

HOT-IN-PLACE RECYCLE

****From Berlin-Barre City NH SURF(44)/Berlin-Montpelier IM SURF(45)/Hartford-Sharon IM SURF(46)**

- xx. DESCRIPTION. This work shall consist of recycling the existing hot mix asphalt (HMA) pavement surface, including heating the pavement surface using specialized equipment causing the asphalt to soften; scarifying the softened HMA surface in a continuous process to the depth specified in the Contract Documents; mixing the scarified asphalt pavement with a recycling agent that rejuvenates the asphalt; and placing and compacting the mix back onto the roadway.

The work under this Section shall be performed in accordance with these provisions, the Plans, and as directed by the Engineer.

- xx. MATERIALS.

- (a) Recycling Agent. The recycling agent shall be a petroleum-based recycling agent specifically designed as a rejuvenator conforming to the requirements of ASTM D 4552, grades RA25 or ERA25 (an emulsified RA25) and meeting the requirements of Table 1 - Recycling Agent.

Table 1 - Recycling Agent

Test Requirements	Test Method	Minimum	Maximum
Tests on Residue from Distillation			
Viscosity, 60°C, cSt	T 201	901	4500
Flash Point, CSC, °C	T 48	215	-
Saturates, weight, %	D 2007	-	30
Test on Residue from RTFO, 163°C:			
Viscosity Ratio	T 240	-	3
Weight Change, ±, %		-	4
Specific Gravity	T 228	Report	
Saybolt Furol Viscosity @ 25°C, s	T 59 ⁽¹⁾	15	85
Storage Stability, 24 hrs, %		-	1.0
Sieve, %		-	0.1
Cement Mixing, %		-	2.0
Asphalt Content by Evaporation, %		65.0	

⁽¹⁾This testing requirement is only for ERA25.

A Type D Certification shall be furnished in accordance with Subsection 700.02.

- xx. MIXTURE DESIGN. The Contractor shall take a minimum of three cores per lane mile or a maximum of 20 cores per project from the existing HMA pavement from locations that will represent the entire project condition. For each of these cores, the Contractor shall provide descriptive notes of the core locations along with the associated test results showing percent of recovered asphalt content, aggregate

gradation, and original penetration value for each sample. The Contractor shall also determine the required depth, in millimeters, of the loose heater scarified HMA behind the screed unit.

Based on the information provided above, the Contractor shall determine the application rate of the recycling agent such that the minimum average penetration value of the performance-graded (PG) binder in the recycled mixture is 30% higher than the average of the original penetration values as tested in accordance with AASHTO T 49. The final penetration value shall not exceed 100.

xx. EQUIPMENT.

(a) Heating Unit. The heating unit shall generate sufficient heat to soften the asphalt pavement to the depth required. Care shall be taken not to overheat the existing pavement thereby softening the underlying asphalt pavement not to be scarified. The burner assembly shall be adjustable to heat between 2.4 and 4.3 meters in width. The entire heating unit shall be enclosed and vented to contain the heat and prevent damage to adjacent properties and landscape. In cooler temperatures, an additional heating unit may be required.

(b) Heater Scarification Train. This equipment shall be a self-contained machine designed to reprocess only the upper layers of the existing HMA pavement. The heater scarification train shall be self-propelled and capable of operating at speeds of 5 to 15 meters per minute while uniformly heating and scarifying the existing HMA pavement to a minimum depth of 25 mm. Listed below are the various units that are part of the heater scarification train.

(1) Scarifying Unit. In increments of 25 mm, the scarifying unit shall contain at least 2 rows of spring-loaded tines that are adjustable to scarify 2.5 to 4.4 meters wide. This unit shall also be able to conform to the pavement contours to insure a uniform penetration from the tines and prevent damage to utility structures.

(2) Spray Unit. This unit shall be immediately behind the scarifying unit and be capable of applying the recycling agent to the reclaimed asphalt pavement at the approved rate. The size of the nozzles located on the spray bar and pump shall be selected based upon the rate of application and the forward speed of the heater scarification unit. This unit shall be equipped with an electronic digital measuring system, which shall be capable of maintaining the required application rate of the recycling agent with a tolerance of $\pm 5\%$ for the mix design. The electronic digital measuring system shall continuously verify and display the application rate of recycling agent and cumulative total with respect to the volume of scarified material for the road surface.

(a) Calibration. The Contractor shall calibrate the electronic digital measuring system in the presence of the Engineer or designee. Approved calibrations

shall be done for each project. Work shall not progress until the calibration has been completed and verified.

- (3) Mill/Remixer Unit. Immediately following the application of the recycling agent, a dual-drum enclosed milling unit shall mill the asphalt pavement to the depth of the heat, thoroughly mixing the recycling agent with the scarified and milled pavement. The mill/remixer unit shall be an integral part of the scarifying machine and shall be located between the spray unit, which applies the recycling agent, and the screed. This unit shall be operated hydraulically, able to work at variable speeds from 0 rpm to 120 rpm, and shall be retractable from 4.45 to 2.62 meters wide. In addition, this unit shall be able to break in the center to allow for quarter point and crown control.
- (4) Screed Unit. The hot scarified material shall be uniformly distributed to the desired longitudinal and transverse section by the use of an attached heated, augured vibratory screed. Temperature of the hot scarified material shall be maintained at 135°C minimum to 165°C maximum. The screed shall be equipped with an adjustable crown control and each end of the screed shall have hand wheel adjusting screws for providing the desired longitudinal grade and transverse slope.
- (5) Rollers. Rollers shall be in good mechanical condition, capable of reversing without backlash, and operated at speeds slow enough to avoid displacement of the bituminous mixture. The mass (weight) of the rollers shall be sufficient to compact the mixture to the required density without crushing the aggregate. Rollers shall be equipped with tanks and sprinkling bars for wetting the rolls or tires.

