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OHD L-8
METHOD OF TEST FOR
COMPACTING BITUMINOUS MIXTURES FOR STABILOMETER VALUE

I. **SCOPE.** This method of preparation of test specimens of bituminous mixtures employs gyratory shearing action of the mixture at low initial pressures, allowing orientation of the aggregate particles. The specimens are compacted to simulate the conditions possible in the actual road surface when proper construction procedures are used in placement of the material. The specimens are intended for use in determining the Hveem stability value, density and bulk specific gravity of bituminous mixtures.

II. **APPARATUS.** The apparatus shall consist of the following:

A. **Gyratory-Shear Molding Press.**

B. **Press Platen,** which is hardened and ground flat.

C. **Hydraulic Compaction Ram,** with non-rotating metal face. The ram face is hardened and ground flat. The ram varies the vertical opening between the ram face and the press platen from plus 4.53 in (115 mm) down to less than 0.98 in (25 mm).

D. **Low Pressure Gauge,** with automatic valve for high pressure protection and with capability of indicating the following:

1. Pregyration Stress - 400 lbf (1.78 kN) total for 4 inch (101.6 mm) diameter specimen (50 psi (344.8 kPa) for Rainhart Gyratory Compactor used by Materials Division).

2. End Point Stress - 1200 lbf (5.34 kN) total for 4 inch (101.6 mm) diameter specimen (150 psi (1034.4 kPa) for Rainhart Gyratory Compactor used by Materials Division).

E. **High Pressure Gauge,** with capability of indicating the following:

1. Consolidation Stress - 20,000 lbf (89.0 kN) total for 4 inch (101.6 mm) diameter specimen (2500 psi (17.24 MPa) for Rainhart Gyratory Compactor used by Materials Division).

F. **Tilt Mechanism,** to cock the mold approximately 4 degrees while the specimen is under pregyration stress. In reverse manner, it squares the mold axially against the press platen, with a smooth quick motion.

G. **Gyration Mechanism,** to move the mold about the ram face approximately 8 degrees total angle and produce gyratory-shear compaction of the specimen. An electric motor drives the gyration mechanism.

H. **Count Mechanism,** to shut the gyration motor off after three complete cycles and to stop it in the loading position.

I. **Hydraulic Hand Pump,** which meters 0.025 inch (0.64 mm) ram movement, with a smooth quick motion.

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J. **Gyratory Mold** - Rigid metal mold with a concentric hardened ring for manipulating gyratory action, and hardened to at least 55 HRC honed and hard-plated interior.

K. **Base Plate** - Solid metal plate with top and bottom surfaces hardened and ground flat.

L. **Funnel** - Wide-Mouth Funnel, with mouth that fits inside mold.

M. **Scale or Balance,** having at least 4000 g capacity, sensitive to 0.1 g.

N. **One Inch Sieve.**

O. **Spatula** - A flexible spatula having a blade about 6 in. long and 1 in. wide (150 mm long x 25 mm wide).

P. **Spoon** - A large spoon with a right angle bend between the bowl and handle.

Q. **Measuring Device** - A micrometer dial assembly or calipers for determining height of specimens is suitable for this purpose.

R. **Specimen Extrusion Device** - A rigid right cylinder, having a minimum height of 4.53 in. and a diameter of approximately 3.9 in. (115 mm high and a diameter of approximately 98 mm).

S. **Oven,** for specimen mixtures and mold assemblies having a range from 104°F to 302°F (40° to 150° C) and thermostatically controlled to within ±5°F (± 3° C).

T. **Miscellaneous** - Thermometers, trowels, gloves, and mixing pans.

NOTE: If the design mixture prepared in the laboratory or the mixture obtained from a commercial asphaltic concrete plant contains large size aggregate, remove the aggregate larger than 1.0 in (25.4 mm) and replace with an equal amount of aggregate larger than 3/4 in (19 mm) and smaller than 1.0 in (25.4 mm).

NOTE: The gyratory mold should be heated to approximately the same temperature as the material to be molded to prevent the cooling of the material and to facilitate the removal of the molded specimen.

III. **COMPACTION TEMPERATURES.** The recommended compaction temperatures are as follows:

A. Road Mixed Surfacing, 75°F ± 5°F (24° ± 3° C).

B. Plant Mixed Surfacing (Hot Mix-Cold Lay) with liquid asphalt, 140°F ± 5°F (60° ± 3° C).

C. Asphalt Concrete and Bituminous Base, Coarse Aggregate Type with Asphaltic Cement, 250°F ± 5°F (121° ± 3° C).

D. Bituminous Base Fine Aggregate Type with Asphaltic Cement, 180°F ± 5°F (82° ± 3° C).

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IV. **PROCEDURE.**

A. Wipe the inside of the heated gyratory mold with a rag lightly moistened with kerosene or light lube oil. Insert the base plate into the mold with the large diameter up, and place a paper gasket over the base plate.

