



SPECIFICATIONS FOR ASPHALT PAVING, MATERIALS, SAMPLING, AND TESTING

September 2023

Regional Municipality of Halton
Public Works Department

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1.0 GENERAL

This specification covers asphalt to be used for the construction of roads, laneways, parking lots, and bikepaths. Unless otherwise specified in the contract documents, or amended herein, materials, production, and placement of asphalt shall conform to OPSS 310, and OPSS 1150. For the purposes of this specification, “Owner” means the Regional Municipality of Halton.

The main body of this specification addresses hot mix asphalt properties developed by Marshall mix design methods. Hot mix asphalt materials and mix specifications conforming to Superpave™ (**Superior Performing Asphalt Pavements**) technology are not required in the main body of this specification. Appendix A provides specifications in conformance with OPSS.MUNI 1151 for Superpave™ and Stone Mastic Asphalt (SMA) mixes.

Trial plant mixes are required. Alternatively, the contractor/supplier may present compliance test results from other projects for the identical mix produced within the calendar year. All trial plant mixes must meet acceptable limits for physical properties, gradation and asphalt cement content. Costs for the trial plant mixes and laboratory testing are at the contractor’s expense.

Warm Mix Asphalt, as outlined in OPSS 310 - Appendix C, is required when the minimum ambient temperature conditions for paving set out in Section 12.2 of this specification, are not satisfied. All extra costs for the supply and placement of the Warm Mix Asphalt in place of hot mix asphalt are at the contractor’s expense.

A Material Transfer Vehicle (MTV) shall be required as outlined in Section 12.1. Echelon paving shall be required for 4 lane roads unless waived at the discretion of the Project Manager.

The contractor is responsible for field sampling of the asphalt and failure to sample as per Section 7.0 of this specification, or produce QC results, will result in any necessary referee testing being completed at the contractor’s cost.

There will be no Asphalt Cement Price Adjustment.

2.0 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Material

OPSS 1001	Material Specification for Aggregates - General
OPSS.MUNI 1003	Material Specification for Aggregates - Hot Mix Asphalt
OPSS.MUNI 1101	Material Specification for Performance Graded Asphalt Cement
OPSS 1150	Material Specification for Hot Mix Asphalt
OPSS.MUNI 1151	Material Specification for Superpave and Stone Mastic Asphalt Mixtures

Ontario Provincial Standard Specifications, Construction

OPSS 310	Construction Specification for Hot Mix Asphalt
OPSS 310, Appendix C,	Construction Specification for Warm Mix Asphalt

Ministry of Transportation (MTO) Publications

MTO Laboratory Testing Manual, Relevant Bituminous and Aggregate Test Standards, with Revisions

MTO Mix Design Method for Recycled Asphalt

MTO Designated Sources of Materials (DSM) List

American Association of State Highway and Transportation Officials (AASHTO)**The Asphalt Institute**

Asphalt Institute MS-02 - Mix Design Methods for Asphalt Concrete and Other Hot mix Types, Asphalt Institute Manual Series No. 2

3.0 MIX CLASSIFICATIONS

Table 1 of OPSS 1150 is replaced by Table 1 of this specification. The classes of hot mix asphalt, and the aggregate requirements of the mixes specified by the Owner for the various construction applications, are outlined in Table 1 of this specification. Table 1 also includes the Designated Large Sieve (DLS) sizes for each mix.

4.0 ASPHALT CEMENT

Asphalt cement shall conform to OPSS.MUNI 1101. The contractor is required to provide satisfactory PGAC results from samples taken at the plant. Sampling may be required to take place on the day of paving under the supervision of the QA representative.

All sampling and testing costs are the responsibility of the contractor and/or supplier.

4.1 Asphalt Cement Grade

The asphalt cement grade for the various hot mix asphalt mix types are given in Table 1. SMA and Superpave™ mix specifications are outlined in Appendix A and the specified asphalt cement grades for each mix are given in Table A-1.

A change in grade of asphalt binder may be considered if the request is submitted in writing to the Owner prior to paving, and only if the grade of asphalt is at least one grade higher than the original grade submitted with the approved mix design.

5.0 AGGREGATES

Asphalt aggregates shall conform to OPSS 1001 and OPSS.MUNI 1003.

5.1 Physical Properties

The physical properties for hot mix asphalt fine and coarse aggregates shall conform to the requirements of OPSS.MUNI 1003, Tables 1, 4, and 5.

5.2 Gradation Properties

The specified total aggregate blends for the various mix classifications are given in Table 2 of OPSS 1150. For key attribute sieves (Table 4 of this specification) with rejectable results, the resolution of the paving conditions will be as per OPSS 310.08.04.

