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DIVISION OF ENGINEERING SERVICES  
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## STANDARD METHOD FOR DETERMINING OPTIMUM BITUMEN CONTENT (OBC) FOR OPEN GRADED ASPHALT CONCRETE

**CAUTION:** Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Section H of this method. It is the responsibility of the user of this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

### A. SCOPE

This is the procedure to be used to determine the Optimum Bitumen Content (OBC) for open graded asphalt concrete using unmodified and polymer modified asphalts. This content should provide a mix with sufficient asphalt film thickness to provide good durability and avoid excessive asphalt drainage.

### B. APPARATUS

1. *Extraction Thimbles* - Three extraction thimbles as used in California Test 310, Figure 6.
2. *Aluminum Discs* - Six aluminum discs,  $140 \pm 1.6$  mm diameter by a nominal thickness of 2 mm.
3. *Sample Mixing Apparatus* - Use suitable equipment. Hand mixing is permissible, but mixing with a mechanical AC mixer as illustrated in CT 304, Figure 2, is recommended.
4. *Cylindrical Steel Blocks for Applying Load* - Three  $4000 \text{ g} \pm 5 \text{ g}$  steel blocks for applying load (76 mm nominal diameter steel block 114 mm high works well).

5. *Oven* - An Electric Oven capable of maintaining a temperature of  $135^{\circ}\text{C} \pm 3^{\circ}\text{C}$ .
6. *Balance* - A balance with a minimum weighing capacity of 5000 g and accurate to 0.1 g.
7. *Miscellaneous Apparatus and Tools* - A small pointed trowel, spatula, metal pans and heat resistant gloves.

### C. PREPARATION OF SAMPLE

1. Nine 1500 g aggregate samples are required for this test. Prepare samples at the aggregate gradation (individual sieve size fractions) proposed by the contractor for sizes retained on the 1.18 mm sieve. Split or quarter the passing 1.18 mm sample portion and add the required mass to give a total representative sample of 1500 g.
2. For mixes using unmodified asphalts, use the asphalt that will be used during production to determine OBC. For mixes using polymer-modified asphalts, e.g., PBA 6a, PBA 6b, and asphalt rubber, use AR 4000 to determine OBC.

3. Determine the approximate bitumen ratio (ABR) as outlined in CT 303 [ABR=( $K_c \times 1.5$ ) + 4.0].

#### D. TEST PROCEDURE

1. Heat the aggregate and the asphalt (see Section C.2) for three of the 1500 g samples to 135°C.
2. Place an aluminum disc in the bottom of each extraction thimble as shown in Figure 1 and attach the screw-on bottom so that the aluminum disc is firmly held in place.
3. Tare each extraction thimble with the bottom disc assembly in place.
4. Preheat three extraction thimble assemblies, three top discs and three 4000 g steel blocks for a minimum of 15 min in an oven at 135°C.
5. Hand mix or mechanically mix three individual samples of asphalt and aggregate at the ABR for 2 min  $\pm$  5 s (mixing must be done over a heat source such as an infrared lamp or a hot plate to avoid loss of temperature).
6. After mixing, immediately transfer each mix into a heated extraction thimble assembly. Use a spatula to scrape clean the insides of the mixing bowl or pan.
7. Place an aluminum disc on top of each mix (Figure 1).
8. Place a 4000 g mass on top of each disc (Figure 1).
9. Place each of the three assembled test samples into an oven maintained at a temperature of 135°C.
10. Remove the test sample from the oven after 30 min  $\pm$  15 s (organize the test samples in the oven to accommodate removal at the prescribed 30 min).
11. Immediately remove the 4000 g mass and top disc and invert the thimble,

dumping the test specimen into a pan. Tap the bottom of the thimble assembly ten times with the spatula handle to dislodge any loose material.

12. Allow the thimble and bottom disc assembly to cool to room temperature for a minimum period of 20 min.
13. Re-weigh each thimble with the bottom disc assembly in place to determine grams of asphalt drainage. (Grams of asphalt drainage are the algebraic difference between this weight and the tared weight – see Section D.3). Average the results of the three samples.
14. Repeat steps 1 through 13 with test specimens prepared with asphalt contents 0.7 % less than and 0.7 % more than ABR. Use more specimens, e.g., 1.4 % more than ABR, as necessary.
15. Plot the average drainage for each asphalt content on Figure 2 (Form TL-601).
16. Connect the successive points using a straight edge.
17. At the intersection of this line with 4.0 g drainage on the abscissa, read the asphalt content from the ordinate that will provide asphalt drainage of 4.0 g.

