CRD-C 650-95

Standard Method for Density and Percent Voids of Compacted Bituminous Paving Mixtures*

1. Scope.

This method of testing is used on either laboratory-compacted samples or samples taken from in-place pavements.

2. Apparatus.

2.1 Balance, 2-kg capacity, sensitive to 0.1 g.

2.2 Wire basket for weighing samples suspended in water.

2.3 Tank or bucket of sufficient capacity to completely immerse the sample in water.

3. Preparation of Specimens.

All specimens shall be marked for identification. Each specimen shall be air dried prior to testing.

4. Testing Procedures.

4.1 *Nonporous samples.* Determine the mass of the samples in air and in water and record the values in the appropriate spaces on a form such as that shown in Figure 2. The density can be determined by the following formula:

$$Specific\ gravity = \frac{A}{A - B}$$

where

A = mass of specimen in air, g

B = mass of specimen in water, g

4.2 *Porous samples.* Samples having an open texture or porous surface (particularly the cut surface of some pavement cores and sawed samples) shall have their mass determined in air, then in water, and then in air again (after blotting excess water with cloth or paper towel) to correct for error in bulk volume caused by adsorption of the water. Record these values in the appropriate columns on a form such as Figure 1. The volume of the sample determined as shown in Figure 1 is then entered on a form similar to that shown in Figure 2 for use in the remaining calculations.

*Formerly MIL-STD-620A, Method 101, 13 January 1966.

5. Calculations.

Before the voids can be calculated, the specific gravity of both the aggregate and asphalt cement and the percentage of each must be known. Then the voids are calculated as follows:

$$Voids = 100 - \left(\frac{G}{H}\right)100$$

where

G = specific gravity of compacted sample column G, Figure 2.

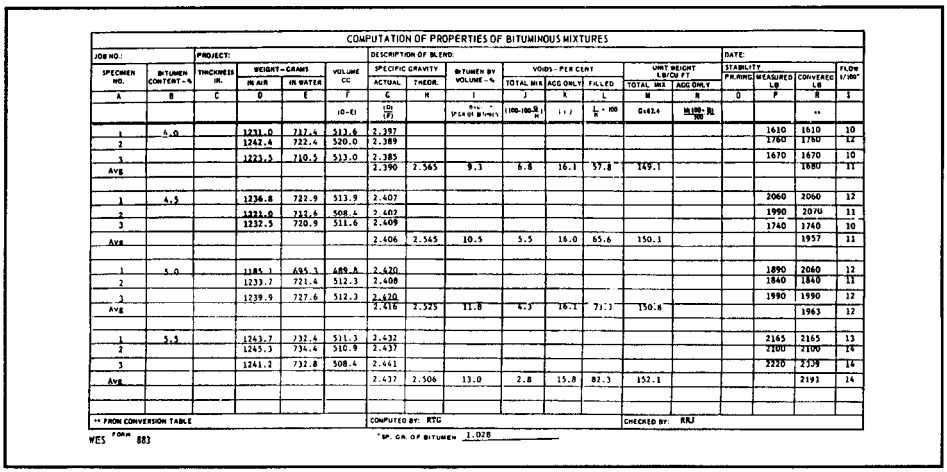
WEIGHT AND VOLUME DETERMINATION FOR SLIGHTLY POROUS BITUMINOUS PAVEMENT SAMPLES

JOB NO.: PROJECT: TYPICAL MIX DATE: 4 JUNE 1983

SPECIMEN NUMBER	BITUMEN CONTENT %	INITIAL WEIGHT IN AIR	WEIGHT IN WATER	SECOND WEIGHT IN AIR	ABSORPTION	CORRECTED WEIGHT IN WATER	VOLUME
		A	B	C	D (C - A)	E (B - D)	F (A - E)
L-10-7	4.6	1,248.6	741.6	1,257.8	9.2	732.4	516.2

TECHNICIAN: DR COMPUTER: JKS CHECKED: RTG

Figure 1. Corrections for absorbed water in density calculation



COMPUTATION OF PROPERTIES OF BITUMINOUS MIXTURES

JOB NO.: PROJECT: DESCRIPTION OF BLEND: DATE:

SPECIMEN NO.	BITUMEN CONTENT - %	THICKNESS IN.	WEIGHT - GRAMS IN AIR	WEIGHT - GRAMS IN WATER	VOLUME CC	SPECIFIC GRAVITY ACTUAL	SPECIFIC GRAVITY THEOR.	BITUMEN BY VOLUME - %	VOIDS - PER CENT TOTAL MIX	VOIDS - PER CENT AGG ONLY	VOIDS - PER CENT FILLED	UNIT WEIGHT LB/CU FT TOTAL MIX	UNIT WEIGHT LB/CU FT AGG ONLY	STABILITY FR.RING	STABILITY MEASURED LB	STABILITY CONVERTED LB	FLOW 1/100"
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S
					(D-E)	(D/F)		(B x G / Specific Gravity of Bitumen)	(100-100 S/H)	(I/J)	(I x 100/K)	(G x 62.4)	(M x 100 / 100-J)				
1	4.0		1231.0	727.4	513.6	2.397									1610	1610	10
2			1242.4	722.4	520.0	2.389									1760	1760	12
3			1223.5	710.5	513.0	2.385									1670	1670	10
Avg						2.390	2.565	9.3	6.8	16.1	57.8	149.1				1680	11
1	4.5		1236.8	722.9	513.9	2.407									2060	2060	12
2			1221.0	712.6	508.4	2.403									1990	2070	11
3			1232.5	720.9	511.6	2.409									1740	1740	10
Avg						2.406	2.545	10.5	5.5	16.0	65.6	150.1				1957	11
1	5.0		1245.1	695.3	489.8	2.420									1890	2060	12
2			1233.7	721.4	512.3	2.408									1840	1840	11
3			1239.9	727.6	512.3	2.420									1990	1990	12
Avg						2.416	2.525	11.8	4.3	16.1	73.3	150.8				1963	12
1	5.5		1243.7	732.4	511.3	2.432									2165	2165	13
2			1245.3	734.4	510.9	2.437									2100	2100	14
3			1241.2	732.8	508.4	2.441									2220	2339	14
Avg						2.437	2.506	13.0	2.8	15.8	82.3	152.1				2193	14

** FROM CONVERSION TABLE

COMPUTED BY: RTC CHECKED BY: RRJ

WES FORM 883

* SP. GR. OF BITUMEN 1.028

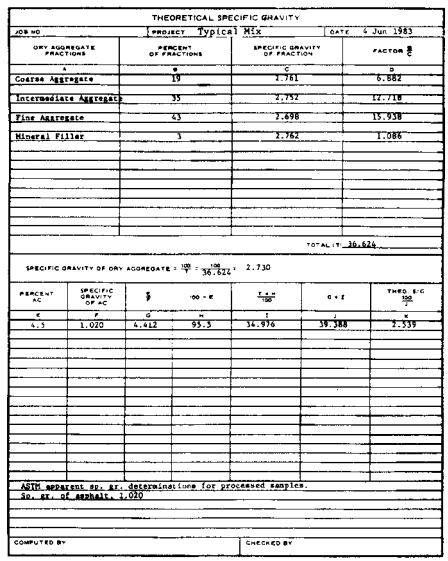
Figure 2. Computation of properties of bituminous mixtures

H = theoretical maximum specific gravity as computed from Figure 3, column K, and recorded in column H, Figure 2.

Figure 3 shows typical data and calculations needed to compute the theoretical maximum specific gravity shown in Figure 2. Procedures for the specific gravity test on the individual components are given in ASTM C 127 for coarse aggregate, ASTM C 128 for fine aggregate, and ASTM D 70 for bituminous materials. The theoretical maximum specific gravity of the combined materials determined from test method ASTM D 2041 may also be used for the calculations of voids in the mixture. Method 105 or ASTM D 2041 is to be used for calculation of theoretical maximum specific gravity when the absorption of the entire blend of aggregate exceeds 2.5 percent.

6. Report.

A summary of computations, such as that shown in Figure 2, shall be prepared for all samples tested.



THEORETICAL SPECIFIC GRAVITY

JOB NO. PROJECT: Typical Mix DATE: 4 Jun 1983

DRY AGGREGATE FRACTIONS	PERCENT OF FRACTIONS	SPECIFIC GRAVITY OF FRACTION	FACTOR B/C
A	B	C	D
Coarse Aggregate	19	2.761	6.882
Intermediate Aggregate	35	2.752	12.718
Fine Aggregate	43	2.698	15.938
Mineral Filler	3	2.762	1.086

TOTAL = 36.624

SPECIFIC GRAVITY OF DRY AGGREGATE = 100/F = 100/36.624 = 2.730

PERCENT AC	SPECIFIC GRAVITY OF AC	S	100 - E	F x E / 100	G + E	THEO. S.G. 100/F
E	F	G	H	I	J	K
4.5	1.020	4.412	95.5	36.976	59.388	2.539

ASTM apparent sp. gr. determinations for processed samples.
Sp. gr. of asphalt, 1.020

COMPUTED BY CHECKED BY

Figure 3. Computation of theoretical maximum specific gravity