TABLE 1 SUMMARY OF ASPHALT MIX TYPES AND AGGREGATE REQUIREMENTS

Hot Mix Type	Typical Use	Acceptable Coarse Aggregate(s) [Note 4]	Acceptable Fine Aggregate(s) [Note 4]	Maximum Allowable RAP Content (%)	Designated Large Sieve (DLS)	Asphalt Cement PG Grade
DFC (Dense Friction Course) (Notes 1,2,5 and 6)	Premium Surface Course for High Traffic Volume Roads Requiring Elevated Skid Resistance Properties	Traprock, Dolomitic Sandstone, Meta-Arkose, Diabase, Andesite, and Gneiss Meeting OPSS Physical & Gradation Specification	Traprock, Dolomitic Sandstone, Meta-Arkose, Diabase, Andesite, and Gneiss Meeting OPSS Physical & Gradation Specification	0	9.5 mm	PG 64-28XJ
HL 1 (Note 2, 5 and 6)	Surface course for major arterial roads with >10,000 AADT & > 15% Heavy Commercial Truck Traffic in design lane	Traprock, Dolomitic Sandstone, Meta-Arkose, Diabase, Andesite, and Gneiss Meeting OPSS Physical & Gradation Specification	Manufactured Sand and Asphalt Sand Meeting OPSS Physical & Gradation Specification	0	9.5 mm	PG 64-28XJ
HL 3 (HS) (Notes 5 and 6)	High Stability surface & levelling course mix for roads with mixed heavy truck, bus and car traffic	100% Crushed Material Meeting OPSS Physical & Gradation Specification	100% Crushed Material Meeting OPSS Physical & Gradation Specification	0	9.5 mm	PG 64-28XJ
HL 3 (Note 6)	Surface course mix for roads and parking lots with mainly car traffic	Aggregate Meeting OPSS Physical & Gradation Specification	Aggregate Meeting OPSS Physical & Gradation Specification	15	9.5 mm	PG 58-28J
HL 3F (Notes 3 and 6)	Fine-graded Surface Course Mix for Driveways and Boulevards Requiring Considerable Hand Work	N/A	Aggregate Meeting OPSS Physical & Gradation Specification	15	9.5 mm	PG 58-28J
HL 2 (Note 6)	Fine Mix for Driveways and Boulevards Requiring Considerable Hand Work	N/A	Aggregate Meeting OPSS Physical & Gradation Specification	0	2.36 mm	PG 58-28J
HL 8 (Note 6)	Binder Course for roads and parking lots with mainly Car Traffic	Aggregate Meeting OPSS Physical & Gradation Specification	Aggregate Meeting OPSS Physical & Gradation Specification	30	16.0 mm	PG 58-28J
HDBC (Heavy Duty Binder Course) [HL8 HS] (Notes 5 and 6)	High Stability Binder Course for Roads & Intersections with Heavy Truck Traffic (>15%) & Bus Routes	100% Crushed Material Meeting OPSS Physical & Gradation Specification	100% Crushed Material Meeting OPSS Physical & Gradation Specification	0	16.0 mm	PG 64-28XJ
MDBC (Medium Duty Binder Course) (Note 6)	Binder Course for Mixed Truck and Car Traffic	Aggregate Meeting Physical & Gradation Specification;	Minimum of 80 % of the coarse aggregate must have two crushed faces Aggregate Meeting Physical & Gradation Specification;	20	16.0 mm	PG 58-28J

- Notes: 1. For DFC, coarse and fine aggregates shall be obtained from the same source.
2. Aggregates for HL 1 and DFC shall be from sources on the current MTO DSM list. Irrespective of physical properties, the Owner may accept or reject aggregates based on past performance.
 3. HL 2 has up to 15 % aggregate retained on the 4.75 mm sieve. HL 3F has between 25 % & 35 % aggregate retained on the 4.75 mm sieve.
 4. Changes in aggregate sources for the approved JMF shall not be made unless approved by the Owner.
 5. Meets AASHTO M-320, Extended BBR at -28, DENT, and MSCR % Recovery.
 6. Meets AASHTO M-320, supplier has not added any of the materials from the banned additives list.

6.0 MIX DESIGNS

Mix designs shall be completed by the contractor in accordance with OPSS 1150.04.01.02 using the Marshall Method.

6.1 Documentation For Mix Design Submissions

Submission of mix design documentation shall be in accordance with OPSS 1150.04.02.03. The Owner reserves the right to make the mix design approval contingent upon the successful duplication of the mix design Marshall properties by the Owner’s designated QA testing laboratory. Changes in aggregate sources for the approved JMF shall not be made unless approved by the Owner.

6.2 Design Properties

Tables 3, 4, 5, and 6 of OPSS 1150 are deleted and replaced by Table 2 of this specification. Voids in the Mineral Aggregate (VMA) requirements are specified in OPSS 1150, Table 7.

TABLE 2 SPECIFIED MARSHALL DESIGN PROPERTIES OF ASPHALT MIXES

MARSHALL PROPERTY	DFC	HL 1	HL 3 HS	HL 3	HL 3F	HL 8	HDBC [HL8 HS]	MDBC
STABILITY N @ 60 °C	8,900 MIN.	8,900 MIN.	12,000 MIN	8,900 MIN	5,800 MIN	10,000 MIN	13,000 MIN.	11,000 MIN.
FLOW Units of 0.25 mm	8.0 MIN.	8.0 MIN.	8.0 MIN.	8.0 MIN.	9.0 MIN	8.0 MIN.	8.0 MIN.	8.0 MIN.
AIR VOIDS %	3.2 - 3.8	3.5 - 4.5	3.5 - 4.5	3.5 - 4.5	4.5 - 5.5	3.5 - 4.5	3.5 - 4.5	3.5 - 4.5
ASPHALT CEMENT CONTENT %	Note 1	5.1 MIN.	5.1 MIN.	5.1 MIN.	5.5 MIN	4.9 MIN.	4.9 MIN.	4.9 MIN.

Note 1. Minimum asphalt cement content is 4.8 % for 100 % Traprock aggregate mix. For DFC mixes incorporating any approved aggregates the minimum asphalt cement content is 5.1 %.