#### E. DETERMINATION OF OBC

The OBC for open graded asphalt concrete using unmodified asphalt shall be the value reported in Section D above.

The OBC for open graded asphalt concrete using polymer-modified asphalt, except asphalt rubber, shall be the value reported in Section D above (see Note 1).

The OBC for asphalt rubber used in Rubberized Asphalt Concrete, Type O (RAC-O), shall be determined using the following formula (see Note 1):

$$OBC_2 = (OBC_1) \times 1.2$$

Where:

$OBC_1$  = OBC from Section D

$OBC_2$  = OBC for RAC-O

Note 1: For mixes using polymer-modified asphalts, e.g., PBA 6a, PBA 6b, and asphalt rubber, use AR 4000 to determine OBC.

## F. PRECAUTIONS

Heat may cause equipment damage or induce erroneous data if hot materials are weighed on sensitive scales.

A clean thimble assembly and aluminum disks shall be used for each test.

## G. REPORTING OF RESULTS

Report the final OBC ( $OBC_2$  for RAC-O), specific gravity of the coarse and fine aggregate,  $K_c$  value, estimated density ( $\text{kg}/\text{m}^3$  per CT 308) and the asphalt grade and source on Form TL-601 (Figure 2).

## H. SAFETY AND HEALTH

Personnel must use heat resistant gloves when working with hot materials. Reasonable care should be exercised to avoid being burned by asphalt, aggregate, or equipment.

Prior to handling, testing or disposing of any waste materials, testers are required to read: Part A (Section 5.0), Part B (Sections: 5.0, 6.0 and 10.0) and Part C (Section 1.0) of Caltrans Laboratory Safety Manual. Users of this method do so at their own risk.

## REFERENCES

California Test 303, 304, 308, and 310

## End of Text

(California Test 368 contains 5 Pages)

