

Hot In-Place Recycling

Sample Construction Specification Guideline

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1. Scope

The scope of this sample construction specification guideline is limited and intended to provide general information regarding the design, component material specification, application, inspection, measurement, and payment of Hot In-Place Recycling of bituminous material.

2. Description

The activities associated with this work include heating the existing pavement, scarifying and/or hot milling the existing surface, adding a rejuvenating agent, and mixing, spreading, leveling, and compacting the recycled material. This process is referred to as Hot In-Place Recycled Asphalt Pavement (HIR).

3. Materials

3.1 Asphalt Emulsion

Asphalt emulsion delivered to the project shall be accompanied by a laboratory Certificate of Analysis and any other certifications as deemed necessary or advisable. The asphalt emulsion shall be designated ARA-2P and meet the requirement set forth in Table 1.

Property	Test Procedure	Specification	
	AASHTO	Min	Max
Emulsion Properties			
Residue From Distillation, % ¹	T59	60.0	65.0
Viscosity, Saybolt-Furol, 77°F, seconds	T59	15	100
Oil Distillate, %	T59	-	2.0
Sieve Test, %	T59	-	0.1
Storage, 24 hours, %	T59	-	1.0
Penetration, 4°C, 100 g, 5 seconds, dmm ²	T49	-25%	+25%

1. Modified ASTM D244 procedure – distillation temperature of 177°C with a 20-minute hold. The ASTM D244 vacuum distillation procedure may be substituted once the maximum oil distillate is satisfied.
2. The penetration value will be +/- 25% of that value reported in the project design. Example: if the penetration is reported to be 200 dmm, the acceptable range would be 150-250 when testing QC/QA samples.

3.2 Mix Design

Submit a mix design to the engineer for approval, prior to the start of the project. Perform additional mix designs based on road variability, as directed by the engineer. The mix design procedure and job mix formula (JMF) shall meet the criteria of Table 2.

150mm specimens shall be prepared in a gyratory compactor. The mixture shall meet the following criteria at the selected design asphalt emulsion content:

Property	Criteria	Purpose
Compaction Effort, Gyratory Compactor	30 gyrations, 1.25 angle, 600 kPa stress	Density Indicator
Density, AASHTO T166 or Equivalent	Report	Compaction Indicator
Tensile Strength* AASHTO T283, 77°F	75 lb/in ² min	Stability Indicator
Retained Strength Based on Cured Stability**	80% min	Moisture Damage
Asphalt Pavement Analyzer, AASHTO TP63, 140°F, Wet, 8000 cycles	8mm Maximum	Rut Resistance
Indirect Tensile Test, AASHTO T322	Report	Thermal Cracking

*Cured Strength tested on compacted specimens after 140°F curing to constant weight

** Vacuum saturation of 55 to 75%, water bath 77°F, 24 hours

4. Equipment

4.1 Processing Equipment

4.1.1 Pre-Heating Mechanism

Supply multiple heating devices, under a 24-foot-long adjustable width closed or shielded hood, capable of heating asphalt concrete pavement to a temperature that allows milling to the desired depth without producing undesirable pollutants prior to the heater milling operation.

4.1.2 Heating Milling Unit

This unit shall heat, mill, and windrow the first layer of the pavement that is being processed. This machine shall have automatic grade controls that allow the correct depth of material to be removed. Under some conditions more than one heating and milling machine can be used if needed.

4.1.3 Tunnel Heater

Tunnel heater shall continue the heating process by straddling the windrow of heated milled material created by the first milling heater. This heater shall continue to heat the underlying pavement while straddling the existing windrow of material. More than one tunnel heater could be needed.

4.2 Milling-Mixing-Paving Unit(s)

The milling-mixing-paving unit(s) shall be equipped with two or more telescopic milling heads capable of milling widths up to 15 feet and depths to three inches. These milling heads shall be controlled by automatic grade controls. The milling units shall leave a milled, textured surface on which to lay the recycled material. The milling head units shall be equipped with a metering device that shall deliver the amount of asphalt emulsion in the milling heads, as required by the mix design. The metering device shall deliver the amount of asphalt emulsion to within +/- 0.2% of the required amount by weight of pulverized bituminous material (for example, if the design requires 1.0%, the metering device shall maintain the emulsion content between 0.8% and 1.2%).

The asphalt emulsion pump shall be of sufficient capacity to allow emulsion contents up to 3.0% by weight of pulverized bituminous material. The unit shall be equipped with a paving screed that shall be capable of spreading and laying the recycled, processed material in one smooth, continuous pass. An independent, self-propelled paver having electronic grade and cross slope control for the screed can be used in conjunction with the milling mixing heaters if performance can be demonstrated to the satisfaction of the engineer. The equipment shall be of sufficient size and power to spread and lay the mixture in one smooth, continuous pass according to the plans. This paver will immediately follow the milling/mixing/heater operations. The material temperature shall be a minimum of 190°F immediately behind the paving screed.

4.3 Additive Meter

Asphalt emulsion shall be controlled through metering devices capable of adjusting for the variation in the depth of the pulverized material going into the milling/mixing unit. The metering devices shall be capable of delivering the amount of emulsion to within +/- 0.2% of the required amount by weight of the pulverized bituminous material. Emulsion shall be applied to the milling drums full width during the final pass of the milling-mixing-paving unit.