7.0 FIELD SAMPLING PROTOCOL

Field samples for quality assurance and/or quality control testing by the Marshall methods shall be plate samples (minimum 300 mm x 300 mm) obtained during asphalt placement and compaction procedures that meet the minimum Marshall sample size of 10 kg as given in OPSS 310, Table 6. Samples obtained from the spreader hopper or truck box shall not be used for QA/QC testing. A Quartermaster will also be an accepted sampling method.

Samples shall be taken and collected by the contractor at locations generated by random numbers (see random number chart in Appendix B) for longitudinal chainage and transverse offset from edge of pavement. These samples shall be representative of the main lane paving operations. At each location, three samples shall be taken (within a 3 m longitudinal length) and packed in separate cardboard boxes supplied by the paving contractor. The box samples shall be numbered in sequence for a given contract, and shall be marked “A”, “B”, and “C” and include the following minimum identification: date; longitudinal chainage or municipal address opposite the sample location; offset in metres from edge of pavement; contract number, and street name. A typical sequence of samples would be identified as 1A, 1B, 1C, and 2A, 2B, 2C, and so on.

Two of the plate samples from each sample location shall be the property of the Owner. The contractor shall obtain and complete the Owner’s Bituminous Sample Identifier Forms for each sample. The contractor’s forms may be used if prior approval is obtained from the Owner. The samples designated for the Owner shall be delivered by the Contractor to the Owner’s facility as designated during the PreConstruction meeting.

If the contractor fails to sample as outlined in this section, or if QC results are not produced, all referee testing, including coring, will be at the contractor’s cost. Furthermore, if the contractor does not produce QC results for a given sample, they forfeit the right to select a referee lab. The QC testing must be performed by a CCIL certified lab. The referee samples will be held a maximum of 30 days after the QA results have been provided.

7.1 Sampling Frequency

The minimum asphalt sampling frequency criteria is given in Table 3. For an evaluation of a given lot, a minimum of 3 sets of test results must be used.

TABLE 3- CRITERIA FOR SAMPLING AND TESTING TO DETERMINE IN-PLACE ASPHALT CEMENT CONTENT AND GRADATION

MIX TYPE	MINIMUM TEST SAMPLES BASED ON ASPHALT PLANT'S DAILY MIX PRODUCTION		
	□ 500 tonnes/day	> 500 tonnes & < 1000 tonnes/day	□ 1000 tonnes/day
Surface Course	1	2	1 per 500 tonnes
Binder Course	1	2	1 per 500 tonnes

8.0 PRODUCTION PROPERTIES OF PAVING MIXTURES

The acceptability of asphalt mix production will be determined on the basis of QA test data compared to allowable tolerances from the JMF values for aggregate gradation and asphalt cement content as set out in Table 4 of this specification. The tolerances on the JMF sieve size parameters are absolute numbers and apply as both plus and minus.

Example:

A binder course mix with a JMF having 50% passing the 4.75 mm sieve has a borderline range of 42.5% (50.0-7.5) to 57.5% (50+7.5) for gradation test data on the 4.75 mm sieve.

TABLE 4 - ALLOWABLE MIX PRODUCTION TOLERANCES ON THE JMF

Mix Type	Attribute	Production Tolerances on the JMF		
		Acceptable	Borderline	Rejectable
Surface Course Mixes	DLS and 4.75 mm sieve sizes	< 5.0%	5.0% - 7.5%	>7.5%
	600 µm sieve size	< 3.5%	3.5% - 5.0%	>5.0%
	75µm sieve size	< 2.0%	2.0% - 3.0%	>3.0%
Binder Course Mixes	DLS and 4.75 mm sieve sizes	< 7.0%	7.0% - 10.0%	>10.0%
	600 µm sieve size	< 4.5%	4.5% - 6.0%	>6.0%
	75µm sieve size	< 2.0%	2.0% - 3.0%	>3.0%
All Mixes	Asphalt Cement Content	Less than 0.3% below JMF to less than 0.3 % above JMF	0.3% - 0.5 % below JMF 0.3% - 0.5 % above JMF	>0.5% below JMF & > 0.5 % above JMF

For key attribute sieves in Table 4 with rejectable results, the resolution of the paving conditions will be as per OPSS 310.08.04.

The mix production shall be rejectable where 3 borderline test results occur for the same attribute representing up to 5,000 tonnes of asphalt mix. When the mix production is rejectable the Owner may request a new mix design before additional paving is carried out

8.1 Consistency of Asphalt Plant Mix Production

1. In addition to the requirements of OPSS 310.08.01, when mix production problems have required two or more new mix designs from a given asphalt plant for work conducted on any contract covering the current or previous paving season, the Owner may exercise the right to withdraw the approval of the asphalt plant as a source of asphalt supply.

8.2 Reinstatement of the Asphalt Plant As An Approved Source

Reinstatement of the asphalt plant as an approved source of supply will be considered if the contractor meets the following conditions:

1. The Owner receives documentation from the contractor that states the cause or causes of the production problems, and the remedial action that was taken;
2. Test results on a trial batch of the specified mix are within specification; a production sample of the same mix from another project will be considered in lieu of a trial batch sample.

Plant reinstatement is allowable for a maximum of two trial batches. Failure after two batches will result in a plant being rejected for one full year on all Halton Region projects.

9.0 COMPACTION REQUIREMENTS

The Owner shall arrange for asphalt compaction testing during the placement and rolling stage using a nuclear density gauge. The compaction standards for Marshall mix paving projects are given in Table 5. The specified compaction is expressed as a percentage of the Marshall Maximum Relative Density (MRD), as established from the approved asphalt mix design for the project, and verified by QA testing.

