



Standard Test Procedures Manual

Section: ASPHALT MIXES

Subject: ASPHALT FILM THICKNESS
DETERMINATION

1. SCOPE

This method is to obtain the asphalt thickness coating the aggregate particles in asphalt mixes.

2. APPARATUS AND MATERIALS

Not applicable.

3. PROCEDURE

3.1 Data Required

The following asphalt mix properties are needed for calculations:

- a) Percent asphalt in mix
- b) Theoretical maximum theoretical specific gravity
- c) Bulk specific gravity of aggregate
- d) Gradation of the designated sieves
- e) Asphalt specific gravity

3.2 Test Procedure

Using the following surface area characteristics for the specified sieve sizes, calculate the total surface area of the aggregate in your mix;

Sieve Size (mm)	Area Factor (m ² /kg)
+4.75 mm	(0.41x1.00)
4.75mm	0.41
2.36 mm	0.82
1.18 mm	1.64
600 µm	2.87
300 µm	6.14
150 µm	12.29
75 µm	32.77

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If your gradation analysis is reported in sieve sizes other than those shown, interpolate to estimate the percent passing on the above noted sieves.

Multiply each sieve passing percentage by its appropriate area factor.

e.g. if 5% passes 75 μm sieve, the calculation is $0.05 \times 32.77 = 1.64 \text{ m}^2/\text{kg}$

Be sure to account for the material above 4.75 mm by using 100% times the factor, i.e. 1×0.41 .

Sum all the above calculated areas. This equals the total surface area (SST) in m^2/kg for the mix.

Calculate the Absorbed Asphalt using the formula:

$$\text{Absorbed Asphalt} = \frac{\text{ASP} \times \text{BSG} - \left[\frac{\text{BSG} (100 + \text{ASP})}{\text{TMSG}} - 100 \right] \text{ASG}}{\text{BSG}}$$

Where:

ASP = Asphalt content of the mix by dry weight of aggregate

BSG = Bulk specific gravity of the aggregates in the asphalt mix

TMSG = Theoretical maximum specific gravity of the asphalt mix

ASG = Specific gravity of the asphalt cement in the mix

Convert percent absorbed asphalt to percent absorbed by total mix basis (P_{ba})

$$P_{ba} = \% \text{ Absorbed Asphalt} \times \frac{100}{100 + \% \text{ Asphalt}}$$

Calculate percent asphalt content (P_b) by total mix basis

$$P_b = \% \text{ Asphalt} \times \frac{100}{100 + \% \text{ Asphalt}}$$

Calculate Effective Asphalt (P_{be}) by total mix basis

$$P_{be} = P_b - P_{ba}$$

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Calculate Effective Film Thickness (F_{be}) in μm

$$F_{be} = \frac{981 \times P_{be}}{SST \times (100 - P_b)}$$

Calculate the Dust Proportion ratio (DP), it is the ratio of the amount passing the 75 μm sieve to the effective asphalt content by total mix.

$$DP = \frac{\text{Percent Passing 75 } \mu\text{m sieve}}{\text{Percent Effective Asphalt } (P_{be})}$$

EXAMPLE

Mix Properties:

% Asphalt	5.5 (by dry weight of aggregate)
TMSG	2.45
BSG	2.595
ASG	1.020 (assumed)
Gradation	Determined as described in this procedure

SST - As determined by described procedure to be = 7.74 m^2/kg

$$\begin{aligned} \text{Absorbed Asphalt} &= \frac{(5.5 \times 2.595) - \left[\frac{2.595 (105.5)}{2.45} - 100 \right] \times 1.020}{2.595} \\ &= 0.90\% \end{aligned}$$

$$P_{ba} = 0.90 \times \frac{100}{105.5} = 0.85\% \text{ (absorbed asphalt by total mix)}$$

$$P_b = 5.5 \times \frac{100}{105.5} = 5.21\% \text{ (%asphalt by total mix)}$$

$$P_{be} = 5.21 - 0.85 = 4.36\% \text{ (effective asphalt by total mix)}$$

$$F_{be} = \frac{981 \times 4.36}{7.74 \times (100 - 5.21)} = 5.82 \mu\text{m} \text{ (effective film thickness by total mix)}$$

$$DP = \frac{5.0\%}{4.36\%} = 1.15$$

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4. RESULTS AND CALCULATIONS

4.1 Collection of Test Results

Report the results for the Effective Film Thickness and for the Dust Proportion ratio. The results for the Effective Film Thickness are reported in micrometres. The results for Dust Proportion ratio have no units.

5. References

Superpave Series No. 2 (SP-2)