1800 Bituminous Mix Design

1801 General

1801.1 Training

Personnel performing these tests must have a Mn/DOT Level-I or II Bituminous Plant Certification or be under the direct supervision of someone who has. Anyone performing mix design calculations, adjustments or is supervising QC testing is required to have a Level II Bituminous Plant Mix Designer certification. Refer to the latest versions of the Asphalt Institute's MS-2 (Marshall) and SP-2 (Superpave) manuals.

1801.2 Scope

This method describes procedures for determining the acceptability of bituminous mixtures for use in highway construction.

1801.3 Significance and Use

These tests are used for the laboratory design of bituminous mixtures. In addition they can be used to monitor the plant process and acceptability of production bituminous mixtures.

1801.4 Applicable Documents

AASHTO T166 (Mn/DOT modified)

AASHTO T209 (Mn/DOT modified)

AASHTO T245 (Mn/DOT modified)

AASHTO T269 (Mn/DOT modified)

AASHTO T308 (Mn/DOT modified)

AASHTO T312 (Mn/DOT modified)

ASTM D 4867 (Mn/DOT modified)

1801.5 Advance Testing of Constituent Materials

Mn/DOT Lab Manual:

A. 1000 Standard Practices

B. 1001 Receiving & Identifying Samples

C. 1200 Aggregate & Sand

D. 1202 Coarse Sieve Analysis

After weighing individual sieves during coarse gradation, separate material into large pans for the following fractions labeled with BA#, date received and size:

+19.0mm (3/4") - Material retained on the 19.0mm (3/4") sieve.

+12.5mm (1/2”) - Material passing the 19.0mm (3/4") sieve and retained on the 12.5mm (1/2”) sieve.

+9.5mm (3/8”) - Material passing the 12.5mm (1/2") sieve and retained on the 9.5mm (3/8”) sieve.

+4.75mm (#4) - Material passing the 9.5mm (3/8") sieve and retained on the 4.75mm (#4) sieve.

+2.36mm (#8) - Material passing the 4.75mm (#4) sieve and retained on the 2.36mm (#8) sieve.

-2.36mm (#8) - Material passing the 2.36mm (#8) sieve.

Note 1: RAP material is to be separated into +3/4”, 3/4" to #4, and - #4 size fractions. RAS material is not fractionated.

After separating the entire sample, material from each fraction should be reblended to ensure a homogenous blend of sizes in each fraction. Virgin aggregates (non-asphalt coated) shall be oven-dried (18-24 hrs.) at 110 ± 5 °C (230 ± 9 °F) to a constant weight. Recycled asphalt pavement (RAP) or Shingles (RAS) will be air-dried to a constant weight prior to batching and mixing.

Note 2: Samples may be submitted graded and split by the submitter. In this case do not run a gradation on the material; use the submitter’s gradation. It will be necessary to run all the other required tests.

E. RAP and RAS (Shingles)

1. Preparation for Splitting (See Section 1201.4)

2. Chemical Extraction (See section 1851 or 1852)

RAP - Upon completion of drying to a constant weight a representative 2000g (minimum) sample of R.A.P. is to be weighed and extracted by the centrifuge extraction method for determination of the percent asphalt. (Other extraction methods conforming to AASHTO T 164 are acceptable.)

RAS - Upon completion of air drying to a constant weight a representative 500g to 700g sample of RAS is to be weighed and extracted by the centrifuge extraction method for determination of the percent asphalt. (Other extraction methods conforming to AASHTO T164 are acceptable.)

Note 3: If an analysis of the extracted asphalt is required contact the Chemical Lab for procedures.

3. Extracted Aggregate Gradation (See section 1203)

RAP - Run a gradation on the extracted aggregate.

RAS – For Mix Designs the following standard aggregate gradation may be used in lieu of determining the shingle aggregate gradation by 1203.

Sieve Size	% Passing
9.5 mm (3/8 in)	100
4.75 mm (#4)	97
2.36 mm (#8)	95
1.16 mm (#16)	80
0.60 mm (#30)	60
0.30 mm (#50)	50
0.150mm (#100)	40
0.075mm (#200)	30

If the actual extracted gradation is to be determined, the shingle fiber should be removed from the sample prior to any shaking and sieving. The majority of fiber will be retained on the #4 sieve. Remove by use of a tweezers or other means.

4. Aggregate Specific Gravity "Gsb" (see 1204,1205 &1815)

RAP - Determine the RAP aggregate Gsb by using Mn/DOT alternate method (1815) in lieu of section 1204 & 1205 (AASHTO T84 & 85)

RAS - Gsb of 2.650 may be used in lieu of determining the Gsb by section 1205 (AASHTO T84)

Note 4: Aggregates subjected to the ignition process will experience changes in their physical properties. Specific gravity and absorption can be altered greatly.

Note 5: When extracting RAP for aggregate specific gravity (sections 1204 &1205) additional 2,500g (minimum) samples are run without the Celite added.

5. Quality Testing

RAP – For most RAP materials the individual aggregates were previously tested for quality (i.e. magnesium sulfate, LAR, Spall etc). Therefore RAP aggregates generally do not need additional quality testing unless required by the Engineer.

When the RAP is required to be examined for "Objectionable" material such as tar, metal, glass, wood, plastic , brick, fabric or other similar materials, a representative 1500-4500 gram sample of + #4 material is prepared. The "objectionable waste" material retained on the #4 sieve is picked and weighed.

RAS – Quality (sizing) requirements of the shredding process is checked by dry sieving a representative 500-700 gram sample over the ½" and #4 sieves. The material retained on each sieve is weighed and the percentage passing the ½" and #4sieve is determined.

To conduct "extraneous waste" testing of RAS a representative 500-700 gram air dried sample is sieved on the #4 sieve and any "extraneous waste" material retained on the #4 is picked and weighed. "Extraneous waste" is defined as tar, paper, wood, metal, glass, rubber, nails, soil, plastic, brick, fabric or other similar materials. The percent extraneous waste is based on the total sample weight.

Example: 650 grams – RAS

2.3 grams – extraneous waste on #4 sieve

(2.3 ÷ 650) x 100 = 0.35% extraneous waste

Note 6: When additional quality testing (litho, LAR, etc) on the RAP aggregate is requested, more than one extraction may be necessary in order to obtain the required size sample for a particular test. Refer to Section 1201 (Tab. 1).