Compaction of a given area of pavement shall be assessed by a minimum of five nuclear density test readings. The pavement area to be assessed should be a maximum of 0.5 lane-km of pavement (i.e. 250 m of 2 lane pavement). The average of at least five nuclear readings for a given area shall be used to assess the asphalt compaction against the standards in Table 5.

Nuclear density test results will be used as a guide to assessing in-place compaction and will not be used to reject the mix compaction. Where compaction results by nuclear gauge do not meet the acceptable range in Table 5, the contractor may request, or the Owner may elect to initiate the Dispute Resolution set out in Section 14.1 of this specification and have cores (minimum 150 mm diameter) taken. Where the average compaction from core densities does not meet the acceptable range, the coring and testing will be at the contractor's expense.

TABLE 5 – ASPHALT COMPACTION SPECIFICATIONS

MIX TYPE	SPECIFIED COMPACTION (%)		
	Acceptable	Borderline	Rejectable
HDBC (Heavy Duty Binder Course)	91.0 – 96.5	96.6 – 97.5	< 91.0 & > 97.5
DFC	92.0 – 97.5	97.6 – 98.5	< 92.0 & > 98.5
All Other Marshall Mixes	92.0 – 96.5	96.6 – 97.5	< 92.0 & > 97.5

9.1 Criteria for Acceptance or Rejection and Removal Based on In-Place Compaction of Mix

This section of the specification shall only apply to main lane paving operations on full construction projects and/or resurfacing contracts that may include padding and/or a scratch coat of asphalt to provide a levelling course. Where the compaction of the in-place mix by nuclear gauge does not meet the acceptable range requirements of Section 9.0, Table 5, the final evaluation of the mix compaction shall be based on core densities and the Dispute Resolution as set out in Section 14.1, and the criteria in Table 5.

Asphalt layer thicknesses that are less than 35 mm shall not be used in the assessment of in-place mix compaction.

10.0 AIR VOID ACCEPTANCE CRITERIA

The acceptance criteria for air voids in the compacted asphalt mixture during construction shall be in conformance with OPSS 310.08.05 for Marshall mixes and as indicated in Table 6. The air voids on laboratory compacted specimens are determined on plate samples taken from the asphalt mat during paving. Where mix air voids are in the borderline range subject to corrective action the Owner may elect to suspend paving operations until an acceptable corrective action plan has been submitted to the Owner by the contractor.

Where mix air voids are in the rejectable range the Owner may elect to have the contractor remove and replace the asphalt at no cost to the Owner.

TABLE 6 – AIR VOID CRITERIA FOR MARSHALL MIXES

Mix Type	Specified Air Void Range for Acceptable Asphalt	Borderline Air Void Range for Asphalt Subject to Corrective Action	Air Void Range for Asphalt Subject to Rejection and Removal and Replacement
DFC	2.50 % to 4.50 %	2.0 % to 2.4 % & 4.6 % to 5.0 %	<2.0 % & > 5.0 %
All other Marshall mixes	3.0 %to 5.0 %	2.0 % to 2.9 % & 5.1 % to 6.0 %	<2.0 % & > 6.0 %

11.0 COMMENCEMENT OF PAVING AND PLACING ASPHALT

This section amends OPSS 310 with the following.

11.1 Material Transfer Device

A material transfer device shall be used for main line paving projects where the quantity of a given mix is greater than 1500 tonnes. The bid price per tonne for placing asphalt shall include all costs related to the use of the material transfer device. At the discretion of the Owner the requirement for the use of a material transfer device may be waived.

11.2 Commencement of Paving

Placement of surface course asphalt shall not commence unless the Contractor has submitted a proposed paving plan that is acceptable to the Owner.

In addition, the Region requires full disclosure in writing on whether modifiers or additives, other than styrene-butadiene polymers, have been used in the production of the asphalt cement. Full disclosure is required before the commencement of asphalt paving.

The paving plan shall indicate the anticipated number of paving days, type of spreader and number and types of compaction rollers to be used, and anticipated minimum and maximum paving lengths per lane. The objective of the Owner is to have a paving plan that minimizes the number of transverse cold joints and avoids extended longitudinal cold joints between paving lanes.

The construction quality of longitudinal and transverse joints shall meet the requirements of OPSS 310.07.11 and the paving plan shall indicate the remedial methods to be used where joint quality fails to meet the OPSS standards.

Unless otherwise approved by the Owner, placement of hot mix asphalt binder course for main line paving shall not commence unless the following site conditions are satisfied:

- (a) The granular base course or existing bituminous surface is free of frost, ice, and standing water.
- (b) The air temperature at the surface of the road is at least 2 °C for granular surface conditions, and at least 7 °C for existing bituminous surface conditions.
- (c) The grade, material quality, and compaction of the granular base course layer and/or bituminous layer have been accepted by the Owner.

Unless otherwise approved by the Owner, placement of surface course hot mix asphalt for main line paving shall not commence unless the following site conditions are satisfied:

- (a) The existing bituminous surface is free of frost, ice, and standing water.
- (b) The air temperature at the surface of the road is at least 7 °C.
- (c) The grade, material quality, and compaction of the bituminous layer have been accepted by the Owner.

Where the above conditions in Section 12.2 cannot be satisfied, the contractor shall supply and place Warm Mix Asphalt at no additional cost to the Region.

