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

MATERIALS PROCEDURE

METHOD OF TEST FOR DETERMINATION OF "R" VALUE, BULK SPECIFIC GRAVITY COHESION, MAXIMUM SPECIFIC GRAVITY, AND AIR VOID VALUE OF BITUMINOUS TREATED BASE COARSE (HOT MIX AND COLD MIX)

1.0 PURPOSE

1.1 To determine the resistance value, bulk specific gravity, unit weight, maximum specific gravity, maximum density, cohesion and air void value of bituminous treated base coarse (Hot and Cold Mix).

2.0 SCOPE

2.1 "R" Value

2.1.1 This method of test covers a procedure for determining the "resistance" value of a bituminous mixture by measuring the transmitted horizontal pressure developed in a compacted specimen under a given vertical pressure and indicates the relative ability of the base coarse to resist plastic deformation. Re: ASTM D-1560

2.2 Bulk Specific Gravity

2.2.1 This method of test determines the bulk specific gravity of the compacted specimen. Re: AASHTO T-165-I

2.3 Maximum Specific Gravity

2.3.1 This method of test determines the maximum specific gravity of the uncompacted bituminous paving mixtures. Re: AASHTO T-209

2.4 Cohesion

2.4.1 This method provides a measure of the cohesion resistance or tensile strength of the compacted bituminous specimen. Re: ASTM D-1560

2.5 Air Voids

2.5.1 A calculated value to obtain the percent voids of the total mix. Primary purpose of air void criteria is to avoid pavement designs that will result in flushed or bleeding pavement.

3.0 EQUIPMENT

3.1 Apparatus and equipment as specified in the following procedures: ASTM D-1560, ASTM D-1561, AASHTO T-165-I, AASHTO T-209, and Form HS-20.

4.0 PREPARATION OF THE AGGREGATE AND MIXTURES

4.1 Material for "R" value determination to be prepared in accordance with ASTM D-1560.

5.0 MOLDING SPECIMENS

5.1 The mixtures are compacted and molded in accordance with ASTM D-1561.

NOTE: Cold Mix specimens are cured prior to determination of "R" value.

6.0 STABILIMETER

6.1 Determine the horizontal pressure at a given vertical load in accordance with ASTM D-1560.

NOTE: Start the vertical movement of the press at the speed of 1.3 mm per second and record the stabilimeter gauge reading at 907 kg (8.90 kN) on Form HS-20.

7.0 CALCULATIONS

7.1 "R" value is determined by using the following equation, or use Nomograph I:

$$R = 100 - \frac{2.5}{D}\left(\frac{P_v}{P_h} - 1\right) + 1$$

Where:
R = "R" Value
P_v = Vertical Pressure (usually 1130 KPa)
P_h = Horizontal Pressure stabilimeter readings in KPa (8.90 kN)
D = Displacement Reading

7.1.1 Attachment II Chart to be used to correct "R" value result on effective height, record result on Form HS-20.

8.0 BULK SPECIFIC GRAVITY AND UNIT WEIGHT

8.1 Determine the bulk specific gravity in accordance with AASHTO T-165-I, record on Form HS-20, use equation on Form HS-20 to determine unit weight in pcf and record on Form HS-20.

9.0 COHESION

9.1 Measure height of the specimen, record height on Form HS-20, test the specimen in accordance with ASTM-D-1560, record on Form HS-20.

NOTE: The height factors in Table 1 may be used to calculate the cohesion value. See example in Table 1.

TABLE 1

Multiply the weight of the shot necessary to break the specimen by the factors established for various heights of a 102 mm diameter specimen.

Height	Factor	Height	Factor
55.9 mm	.382	63.5 mm	.322
57.1 mm	.371	64.8 mm	.313
58.4 mm	.360	66 mm	.305
59.7 mm	.349	67.3 mm	.297
61.0 mm	.340	68.6 mm	.290
62.2 mm	.331	69.9 mm	.283

Example: Assume it takes 600 grams of shot to break a specimen 102 mm in diameter, a height of 63.5 mm. Cohesion Value = 600.0 x .322 = 193.

10.0 MAXIMUM SPECIFIC GRAVITY AND MAXIMUM THEORETICAL DENSITY

10.1 Determine the maximum specific gravity in accordance with AASHTO T-209, record on Form HS-20. Use equation on Form HS-20 to determine the maximum theoretical density in pcf, and record on Form HS-20.

11.0 AIR VOIDS

11.1 Air Voids determined by the following equation:

$$\% \text{ Air Voids} = \frac{A - B}{A} (100)$$

Where:

A = Maximum theoretical density pcf
B = Unit Weight pcf, record results on Form HS-20

Gary L. Robson, Director
Materials Control, Soils
and Testing Division

GLR:c

Attachments

HS-20
Rev 8-94

WEST VIRGINIA DEPARTMENT OF HIGHWAYS

MATERIALS CONTROL, SOIL & TESTING DIVISION

"BITUMINOUS DESIGN DATA SHEET"

Lab No _____ Project _____ County _____

Date _____ Operator _____

Specimen Identification

Stabilometer																		
500																		
1000																		
1500																		
2000																		
3000																		
4000																		
5000																		
6000																		
DISPLACEMENT																		
"R_i" or "S_2" Value																		
Average Value																		

"R_i" $V = 100 - \frac{100}{\frac{2.5}{D}\left(\frac{160}{Ph} - 1\right) + 1}$ (or use nomograph Fig 1)

"S_2" $V = \frac{22.2}{(Ph)(D) / (430 - Ph) + 0.222}$

Cohesiometer																		
Height in inches																		
(A) Height Factor																		
(B) Wt of shot no 1 (g)																		
Cohesion no 1 g/in																		
(A) Wt of shot no 2 (g)																		
(B) Cohesion no 2 g/in																		
Av Cohesion g/in																		

Cohesion "1 or 2" = (A) (B) see chart below for height factor

Bulk Specific Gravity																		
(A) Weight in air (g)																		
(B) SSD in air (g)																		
(C) Wt in water (g)																		
Bulk Sp Gr																		
Unit Weight (pcf)																		
Av Unit Weight (pcf)																		

Bulk Specific Gravity = $\frac{A}{B-C}$ Unit Weight = (Bulk Sp Gr) (62.4)

Maximum Specific Gravity:																		
(A) Wt of Dry Sample																		
(D) Wt of Flask w/Water																		
(E) Flask, same $B H_2O$ Wt																		
Max Sp Gr (62.4) (pcf)																		
Av Max Density (pcf)																		

Maximum Specific Gravity $= \left(\frac{A}{A+D-E}\right)$ (62.4)

Air Void Content:																		
(A) Av Max Density (pcf)																		
(B) Av Unit Wt (pcf)																		
Air Void Content (%)																		

% Air Voids $= \left(\frac{A-B}{A}\right)$ (100)

Ht	Factor	Ht	Factor
2.20	382	2.60	322
2.25	371	2.55	313
2.30	360	2.60	305
2.35	349	2.65	297
2.40	340	2.70	290
2.45	331	2.75	283

CHART FOR DETERMINING R-VALUE

FROM STABILOMETER DATA

$$R = 100 - \frac{100}{\frac{2.5}{d}\left(\frac{P_v}{P_h} - 1\right) + 1}$$

where P_v = 160 psi