

AMENDMENT TO OPSS 1151, APRIL 2021

Special Provision No. 111F13

July 2022

Mix Design Criteria for Hot In-Place Recycled (HIR) Mix

1151.01 SCOPE

Section 1151.01 of OPSS 1151 is amended by the addition of the following:

This specification also covers the requirements for materials, equipment, and processes for proportioning and mixing hot in-place recycled (HIR) mix according to the Superpave mix design methodology.

1151.02 REFERENCES

Section 1151.02 of OPSS 1151 is amended by the addition of the following:

Ontario Provincial Standard Specifications, Construction

OPSS 332 Hot In-place Recycling

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-324 Practice for Hot In-place Recycled Mix Design

ASTM International

D70-21 Standard Test Method for Specific Gravity and Density of Semi-Solid Asphalt Binder (Pycnometer Method)

D92-18 Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester

D1160-18 Standard Test Method for Distillation of Petroleum Products at Reduced Pressure

D2006-70 Standard Test Method for Characteristic Groups in Rubber Extender and Processing Oils by the Precipitation Method

D2007-19 Standard Test Method for Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method

D2170-18 Standard Test Method for Kinematic Viscosity of Asphalts

1151.03 DEFINITIONS

Section 1151.03 of OPSS 1151 is amended by the addition of the following definitions:

Beneficiating HMA means as defined in OPSS 332.

Hot In-place Recycled (HIR) Mix means as defined in OPSS 322.

Hot Milled Material means as defined in OPSS 332.

Job Mix Formula (JMF) means as defined in OPSS 332.

Mix Design means as defined in OPSS 332.

Recovered Asphalt Cement (RAC) means as defined in OPSS 332.

Rejuvenating Agent means as defined in OPSS 332.

1151.04 DESIGN AND SUBMISSION REQUIREMENTS

1151.04.01 Design Requirements

1151.04.01.01 General

Clause 1151.04.01.01 of OPSS 1151 is amended by the addition of the following:

HIR mixes shall be designed using the procedures specified in LS-324.

For HIR mixes, the Superpave materials, mix designs, and the JMF shall be according to the requirements specified in Tables 1, 2, and 3 for the HMA mix type the HIR mix is required to meet as specified in the Contract Documents.

HIR mix designs shall not incorporate RAP from other sources or RST into the HIR mix. HIR mixes may contain up to 100% hot milled material from the Work. Rejuvenating agents shall not incorporate any wax components.

The JMF selected for use shall produce a HIR mix that meets all the requirements as specified in the Contract Documents.

For HIR mixes, the mix properties, the compaction effort, and the aggregate properties as specified in the Contract Documents, shall conform to the requirements for the traffic category specified in Table B. The use of a HIR mix designed with a traffic category different than that specified in Table B shall not be permitted.

The AC recovered from the HIR mix shall be performance graded RAC as specified in Table B. The specified percentage by mass of asphalt cement, AC_{SPEC} contained in the various HIR mix types shall be as specified in Table B.

Beneficiating HMA shall be a HMA designed specifically to be added to the HIR mix in order for the HIR mix to meet the requirements specified in the Contract Documents. The aggregates incorporated into a beneficiating HMA shall meet the requirements of the traffic category specified for the HIR mix the beneficiating HMA is added to as specified in Table B. The AC added to a beneficiating HMA shall be PGAC with the same performance grade as the RAC required for the HIR mix it is added to as specified in Table B. Prior to the use of a performance grade other than that specified in Table B in the beneficiating HMA, written approval shall be obtained from the Contract Administrator.

1151.04.02 Submission Requirements

1151.04.02.01 Mix Design

Clause 1151.04.02.01 of OPSS 1151 is amended by the addition of the following:

For HIR mixes, the following additional information shall be submitted to the Contract Administrator in writing with each HIR mix design:

- a) The amount, name, manufacturer, and supplier of the rejuvenating agent or beneficiating HMA or both, if used;
- b) The hot milling depth to meet the required mix properties and the design lift thickness with a maximum increase in pavement elevation of 15.0 mm;
- c) The mix proportions, gradation, and source of the materials in the beneficiating HMA, if used;
- d) A copy of all calculations that were completed to determine the amount of rejuvenating agent or beneficiating HMA or both, if used;
- e) Test results showing the rejuvenating agent meets the requirements in Table C;
- f) The rejuvenating agent manufacturer's established recommendations for usage including application temperature, safety data sheet, and technical data sheet;
- g) Air void laboratory test results and calculations for the HIR mix; and
- h) A graph of both the high and low temperature RAC performance grades vs rejuvenating agent content for the combined rejuvenating agent, the recovered AC present in the existing pavement, and the new AC in the beneficiating HMA. The graph shall include enough data to determine the relationship between RAC performance grade and rejuvenating agent content such that the amount of rejuvenating agent required to meet the RAC performance grade as specified in the Contract Documents is plotted.
- i) When applicable, a declaration that the percentage of the beneficiating HMA comprising quartzite and dolomitic sandstone aggregates, or combinations thereof, is more or less than 75%.
- j) When applicable, a copy of all calculations and testing done to justify the use of PGAC with a performance grade other than that specified in Table B in the beneficiating HMA.

Each HIR mix design shall only be valid for the section of roadway for which it was designed.

OPSS 1151 is amended with the addition of the following Tables:

B
HIR Mix Design Criteria

HMA Mix Type HIR Mix is Required to Meet	Location in Contract	Traffic Category	RAC Performance Grade	AC_{SPEC} (%)	Range of Beneficiating HMA (%)
*	*	*	*	*	*

[* Designer Fill-Ins for B, See Notes to Designer]

TABLE C
Rejuvenating Agent Requirements

Properties and Attributes	Testing Method	Requirement
Kinematic Viscosity @ 60 °C	ASTM D2170	200 – 4,000 mm ² /s
Specific Gravity	ASTM D70	0.98 – 1.02
Flash Point by Cleveland Open Cup	ASTM D92	204 °C min
Volatility: - Initial Boiling Point (IBP)- - 2% by volume - 5% by volume	ASTM D1160 (10 mm Hg)	150 °C min 190 °C min 210 °C min
Compatibility: (PC/S)	ASTM D2006	0.5 min
Saturates, %w	ASTM D2007	28 max
Asphaltenes, %w	ASTM D2006	7.0 max
Chemical Composition: (PC+A1)/(S+A2)	ASTM D2006	0.4 – 1.0

NOTES TO DESIGNER:

* **Designer Fill-Ins for B**

- In the first column, insert the HMA type the HIR mix is required to meet (Superpave 12.5, Superpave 12.5FC 1, or Superpave 12.5FC 2) as determined by the Regional Geotechnical Section.
- In the second column, insert the location of this HIR mix type. This could be a highway number or a particular feature of the Work, such as paved shoulder.
- In the third column, select and insert the traffic category (A through E) for this Work. It should be the same as the traffic category for the last Contract completed on this roadway as supplied by the Regional Geotechnical Section.
- In the fourth column, indicate the RAC performance grade to be used for acceptance as provided by the Regional Geotechnical Section based on existing RAC performance grade and pre-engineering analysis.
- In the fifth column, indicate the desired percentage by mass of RAC (AC_{SPEC}) as provided by the Regional Geotechnical Section based on existing AC content and pre-engineering analysis.
- In the sixth column, indicate the range of beneficiating HMA to be incorporated into the HIR mix as provided by the Regional Geotechnical Section based on the pre-engineering analysis. This should be a range from x to y where x can be 0% or more and y can be 30% or more.

WARRANT: Always with OPSS 332, Hot In-place Recycling.