11.3 Placement of Hot Mix Asphalt Mixture

OPSS 310.07.06 is amended by the following:

- (a) The temperature of the mixture delivered to the job site shall not exceed 185 °C.
- (b) The temperature of the mixture immediately after spreading, and before initial rolling, shall not be less than 125 °C.

12.0 PAYMENT FOR ASPHALT MIX

Payment for all asphalt mix types satisfactorily placed and compacted will be by the tonne. The pay quantity will be based on the weigh tickets for each mix type supplied and placed at the job site.

12.1 Dense Friction Course (DFC)

For DFC, the estimated contract tonnage quantity is based on a benchmark mix incorporating Traprock fine and coarse aggregate. The density of the benchmark asphalt mix is 2.650 (t/m³), unless otherwise noted in the contract Special Provisions. No pay adjustment will be made for mixes produced with different combinations of aggregates that result in different compacted bulk relative densities.

12.2 HL 1 Surface Course

For HL 1, the estimated contract tonnage quantity is based on a benchmark HL 1 mix incorporating 50 % Traprock coarse aggregate and 50 % local fine aggregate. The density of the benchmark asphalt mix is 2.512 (t/m³), unless otherwise noted in the contract Special Provisions. No pay adjustment will be made for mixes produced with different combinations of aggregates that result in different compacted bulk relative densities.

13.0 DISPUTE RESOLUTION

The following outlines the methodology for resolving disputes regarding asphalt mix compaction based on compaction determined by core densities.

13.1 Acceptance or Rejection of Mix Compaction Based On Core Densities

Where there is disagreement on the compaction findings by the Owner's designated QA laboratory, the contractor has the option of taking cores. The cores shall be tested by a third party laboratory that is CCIL certified and is acceptable to the contractor and the Owner to carry out the core testing. The core densities and compaction values with respect to MRD shall be determined by the methods in LS 287.

The cores shall be taken at locations selected jointly by the contractor and the Owner. For any given area in dispute a minimum of five cores shall be taken for compaction determination.

The results of the third party laboratory will be binding on both the Owner and the contractor. Payment for the costs of the coring, testing and core sample delivery will be the responsibility of the contractor if the average of the test results is not within the acceptable compaction range given in Table 5. If the third party laboratory test results indicate that the average mix compaction is within the acceptable range the costs will be borne by the Owner.

APPENDIX A

**SPECIFICATIONS FOR SUPERPAVE AND STONE MASTIC ASPHALT
MIXTURES**

A1.0 GENERAL

This specification covers mixes developed according to Superpave™ (Superior Performing Asphalt Pavements) technology, and Stone Mastic Asphalt (SMA) mixes. Unless otherwise specified in the Contract Documents, or amended herein, materials, production, and placement of hot mix asphalt shall conform to OPSS 310, and OPSS.MUNI 1151. For the purposes of this specification, “Owner” means the Regional Municipality of Halton, which is the party to the contract for whom the work is being performed.

A2.0 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Material

OPSS 1001	Material Specification for Aggregates - General
OPSS.MUNI 1003	Material Specification for Aggregates - Hot Mix Asphalt
OPSS.MUNI 1101	Material Specification for Performance Graded Asphalt Cement
OPSS.MUNI 1151	Material Specification for Superpave and Stone Mastic Asphalt Mixtures

Ontario Provincial Standard Specifications, Construction

OPSS 310	Construction Specification for Hot Mix Asphalt
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Ministry of Transportation (MTO) Publications

MTO Laboratory Testing Manual, Relevant Bituminous and Aggregate Test Standards, with Revisions
MTO Designated Sources of Materials (DSM) List

American Association of State Highway and Transportation Officials (AASHTO)

ASTM International

The Asphalt Institute

Superpave Series SP-2 - Superpave Mix Design Method

National Cooperative Highway Research Program

NCHRP Report 452 Recommended Use of Reclaimed Asphalt Pavement in the Superpave Mix Design Method, Technician’s Manual

A3.0 DEFINITIONS

The definitions outlined in OPSS.MUNI 1151.03 are specific to this specification.

A4.0 MIX CLASSIFICATIONS

Table 1 of OPSS.MUNI 1151 shall be used to identify the traffic category unless otherwise specified in the Contract Documents. The classes of hot mix asphalt, and the aggregate requirements of the mixes specified by the Owner for the various construction applications, are outlined in Table A-1 of this specification. Table A-1 also includes the Designated Large Sieve (DLS) sizes and allowable maximum percentages of RAP for each mix.

A5.0 ASPHALT CEMENT

Asphalt cement shall conform to OPSS.MUNI 1101.

A5.1 Asphalt Cement Grade

The specified asphalt cement grades for Superpave and SMA mixes are provided in Table A-1. The allowable maximum percentages of RAP in Superpave and SMA mixes are also given in Table A-1.

A change in grade of asphalt binder may be considered if the request is submitted in writing to the Owner prior to paving, and only if the grade of asphalt is at least one grade higher than the original grade submitted with the approved mix design.

A6.0 AGGREGATES

Asphalt aggregates shall conform to OPSS 1001 and OPSS.MUNI 1003.

A6.1 Physical Properties

The physical properties for asphalt fine and coarse aggregates shall conform to the requirements of OPSS.MUNI 1003, Tables 1, 2, 4, 5, 6, and 7.

A7.0 MIX DESIGNS

Mix designs shall be completed by the contractor in accordance with OPSS.MUNI 1151.04.