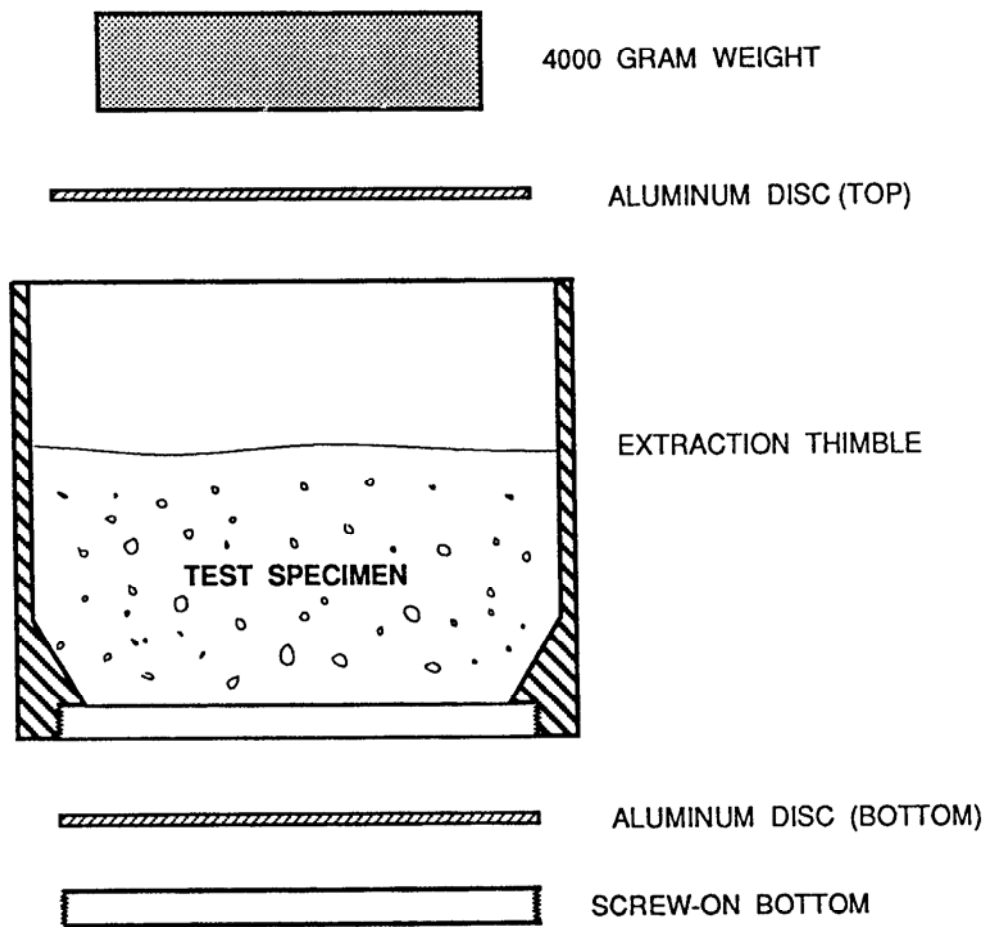
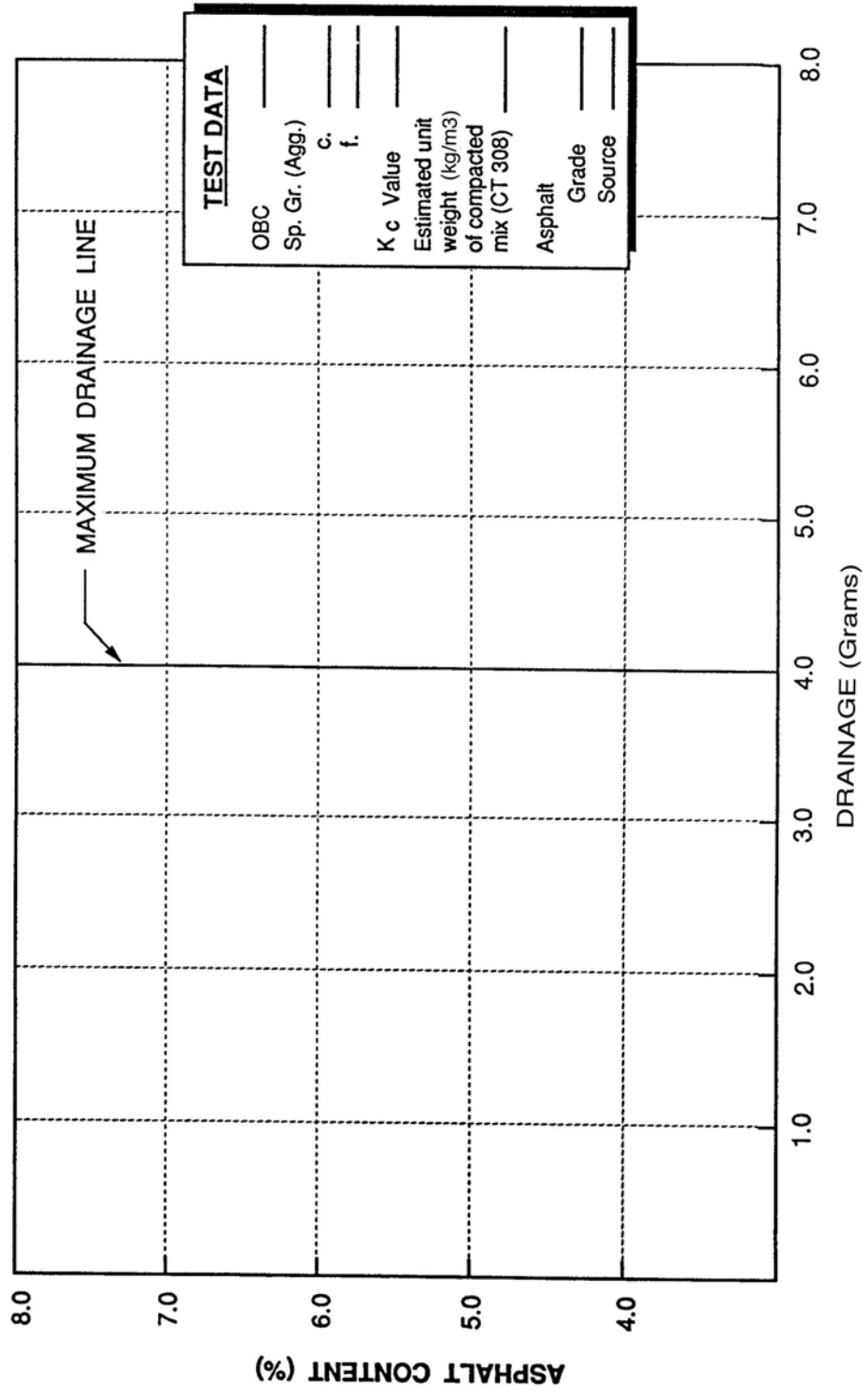


FIGURE 1

**OBC CURVE FOR O.G.A.C.**



TL 601

**FIGURE 2**