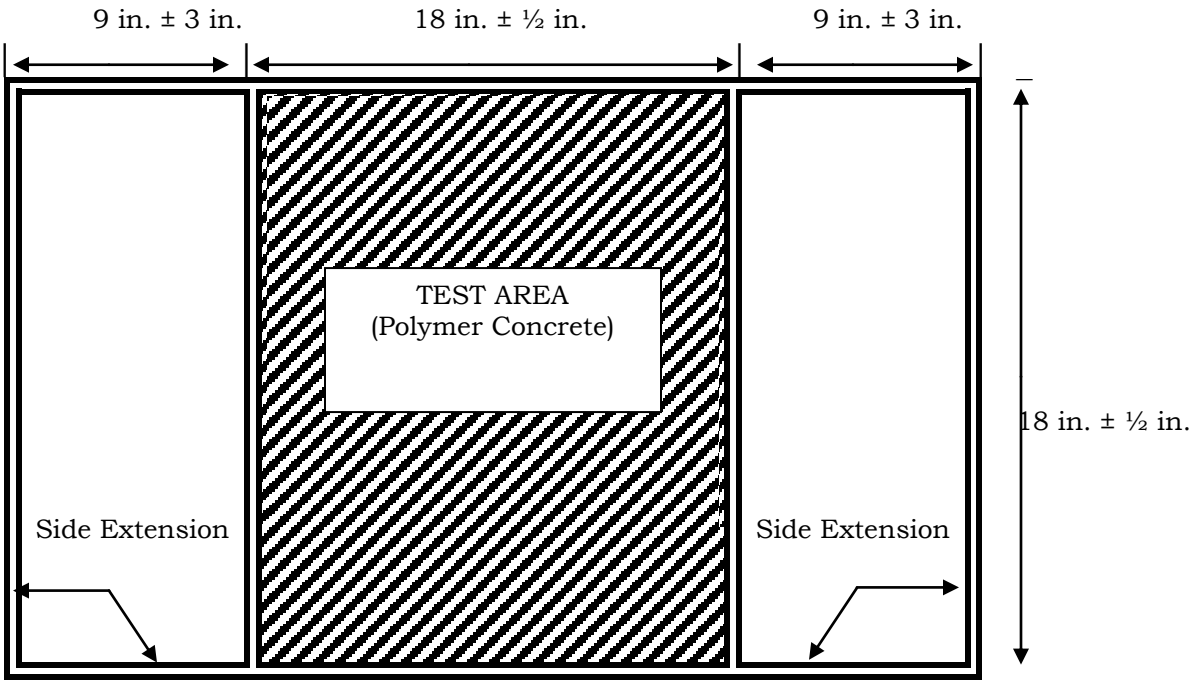

FIGURE 1. Plan View Of Rigid Frame
(Polymer Concrete Compaction Testing)

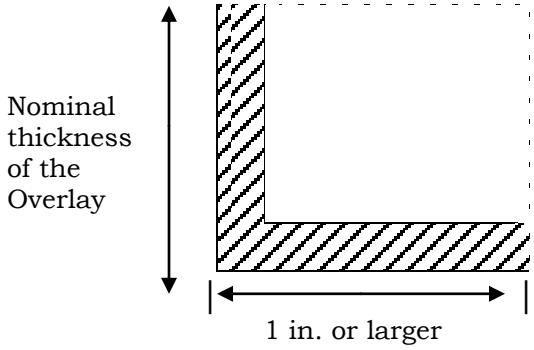

FIGURE 2. Typical Cross Section Of Frame (angle iron)

Note: More than one rigid test frame may be required for a project. A rigid test frame with a 2 in. height would be unacceptable for use on a project with a specified overlay thickness of 1 in.