A7.1 Documentation for Mix Design Submissions

Submission of mix design documentation shall be in accordance with OPSS.MUNI 1151.04. The Owner reserves the right to make the mix design approval contingent upon the successful duplication of the mix design properties by the Owner’s designated QA testing laboratory. Changes in aggregate sources for the approved JMF shall not be made unless approved by the Owner.

A7.2 Design Properties

Superpave and SMA mixes shall conform to the material requirements outlined in OPSS.MUNI 1151.

TABLE A-1 SUMMARY OF MIX TYPES AND AGGREGATE REQUIREMENTS

Mix Type	Typical Use	Acceptable Coarse Aggregate(s) [Note 2]	Acceptable Fine Aggregate(s) [Note 2]	Maximum Allowable RAP Content (%)	Designated Large Sieve (DLS)	Asphalt Cement PG Grade
SP 4.75 (Note 4)	Fine-graded mix used for surface course and levelling course for miscellaneous paving applications suitable for traditional “sand” mixes	100 % crushed Bedrock or crushed Gravel Meeting OPSS 1003 Tables 2 & 6	Manufactured Sand & Asphalt Sand Meeting OPSS 1003 Table 1	15	2.36 mm	PG 58-28J

Mix Type	Typical Use	Acceptable Coarse Aggregate(s) [Note 2]	Acceptable Fine Aggregate(s) [Note 2]	Maximum Allowable RAP Content (%)	Designated Large Sieve (DLS)	Asphalt Cement PG Grade
SP 9.5 (Note 4)	Fine-graded mix used for surface course, padding, and levelling course applicable to low volume roads, parking lots, driveways & local residential roads	Traprock, Dolomitic Sandstone, Meta-Arkose, Diabase, Andesite, and Gneiss Meeting OPSS 1003 Tables 2 & 6	Manufactured Sand and Asphalt Sand Meeting OPSS 1003 Table 1	15	4.75 mm	PG 58-28J
SP 12.5 (Note 4)	All purpose surface course mix for residential roads and mainly car traffic areas	100% Crushed Bedrock or crushed Gravel Material Meeting OPSS 1003 Tables 2 & 6	100% Crushed Bedrock or crushed Gravel Material Meeting OPSS 1003 Table 1	15	9.5 mm	PG 58-28J
SP 12.5 FC1 (Notes 3 and 4)	Surface course mix suitable for major collector and minor arterial roads with mixed car and truck traffic	100% Crushed Bedrock Material Meeting OPSS 1003 Tables 2 & 6	Aggregate Meeting OPSS 1003 Table 1	0	9.5 mm	PG 64-28XJ
SP 12.5 FC2 (Notes 3 and 4)	Premium surface course mix for use on arterial roads with high volumes of truck and bus traffic	100% Crushed Bedrock Material Meeting OPSS 1003 Tables 2 & 6	Aggregate Meeting OPSS 1003 Table 1	0	9.5 mm	PG 64-28XJ
SP 19.0 (Notes 3 and 4)	Binder Course mix for all categories of traffic	N/A	Aggregate Meeting OPSS 1003 Table 1	30	12.5 mm	PG 58-28J (Category A and B) PG 64-28XJ (Category C, D and E)
SP 25.0 & 37.5 (Note 4)	Large stone binder course mixes applicable to situations where minimum lift thicknesses of 60 mm for SP 25.0 and 100 mm for SP 37.5 are required	N/A	Aggregate Meeting OPSS 1003 Table 1	30	19.0 mm for SP 25.0 & 25.0 mm for SP 37.5	PG 58-28J
SMA 9.5 & 12.5 (Notes 3 and 4)	Premium surface course mixes with high frictional properties, rut resistance, water spray reduction, & noise reduction for use on major arterial & Freeway routes	100% Crushed Material from DSM sources (Note 2)	100% Crushed Material Meeting OPSS 1003 Table 1 and from DSM sources [Note 2]	0	9.5 mm	PG 70-28XJ
SMA 19.0 (Notes 3 and 4)	Premium binder course mix with high rut resistance for use on major arterial & Freeway routes	100% Crushed Material from DSM sources [Note 2]	100% Crushed Material Meeting OPSS 1003 Table 1 and from DSM sources [Note 2]	0	12.5 mm	PG 70-28XJ

Note 1. Both the fine and coarse aggregates shall be crushed from the same source of traprock, diabase, dolomitic sandstone, or meta-arkose.

Note 2. Changes in aggregate sources for the approved JMF shall not be made unless approved by the Owner.

Note 3. Meets AASHTO M-320, Extended BBR at -28, DENT and MSCR % Recovery.

Note 4. Meets AASHTO M-332, supplier has not added any of the materials from the banned additive list.

A8.0 QUALITY ASSURANCE SAMPLING AND TESTING

All provisions for quality assurance sampling and testing as outlined in the main specification document shall apply to Superpave and SMA paving projects unless amended herein.

A8.1 Field Sampling

Field samples for quality assurance testing shall be a minimum sample size of 20 kg as given in OPSS 310, Table 6. The sample frequency shall be in accordance with Table 3 of the main body of this specification. The contractor shall determine the method of obtaining QA samples for testing. All QC, QA, and referee samples shall be taken by the contractor and QA and referee samples shall be distributed as outlined in the main body of the specification.

A8.2 Compaction Requirements

The compaction requirements of OPSS 310.08.06 are amended by this section. The Owner shall arrange for asphalt compaction testing during the placement and rolling stage using a nuclear density gauge. The specified allowable compaction is given in Table A-2. The specified compaction is expressed as a percentage of the Maximum Relative Density (MRD), as established from the approved asphalt mix design for the project, and verified by QA testing.