Pneumatic-tired rollers shall be equipped with appropriate skirts at all times and be preheated prior to use in order to avoid picking. The Contractor shall remove all picked material from the surface.

Vibratory rollers shall have separate controls for energy and propulsion. They shall be equipped with automatic cutoffs that stop the vibration prior to the roller stopping and/or reversing its direction of travel.

xx. CONSTRUCTION REQUIREMENTS.

- (a) Weather and Seasonal Limitations. Heater scarification shall be allowed only when the surface temperature is 10°C or above.
- (b) Cleaning. The existing pavement and shoulder to be scarified shall be cleaned by using mechanical sweepers, hand brooms, or other effective means until the surface is free of all material which might interfere with the scarification process.

- (c) Heater Scarification. The heating unit shall be operated in such a manner as to prevent damage to adjacent property and vegetation. All heat-damaged areas shall be repaired immediately to the satisfaction of the Engineer and at no additional cost to the State.

The speed of the equipment shall be controlled to ensure that the recycled pavement is properly milled, mixed, and uniformly distributed to the proper thickness, slope, and crown shown in the Contract Documents. Extra care shall be taken in controlling heater scarification equipment to prevent segregation of the recycled mix at the start and end of paving production as well as at any points where the heater scarification train needs to stop and restart.

The pavement shall be constructed to conform to the depth requirements and tolerances shown in the Plans. The width of each pass shall be controlled to provide proper placement of longitudinal joints, including a 75 mm overlap onto adjacent lane passes.

Recycling agent shall be added uniformly to the scarified HMA pavement at the predetermined application rate to produce a homogenous HMA recycled mix.

The temperature of the scarified mixture shall be maintained between 135°C and 165°C prior to initial compaction.

In areas such as catch basins or manholes not accessible to scarifying equipment, the Engineer will determine if they require repair. Pavement surfaces that are in good condition and are less than one square meter in size do not require repair. Areas with cracks or spalls that are greater than one square meter in size shall be repaired as approved by the Engineer at no additional cost to the State.

- (d) Surface Tolerance. The surface will be tested by the Engineer using a straightedge at least 4.9 m in length at selected locations parallel with the centerline. Any variations exceeding 3 mm between any two contact points shall be satisfactorily eliminated. A straightedge at least 3 m in length may be used on a vertical curve. The straightedges shall be provided by the Contractor in accordance with Subsection 631.06.
- (e) Compaction. Compact the recycled mixture in accordance with Subsections 490.14(a) and 490.14(b).
- (f) Scarified Mixture Verification. On the first day of production, two random core locations will be selected by the Engineer for evaluation. Both locations will be within a lane mile or fraction thereof if production is less than one mile. Two 150 mm diameter cores shall be taken from each of these locations and identified by location. The Contractor shall test one core from each location to determine the penetration value of the PG binder recovered from the recycled mixture in accordance with AASHTO T 49. The companion cores shall be submitted to the Engineer and

may be evaluated by the Materials and Research Lab to verify the Contractor's test results.

Test results shall be submitted to the Engineer by end of the next day's production. If test results are not provided, the Engineer may suspend the paving operation until the results are submitted. The penetration values for these cores shall be at least 30% or more than the average original penetration values specified in the Contract Documents but not exceeding a penetration value of 100.

If the average penetration values fail to meet this requirement, production shall be stopped and the application rate adjusted. The new application rate shall be submitted to the Engineer. Once production is stabilized using the new application rate, the Contractor shall take two loose mix samples of the recycled mix at separate locations and test these samples for penetration in accordance with AASHTO T 49. The results shall be submitted to the Engineer by end of the next day's production. The application rate for the recycling agent shall continue to be adjusted until the minimum percentage penetration value is met as determined by the sampling and testing. If the specification requirements are met after the first day's production, samples shall be taken as described above every three days of production for quality control and quality assurance purposes.

If, at any time, the loose mix samples produce test results where average penetration values are greater than 100, the Engineer may request the scarified pavement be removed and replaced at no additional cost to the State. The scarified section to be removed and replaced will be determined by core test results. These cores shall be drilled at no additional cost to the State and are to be submitted to the Engineer for testing at the Materials and Research Lab.

If the existing pavement condition changes or the recycled pavement is not satisfactory, the Engineer may require additional tests performed at no cost to the State. For quality assurance purposes, loose mix samples of the recycled mix may be requested at any time by the Engineer to determine if the application rate being used provides satisfactory test results that meet the minimum percentage penetration value required.

(g) Overlay. The heater scarified HMA pavement can be overlaid once work is completed to the satisfaction of the Engineer. The overlay shall be placed prior to the end of the paving season. This work shall be done under a separate pay item in the Contract Documents.

xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Hot-In-Place Recycle) to be measured for payment will be the number of square meters (square yards) of pavement surface recycled in the complete and accepted work.

xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Hot-In-Place Recycle) will be paid for at the Contract unit price per square meter (square yard). Payment shall be full compensation for cleaning

debris from the existing pavement; providing the recycling agent; heating and scarifying, mixing, paving, compacting, coring, and testing the recycled materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

No deduction will be made in areas such as catch basins or manholes where the scarifying equipment cannot be used.

Furnishing and incorporating the recycling agent will not be paid for separately, but will be included in the unit price bid for Special Provision (Hot-In-Place Recycle).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.675 Special Provision (Hot-In-Place Recycle)	Square Meter (Square Yard)