B. By means of the bent spoon and wide mouth funnel, fill the mold approximately one-third (⅓) full and press the mix down lightly with the spoon. Fill the cylinder two-thirds (⅔) full and press it down. Place the remainder of the mix in the cylinder and level off with the spoon. Cover the mix with a paper gasket. Be very careful at all times to avoid segregation or loss of material while placing it in the cylinder.

C. Quickly place a small amount of lightweight oil in the center of the motorized press platen and a drop or two on the surface of the lower bearing. (This is the bearing that "cocks" the mold and gives or creates the gyratory action.)

D. Squirt a small ring of oil around the periphery of the mold on the top surface of the hardened steel ring. This ring of oil should be in the path that the upper bearing will follow during gyration. Do not use an excessive amount of oil in making this ring.

When molding a number of Hveem specimens, Steps C and D should be repeated every 10 to 15 specimens or as appears necessary when wearing surfaces become dry.

E. Steps C and D should be done quickly without delay. Then slide the hot mold and contents to the edge of the work table, and with gloved hand holding the base plate in place, transport the mold to the platen of the press.

F. Slide the mold onto the platen and center it in molding position beneath the ram of the press.

G. Move the lever on the control valve to the forward or positive position and pump the ram down into the center of the mold. Continue pumping until the low pressure gauge registers the pregyration stress.

H. Immediately pull the handle of the cam-lever down, cocking the mold to the proper angle of gyration. Be certain that the cam-lever is pulled all the way down. The pump handle should be all the way up.

I. Rotate the gyration control crank one complete turn. The mold will then gyrate three (3) times and stop.

J. As soon as the mold stops gyrating, raise the cam-lever handle leveling the mold, and immediately make <u>one</u> (1) full stroke with the pump handle. No time should be wasted in the leveling of the mold and stroke of the pump. It should be two (2) smooth consecutive motions. (The <u>full</u> stroke of the pump is important, for it serves as an end point for the procedure. When one full stroke of the pump causes the low pressure gauge to surge to the end point stress or more, the gyrating portion of the molding procedure is complete.)

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K. Adjust the pressure to the pregyration stress and repeat Steps H, I, and J. Experience has revealed that the smoothest operating procedure, and certainly the safest is for the operator to keep the right hand on the pump handle at all times while operating the cam-lever, gyration control crank, and pressure valve with the left hand.

L. Continue Steps I through K until one (1) smooth, but not violent, stroke of the pump handle will cause the low pressure gauge to surge to the end point stress or more. During molding when one stroke of the pump handle causes the gauge to come to rest between the pregyration stress and the end point stress, drop the pressure below the pregyration stress by opening the pressure valve to release pressure and then returning it to the closed position. Then pump the pressure back up to the pregyration stress. Continue Steps I through L until the end point is reached.

M. When the end point stress is reached, bring the pump handle down slowly until the automatic gauge protector valve cuts the low pressure gauge out of the system. Now at approximately one stroke per second, pump the pressure up to the consolidation stress as measured on the high pressure gauge.

N. Hold the specimen at the consolidation stress for five (5) seconds, then with the left hand, very carefully release the pressure by slowly opening the pressure valve. Watch the high pressure gauge when releasing pressure to prevent damage to low pressure gauge due to sudden, violent releases of pressure.

O. Move the control lever on the control valve to the reverse position, then pump the ram up and out of the mold.Slide the mold out of the press, remembering to place a gloved hand beneath the mold to keep the base plate from falling out.

P. Allow the base plate to drop out of the mold onto the work table and remove the specimen from the mold, with the specimen extrusion device. Set the specimen aside to cool until it can be handled safely for measuring.

Q. It is to be emphasized that this motorized press must be kept clean. If dirt and grit collect on the platen or hardened steel ring, wipe it off and re-oil before molding the next specimen. Attention must be given to the cleanliness of the press during and after molding.

R. When all the molding is completed, disconnect the press from the electric outlet, clean the unpainted parts of the press, the mold and base plate with a lightly moistened kerosene rag and coat with a thick coating of lightweight oil. This cleaning and oiling is an absolute necessity if the press is expected to continue functioning properly. Wipe the painted parts of the press with a clean dry rag.

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S. Measure the height of the specimen (average of four (4) measurements). The specimen shall be 2.5 in ± 0.1 in (63.5 ± 2.5 mm) in height. If the height is not within this tolerance, the specimen shall not be used, and the weight of the sample required to produce a specimen of the proper height shall be calculated according to the following formula:

$$\textit{Mass of sample to be used} = \frac{63.5 \times W}{H}$$

Where:

W = Weight of specimen, g
H = Height of specimen, mm

T. The compacted specimens are now ready for testing in accordance with OHD L-16.

NOTE: Automatic Gyratory Shear Compactors shall be checked by the Materials Division prior to being placed in service. Modifications to the compaction procedure may be required, if necessary, to duplicate Materials Division's results.