Standard Practice for: **Hot Mixed Bituminous Mix Design Using the Marshall Method**

1.0 SCOPE

This specification covers the property requirements for hot mixed bituminous mix design using the Marshall method.

2.0 REFERENCE STANDARDS

ASTM Standards

- D2041 Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
- D2726 Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
- D3203 Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
- D6307 Standard Test Method for Asphalt Content of Hot Mix Asphalt by Ignition Method
- D6926 Standard Practice for Preparation of Bituminous Specimens using Marshall Apparatus
- D6927 Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures

AASHTO Standards

- T166 Bulk Specific Gravity of Compacted Bituminous Mixtures
- T209 Maximum Specific Gravity of Bituminous Paving Mixtures
- T245 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- T308 Determining the Asphalt Binder Content of Hot Mix Asphalt by the Ignition Method

MEB Standard Test Methods

- C202 Sieve Analysis of Coarse and Fine Aggregate
- C204 Materials Finer than 0.075 mm Sieve by Washing
- C303 Maximum Theoretical Specific Gravity of Bituminous Mixtures
- C305 Bulk Density of Compacted Bituminous Mixtures
- C306 Stability and Flow of Bituminous Mixtures
- C323 Specific Gravity of Semi-Solid Bituminous Materials.
- C330 Kinematic Viscosity of Bitumens
- C331 Absolute Viscosity of Bitumens by Vacuum Capillary Viscometer
- C341 Quantitative Extraction of Bitumen from Bituminous Paving Mixtures by the Ignition Method

3.0 MIX DESIGN

The Marshall mix design shall produce a job mix formula for hot mixed bituminous that meet the mix properties as specified in Table 1.

All mixes shall be designed using 75 blows per side of the test specimen with manual compaction hammer or a mechanical equivalent to 75 blows applied manually per side of the test specimen.

The aggregates used in the mix design shall meet the Specification No.920 *"Specification for Aggregate for Bituminous Pavement"*.

The return of fines to the mixture and the aggregate breakdown from plant production may require appropriate changes to the job mix formula to meet requirements as specified in Table 1.

Table 1: Marshall Mix Requirements

Mix Properties	Bituminous Pavement Class "B"
Voids in Mineral Aggregate (%) Final lift Other lift	 14 - 16 13.5 – 16.5
Air Voids(%) Final lift Other lift	 3 – 4 3 – 4.5
Effective Asphalt (%), minimum	4.5
Marshall Flow, 0.25 mm	8 - 14
Marshall Stability (kN), minimum	8

3.1 Changes to the Job Mix Formula

The Department will monitor the mix properties using a quality assurance laboratory as per *MEB P039 Standard Practice for Sampling and Testing of Hot Mixed Bituminous*. Changes to the job mix formula shall be made when the mix properties are outside the acceptable limits.

4.0 RECYCLED ASPHALT PAVEMENT

The Recycled Asphalt Pavement (RAP) shall be tested once processed to verify the gradation, recovered binder grade and asphalt cement content.

The blended aggregates shall meet the gradation requirements as specified in the construction specification.

The blended binder shall meet the design asphalt binder grade.

The binder content of the RAP will be determined to adjust the virgin binder requirements.