Compaction of a given area of pavement shall be assessed by a minimum of five nuclear density test readings. The pavement area to be assessed should be a maximum of 0.5 lane-km of pavement (i.e. 250 m of 2 lane pavement). The average of at least five nuclear readings for a given area shall be used to assess the compaction against the standards in Table A-2.

Nuclear density test results will be used as a guide to assessing in-place compaction and will not be used to reject the mix compaction. Where compaction results by nuclear gauge do not meet the acceptable range in Table A-2, the contractor may request, or the Owner may elect to initiate the Dispute Resolution set out in Section A12.0 and have cores (minimum 150 mm diameter) taken. Where the average compaction from the core densities is not within the acceptable range, the coring and testing will be at the contractor's expense

Asphalt layer thicknesses that are less than 35 mm shall not be used in the assessment of in-place mix compaction.

TABLE A-2 – ASPHALT COMPACTION SPECIFICATIONS

TYPE OF MIX	SPECIFIED COMPACTION (%)		
	Acceptable	Borderline	Rejectable
Superpave 19.0, 25.0, & 37.5	91.0 – 96.5	96.6 – 97.5	< 91.0 & > 97.5
Superpave 12.5 FC2	92.0 – 97.5	97.6 – 98.5	< 92.0 & > 98.5
All Other Mixes	92.0 – 96.5	96.6 – 97.5	< 92.0 & > 97.5

A9.0 CRITERIA FOR ACCEPTANCE OR REJECTION AND REMOVAL BASED ON IN-PLACE COMPACTION OF MIX

This section of the specification shall only apply to main lane paving operations on full construction projects and/or resurfacing contracts that may include padding and/or a scratch coat of asphalt to provide a levelling course. Where the compaction of the in-place mix by nuclear gauge does not meet the acceptable range requirements of Section A8.0, Table A-2, the final evaluation of the mix compaction shall be based on core densities and the Dispute Resolution as set out in Section A12.0, and the criteria in Table A-2.

The cores shall be tested by a third party laboratory that is CCIL certified and is acceptable to the contractor and the Owner to carry out the core testing.

The cores shall be taken at locations selected jointly by the contractor and the Owner. For any given area in dispute a minimum of five cores shall be taken for compaction determination.

The results of the third party laboratory will be binding on both the Owner and the contractor. Payment for the costs of the coring, testing and core sample delivery will be the responsibility of the contractor if the average of the test results is not within the acceptable compaction range given in Table A-2. If the third party laboratory test results indicate that the average mix compaction is within the acceptable range the costs will be borne by the Owner.

A10.0 AIR VOID ACCEPTANCE CRITERIA

The acceptance criteria for air voids in the compacted asphalt mixture during construction shall be in conformance with OPSS 310.08.05 and as indicated in Table A-3. The air voids on laboratory compacted Superpave and SMA specimens shall be determined on samples taken by the contractor during paving. Where mix air voids are in the borderline range subject to corrective action the Owner may elect to suspend paving operations until an acceptable corrective action plan has been submitted to the Owner by the contractor.

Where mix air voids are in the rejectable range the Owner may elect to have the contractor remove and replace the asphalt at no cost to the Owner.

TABLE A-3 – AIR VOID CRITERIA FOR SUPERPAVE AND SMA MIXES

Mix Type	Specified Air Void Range for Acceptable Asphalt	Borderline Air Void Range for Asphalt Subject to Corrective Action	Air Void Range for Asphalt Subject to Rejection and Removal and Replacement
All Superpave and SMA mixes	3.0 % to 5.0 %	2.0 % to 2.9 % & 5.1 % to 6.0 %	<2.0 % & > 6.0 %

A11.0 DISPUTE RESOLUTION

The following outlines the methodology for resolving disputes regarding asphalt mix compaction based on compaction determined by core densities.

A11.1 Acceptance or Rejection of Mix Compaction Based On Core Densities

Where there is disagreement on the compaction findings by the Owner's designated QA laboratory, the contractor has the option of taking cores. The cores shall be tested by a third party laboratory that is CCIL certified and is acceptable to the contractor and the Owner to carry out the core testing. The core densities and compaction values with respect to MRD shall be determined in accordance with OPSS 310.08.06.03.02.

The cores shall be taken at locations selected jointly by the contractor and the Owner. For any given area in dispute a minimum of five cores shall be taken for compaction determination.

The results of the third party laboratory will be binding on both the Owner and the contractor. Payment for the costs of the coring, testing and core sample delivery will be the responsibility of the contractor if the average of the test results is not within the acceptable compaction range given in Table A-2. If the third party laboratory test results indicate that the average mix compaction is within the acceptable range the costs will be borne by the Owner.

