WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION
MATERIALS PROCEDURE

GUIDE TO DETERMINING INTERFACE BOND SHEAR STRENGTH OF MULTI-LAYERED ASPHALT PAVEMENT SPECIMENS

1. PURPOSE

1.1 To establish an approved method for determining the interface bond shear strength between layers of asphalt concrete pavement in cored samples taken from the roadway.

2. SCOPE

2.1 This test method covers the determination of the interface bond shear strength between layers of asphalt concrete pavement in cored samples of both Marshall and Superpave mixes.

2.2 This test method is applicable for cores obtained from both newly constructed and previously existing asphalt concrete pavements. It could also be used to determine the interface bond strength between asphalt concrete and Portland cement concrete.

2.3 This test is applicable on six-inch diameter cores that are not less than two inches thick.

3. REFERENCED DOCUMENTS

3.1 *AASHTO Standards:*

a) T-168, Standard Practice for Sampling Hot-Mix Asphalt Paving Mixtures

b) T-245, Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

3.2 ASTM Standards

a) D 5581, Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen)

4. APPARATUS

4.1 Bond Test Device – The device used for the bond shear test shall be designed to accommodate six-inch diameter test specimens. The specimen shall have a nominal diameter of 6.0 +/- 0.125 inch. The device shall have a metal cylindrical specimen holder (reaction frame) and a movable specimen holder (shearing frame). The reaction frame shall have the capabilities to tightly hold samples slightly smaller than

six-inches. The shearing frame shall move freely through the use of friction reducing bearings. The shearing frame shall have a spherical loading head. The gap between the reaction frame and the shearing frame shall be ¼ inch ± 1/32 inch.

4.2 Loading Machine – The loading machine shall produce a uniform vertical movement of two inches per minute. The Marshall Stability test apparatus or other mechanical or hydraulic testing machine may be used provided the rate of movement is maintained at two inches per minute while the load is being applied.

4.3 Wet masonry saw.

4.4 White or silver paint (See 6.3)

4.5 Infrared temperature gun (capable of measuring to 0.1 °F)

4.6 Supply of MP 401.07.23 data sheets

5. ROUNDING OF DATA

5.1 Test data and calculations are rounded to the following nearest significant digit.

Station Number	1ft (not on data sheet)
Diameter	0.05 in
Thickness of Overlay	0.05 in
Thickness of Existing HMA	0.05 in
Max Load Applied	1 lb
Cross Section Area	1 in^2
Bond Shear Strength	1 psi
Average Bond Shear Strength	1 psi
Standard Deviation	0.1 psi
Internal Temperature	0.1 °F

6. PREPARATION OF TEST SPECIMENS

6.1 Number of Test Specimens – a single test procedure shall consist of at least three specimens.

6.2 Each roadway core specimen shall be six inches in diameter with the entire surface of the perimeter perpendicular to the top surface of the core within ¼ inch. If the height of the core above or below the interface being tested is greater than three inches, it shall be trimmed with a wet masonry saw to a height of approximately three inches.

6.3 Identify the location of the interface layer with white or silver paint with three equally spaced marks approximately one inch long around the perimeter of each core.

7. PROCEDURE

7.1 Specimen dimensions – measure the diameter of the core and the thickness of the overlay and existing HMA layer to the nearest 0.05 inch. Measure the diameter in at least three locations and average the readings. For more details, see MP 401.07.22.

7.2 Specimen conditioning – allow the specimens to stabilize at the test temperature of 75±5°F (24±2°C) in a water bath or oven; this stabilizing process should take a minimum of 120 minutes.

7.3 Specimen positioning – orient the core in the bond strength device so that the direction of traffic marked on the core is vertically pointing downward and the marked interface is centered between the edge of the reaction frame and the edge of the shearing frame.

7.3.1 Align the loading head adjacent to the bonded interface. The loading head shall rest parallel to the bonded interface on the asphalt overlay portion of the specimen. Sample positioning and loading is shown in Figure 1.

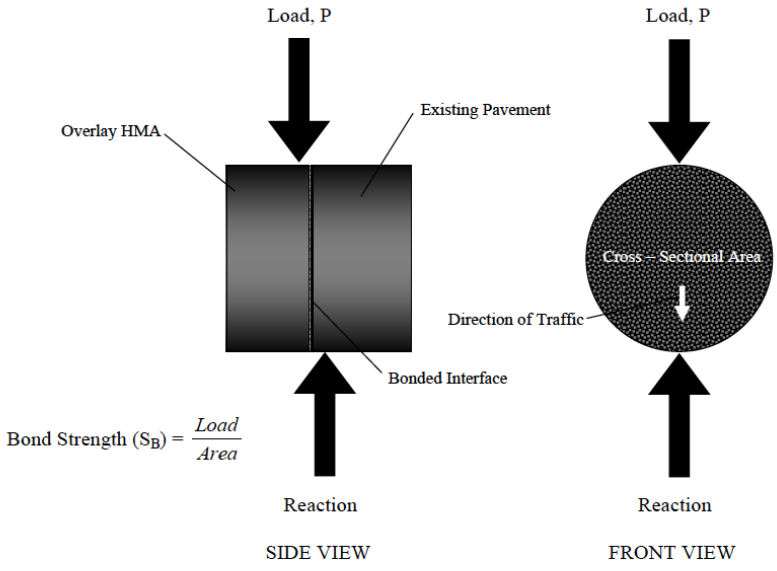

Figure 1. Loading Scheme Used for the Bond Strength Test

Note: Thinner layer of the sample should be placed in the loading side of the frame.

7.4 Rate of displacement - Apply the displacement continuously and without shock at a constant strain rate of two inches per minute until failure occurs. Record the maximum load in pounds, P_{MAX}, carried by the specimen during the test.

7.5 Immediately following the shearing of the sample, measure and record the temperature of the sample at the interface using the infrared temperature gun.

8. CALCULATION

Calculate the bond shear strength, S_B, as follows:

$$S_B = P_{MAX} / A$$

Where:

S_B = bond shear strength, pounds per square inch (psi)
P_{MAX} = maximum load applied to the specimen, pounds-force (lbf)
A = cross sectional area of test specimen, square inches (in^2)

And:

$$A = \pi D^2/4$$

Where:

A = cross-sectional area of test specimen, square inches (in^2)
D = average diameter of test specimen, inches (in)

9. REPORT

9.1 Record each core number or identification, sampling date, and test date.

9.2 Failure surface. Identify if failures occurred at the interface, in the existing layer, or in the overlay of each core.

9.3 Note the appearance of the interface including any contaminants, milling striations, stripping, tack coat streaks, or other observations.

9.4 Record the test results for each core.

9.4.1 Specimen dimensions – including thickness of the overlay asphalt, thickness of the existing layer, the average diameter as specified in Section 7.1, and the cross-sectional area.

9.4.2 Maximum load applied.

9.4.3 Temperature of the sample interface, recorded to the nearest 0.1 °F.

9.4.4 Bond shear strength, rounded to the nearest psi.

9.5 Calculate and record the mean and standard deviation of the bond strength for the set of cores.

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