

**ITEM 402.99      18 - HEATER SCARIFICATION OF HOT MIX ASPHALT (HMA)**

**PAVEMENT**

**ITEM 618.99      18 - RECYCLING AGENT**

**DESCRIPTION**

This work shall consist of recycling the existing hot mix asphalt (HMA) pavement surface. The HMA pavement surface is heated using specialized equipment causing the asphalt to soften. In a continuous process, the softened HMA surface is scarified to a specified depth as detailed in the Contract documents. The scarified asphalt pavement is then mixed with a recycling agent that rejuvenates the asphalt. This mix is then placed and compacted back onto the roadway. All work under this item shall be in accordance with the Standard Specifications and as detailed in this specification.

**MATERIALS**

- 1. Recycling Agent.** Use ASTM D 4552, Standard Practice for Classifying Hot-Mix Recycling Agents, grades RA25 or ERA25 (an emulsified RA25) petroleum-based recycling agents specifically designed as a rejuvenator meeting the requirements outlined in Table 1 – Recycling Agent. At the start of production and during, supply certified test results and documented quantities to the Engineer for each shipment of recycling agent. Acceptance of this material is based on a signed Manufacturer's Certification stating conformance to this specification. The use of any other grade of recycling agent requires prior approval from the Director, Materials Bureau. A 2-week notice is needed for this approval.

**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  |                     | 15      | 85      |
| Storage Stability, 24 hrs, %       |                     | -       | 1.0     |
| Sieve, %                           | T 59 <sup>(1)</sup> | -       | 0.1     |
| Cement Mixing, %                   |                     | -       | 2.0     |
| Asphalt Content by Evaporation, %  |                     | 65.0    |         |

1. This testing requirement is only for ERA25.

- 2. Mixture Design.** The Regional Materials office will take a minimum of three cores per lane mile or a maximum of 20 cores per project from the existing HMA pavement to be analyzed by the Department. These cores will be taken from locations that will represent the entire project condition. Provided in the Contract documents is the following information:

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- Descriptive notes of the core locations along with their test results showing percent of recovered asphalt content, aggregate gradation, and original penetration value for each sample.
- The depth of existing HMA pavement to be scarified in millimeters.

Based on the information provided above, 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, Penetration of Bituminous Materials. The final penetration value shall not exceed 100. The Contractor may request to take additional cores from the existing HMA pavement to determine the mixture design. A 2-week notice shall be given to the Regional Materials Engineer requesting permission for coring.

### **3. Equipment**

- Heating Unit – This 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.
- 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 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 determined by the approved 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

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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.

**Calibration.** Calibrate the electronic digital measuring system in the presence of the Regional Materials Engineer or designee. A minimum 2-week notice is required when scheduling this calibration. Approved calibrations shall be done for each project. Work shall not progress until the calibration has been completed and verified.

3. Mill/Remixer Unit (Optional) – 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.
- Rollers – Shall meet §402-3.04, Rollers in the Standard Specifications.

CONSTRUCTION DETAILS

§402-3, Construction Details applies except as modified below:

1. **Weather and Seasonal Limitations:** Heater scarification is allowed only when the surface temperature is 10°C or above.
2. **Cleaning:** Clean the existing pavement and shoulder to be scarified by using mechanical sweepers, hand brooms, or other effective means until the surface is free of all material, which might interfere with scarification process.
3. **Heater Scarification:** Operate the heating unit in a manner to prevent damage to adjacent property and vegetation. Repair all heat-damaged areas immediately, at no additional cost to the Department.

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Control the speed of the equipment to ensure that the recycled pavement is properly milled, mixed, and uniformly distributed to the proper thickness, slope, and crown shown on the Contract plans. Construct the pavement so that it conforms to the requirements of Sections 402-3.10, Surface Tolerance and 402-3.11, Thickness Tolerance, of the Standard Specifications. Control the width of each pass to provide proper placement of longitudinal joints including a 75 mm overlap onto adjacent lane passes.

Add recycling agent uniformly to the scarified HMA pavement at the predetermined application rate to produce a homogenous HMA recycled mix.

Maintain the temperature of the scarified mixture 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.

4. **Compaction:** Compact the recycled mixture in accordance with §402-3.07, D., 80 Series Compaction Method.
5. **Scarified Mixture Verification:** On the first day of production, the Engineer will select two random core locations for evaluation. Both locations will be within a lane mile or fraction thereof if production is less than one mile. Drill two 150-mm diameter cores from each of these locations and identify each core by its location. 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. Provide the companion cores to the Engineer, which may be evaluated by the Department's Lab to verify test results.

Submit these test results to the Engineer by end of the next day's production. If test results are not provided, the Engineer may shutdown 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 penetration values fail to meet this requirement, stop production, and adjust the application rate. Submit the new application rate to the Engineer. Once production is stabilized, using new application rate, take two loose mix samples of the recycled mix at separate locations and test these samples for penetration in accordance to AASHTO T 49. Submit these results to the Engineer by end of the next day's production. Continue to adjust the application rate for the recycling agent until the minimum percentage penetration value is met as determined by the sampling and testing provided.

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Should these penetration values be 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 Department's Lab for testing.

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 anytime by Engineer, to determine if the application rate being used provides satisfactory test results that meet the minimum percentage penetration value required.

- 6. **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.

**METHOD OF MEASUREMENT**

Heater Scarification of Hot Mix Asphalt (HMA) Pavement – This work will be measured as the number of square meters of pavement surface recycled as detailed in this specification.

Recycling Agent – The quantity to be measured for payment will include the number of liters incorporated in the work, measured at a temperature of 16°C, as detailed in this specification.

**BASIS OF PAYMENT**

Heater Scarification of Hot Mix Asphalt (HMA) Pavement – The unit price bid per square meter for this item shall include the cost of all labor, tools, equipment, and incidentals necessary to satisfactorily complete the work including cleaning debris from the existing pavement, heating and scarifying, mixing, paving, compaction, and coring and testing of the recycled materials. No deduction will be made in areas such as catch basins or manholes where the scarifying equipment cannot be used.

Recycling Agent – The unit price bid per liter of recycling agent shall include the cost of all labor, material, and equipment necessary to complete the work satisfactorily.

Payment will be made under:

| <b>Item No.</b> | <b>Item</b>  | <b>Pay Unit</b> |
|-----------------|--|-----------------|
| 402.99 18       | Heater Scarification of Hot Mix Asphalt (HMA) Pavement | Square Meter    |
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