APPENDIX B

RANDOM NUMBER TABLE

.318	.801	.435	.202	.745	.489	.900	.027	.827	.279
.922	.683	.847	.320	.476	.421	.893	.826	.444	.619
.726	.473	.854	.662	.381	.761	.661	.868	.174	.799
.711	.341	.219	.228	.466	.683	.676	.327	.502	.469
.978	.631	.469	.885	.267	.510	.601	.135	.290	.025
.689	.152	.703	.533	.742	.335	.670	.521	.007	.590
.521	.351	.824	.854	.347	.792	.542	.590	.051	.713
.960	.690	.343	.019	.917	.876	.365	.271	.942	.355
.991	.530	.165	.042	.448	.626	.526	.926	.607	.827
.713	.765	.812	.496	.626	.770	.331	.770	.662	.200
.141	.266	.141	.919	.199	.520	.332	.526	.752	.991
.966	.697	.704	.305	.831	.842	.740	.050	.925	.239
.681	.637	.035	.023	.335	.799	.623	.673	.509	.480
.106	.702	.879	.408	.519	.929	.416	.584	.486	.818
.635	.427	.554	.288	.318	.983	.844	.858	.059	.851
.507	.673	.434	.163	.060	.375	.025	.514	.848	.637
.297	.057	.951	.411	.441	.564	.171	.693	.052	.063
.817	.663	.369	.038	.653	.001	.321	.506	.886	.920
.763	.580	.967	.071	.368	.351	.950	.098	.529	.793
.496	.290	.698	.183	.504	.687	.005	.814	.954	.356
.314	.490	.174	.925	.886	.170	.496	.453	.835	.546
.306	.360	.103	.152	.234	.654	.941	.108	.980	.439
.444	.097	.321	.233	.725	.434	.416	.919	.578	.493
.178	.245	.433	.486	.622	.175	.238	.108	.637	.215
.984	.396	.434	.416	.101	.104	.597	.875	.543	.576
.574	.639	.116	.101	.754	.982	.358	.444	.856	.269
.648	.264	.090	.088	.176	.867	.485	.794	.388	.790
.764	.412	.018	.018	.523	.060	.329	.655	.313	.135
.899	.070	.117	.270	.914	.048	.048	.584	.566	.209
.792	.356	.793	.143	.640	.582	.267	.216	.824	.437
.489	.886	.430	.327	.315	.988	.426	.805	.934	.717
.238	.089	.246	.485	.958	.600	.253	.142	.082	.320
.635	.122	.911	.217	.136	.907	.322	.090	.216	.392
.557	.997	.727	.181	.510	.704	.349	.505	.863	.872
.244	.180	.057	.721	.359	.643	.432	.780	.052	.125
.546	.478	.347	.550	.471	.608	.325	.426	.002	.398
.593	.238	.636	.852	.030	.196	.939	.804	.453	.222
.660	.685	.385	.749	.813	.926	.004	.225	.115	.425
.339	.388	.357	.853	.634	.170	.448	.564	.383	.310
.755	.918	.791	.359	.414	.149	.799	.173	.156	.482

.511	.455	.333	.085	.021	.048	.265	.797	.430	.371
.941	.656	.523	.385	.994	.813	.012	.823	.502	.839
.673	.721	.637	.123	.748	.661	.372	.018	.243	.837
.623	.125	.748	.141	.648	.765	.933	.514	.969	.321
.498	.162	.692	.878	.474	.159	.751	.130	.691	.831
.731	.909	.171	.055	.139	.911	.113	.100	.178	.526
.556	.031	.853	.660	.417	.154	.051	.984	.881	.607
.652	.347	.261	.626	.778	.667	.321	.987	.404	.102
.815	.058	.984	.893	.741	.420	.400	.853	.715	.406
.567	.607	.476	.847	.120	.358	.313	.226	.091	.065
.651	.121	.116	.531	.112	.952	.329	.659	.328	.426
.380	.119	.809	.074	.450	.294	.254	.992	.543	.468
.117	.790	.119	.214	.858	.563	.163	.630	.185	.112
.689	.342	.174	.450	.134	.503	.421	.835	.607	.458
.871	.947	.688	.521	.923	.904	.436	.405	.400	.370
.976	.402	.486	.070	.999	.912	.375	.307	.134	.183
.530	.153	.153	.665	.521	.673	.595	.136	.507	.350
.433	.142	.067	.485	.816	.919	.963	.090	.751	.109
.247	.575	.220	.881	.124	.531	.012	.304	.165	.532
.985	.274	.841	.514	.476	.054	.371	.445	.131	.143
.153	.225	.585	.818	.598	.942	.333	.875	.250	.343
.091	.363	.923	.765	.005	.723	.899	.040	.114	.329
.491	.031	.258	.483	.518	.486	.840	.473	.544	.420
.231	.641	.742	.545	.179	.239	.142	.285	.170	.939
.931	.282	.138	.982	.406	.460	.059	.632	.239	.478
.587	.524	.683	.925	.145	.942	.385	.789	.371	.284
.580	.031	.961	.573	.009	.041	.992	.477	.556	.334
.334	.334	.106	.583	.892	.252	.111	.046	.604	.406
.967	.493	.221	.596	.314	.105	.328	.298	.385	.056
.367	.069	.941	.022	.162	.689	.959	.192	.896	.887
.980	.035	.631	.863	.234	.175	.946	.286	.678	.269
.673	.050	.559	.199	.416	.973	.543	.284	.157	.683
.356	.760	.248	.205	.054	.122	.160	.689	.197	.248
.578	.991	.208	.348	.259	.215	.946	.718	.795	.626
.589	.082	.788	.836	.125	.718	.733	.158	.493	.834
.358	.241	.973	.766	.790	.027	.703	.111	.136	.417
.369	.227	.963	.801	.718	.581	.254	.753	.451	.029
.379	.696	.880	.955	.858	.861	.443	.131	.858	.861
.327	.443	.131	.858	.619	.604	.277	.663	.156	.058
.567	.356	.247	.001	.124	.458	.646	.894	.576	.893