4.4 Rollers

Rollers shall be in good condition, capable of reversing without backlash, and operable at speeds slow enough to avoid displacement of the recycled mixture. Vibratory rollers shall be equipped with working amplitude and/or frequency controls specifically designed for compaction of the material on which it is to be used. Two double-drum vibratory rollers and one pneumatic tired roller shall be on the project at all times for compaction as directed by the engineer. The vibratory rollers shall have a gross operating weight of not less than 20,000 lbs and a width of 78 inches. All rollers must have properly working scrapers and water spraying systems. Provide sufficient rolling capacity to satisfy the density requirements of this special provision.

5. Construction

5.1 Heating, Milling, and Placement

The existing pavement shall be heated and hot milled to the required depth and width as indicated on the plans. The existing pavement shall be heated and milled a minimum of three times to reach the required depth of treatment. The maximum depth of milling for each individual pass shall be 0.75 inches. Recycling shall be in a manner that does not disturb the underlying material in the existing roadway. The hot recycled material shall be produced through a milling and mixing unit capable of processing the paving material and asphalt emulsion to a homogeneous mixture. The asphalt emulsion shall be incorporated into the hot recycled bituminous material at the initial rate determined by the mix design(s) and approved by the engineer.

Sampling and testing for the mix design and during mixture production may result in varying quantities of asphalt emulsion at various locations of the project to achieve desired design specifications. Asphalt emulsion changes shall be directed by the engineer. The material shall be spread using a screed attached to the milling and mixing unit or a separate paver as described in this special provision. The recycled material shall be spread in one continuous pass, without segregation and to the lines and grades established by the engineer.

5.2 Compaction

Compaction of the recycled mix shall be completed using rollers meeting the requirements of Section 4.4. Rolling patterns shall be established to achieve a maximum density determined by nuclear density testing. Vibratory mode should only be used if it is shown to not damage the pavement. Compact the recycled mix to contain 93 +/- 3% in-place density. The selected rolling pattern shall be followed unless changes in the recycled mix or placement conditions occur and a new rolling pattern is established at that time. Rolling or roller patterns shall change when major displacement and/or cracking of the recycled material are occurring. When possible, ensure pavement is fully compacted before allowing rollers to stand on the pavement. Upon completion of the rolling operations, rollers shall not be parked with drum contact perpendicular to the longitudinal joint.

5.3 Traffic

After compaction of the recycled material, no traffic, including that of the contractor, shall be permitted on the completed recycled material until the material has cooled to 150°F or less. After opening to traffic, the surface of the recycled pavement shall be maintained in a condition suitable for the safe movement of traffic.

5.4 Irregularities

Any damage to the completed milled hot in-place recycled bituminous material shall be repaired by the prime contractor prior to the placement of the wearing course as directed by the engineer.

5.5 Curing

The recycled asphalt surface shall be allowed to cure for a minimum of 24 hours prior to placing the wearing course. The final surface course/treatment shall be applied within 21 days after placement of the recycled mat.

5.6 Weather Limitations

Milled Hot In-Place Recycling operations shall be completed when the atmospheric temperature is 55°F and rising. The weather shall not be foggy or rainy.

6. Quality Control

6.1 Asphalt Emulsion

The sampling rate for emulsion content shall be determined by the engineer. Samples shall be obtained from the shipping trailers prior to unloading into the contractor's storage units. Emulsion content shall be checked and recorded for each segment in which the percentage is changed. The emulsion used shall be checked daily for yield per unit of measure in addition to the calibrated emulsion metering system for correct yield. For reporting purposes, the yield determination shall be used. Emulsion content changes shall be made based upon mix design recommendations for each road segment of varying construction. Adjustments to the JMF asphalt emulsion content shall not be made without the consent of the engineer.

6.2 Mixture Testing

Samples can be gathered for testing mixture results from the design given at the engineer's discretion. Sample preparation and testing protocol shall follow those approved in the submitted design and JMF.

6.3 Recycled Material Compacted Density

A rolling pattern will be established such that a maximum density is achieved with the rollers specified. However, care should be taken not to over-roll the mat based on visual observations of check cracking or shoving. A new rolling pattern shall be established if the material being recycled changes.

7. Measurement

Work as described for this item will be measured by the square yard of the completed sections for the depth specified. The asphalt emulsion will be measured by the ton. Recycled Material Patching will be measured by the ton. Mobilization and traffic control shall be separated bid items from the recycling.

8. Payment

The work performed and materials furnished, as prescribed by this Item and measured as provided under "Measurement," will be paid for at the unit prices bid for "Surface Recycling," and "Asphalt Rejuvenation Agent." Prices shall be full compensation for the removal and processing of the existing pavement; for preparing, hauling, and placing all materials; for all freight involved; for all manipulations, including rolling; and for all labor, tools, equipment, and incidentals necessary to complete the work. Mobilization and traffic control shall be paid lump sum. Asphalt emulsion shall be paid by the ton. Surface Recycling shall be paid by the square yard.