



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0016

Paul R. LePage
GOVERNOR

David Bernhardt
COMMISSIONER

February 1, 2018
Subject: Pavement Milling, Hot
In-Place Recycling, HMA Overlay
with Safety Improvements
State WIN: 020884.00
Location: **Wesley, T24 MD BPP,
T30, MD BPP, T26 ED BPP &
Day Block Township
Amendment No. 1**

Dear Sir/Ms.:

Please make the following changes to the Bid Documents:

In the Bid Book:

REMOVE pages 65 – 72, SPECIAL PROVISION - SECTION 312 - HOT IN-PLACE RECYCLING, 8 pages, dated January 11, 2018, and **REPLACE** with the attached, revised SPECIAL PROVISION - SECTION 312 - HOT IN-PLACE RECYCLING, 8 pages, dated January 31, 2018.

The following questions have been received:

Question: Recycling Agent – The spec calls for an RA25 or ERA25, however, there is language that suggests a substitute may be considered by the Department as was the case for last year's project. If a substitute is proposed what will the Department expect for material testing as part of the proposal?

Response: The Department would consider the use of other rejuvenating agents such as rejuvenating oils or softer asphalt binders if it is shown the addition of these rejuvenators are capable of softening the existing pavement binder properties to the desired levels and the proposed rejuvenator can be introduced in a controlled, uniform manner. This additional language was left in the specification after reviewing technical documents developed by the Asphalt Recycling and Reclaiming Association (ARRA) and FHWA, as well as speaking to other Transportation Agencies that have utilized other rejuvenators successfully. If a change in rejuvenator type is proposed the appropriate design and test methods for the rejuvenator type shall be required before approval is given.



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Question: Recycled Depth – If cores are to be taken after compaction for depth verification, what is the minimum compacted depth the Department is looking for?

Response: The Department expects a final treated, compacted averaged layer depth of 1.5 inches.

Question: Is the depth to be treated 1.5” loose or compacted?

Response: The Department expects the Contractor to heat, scarify, add rejuvenators, blend and place sufficient material to produce a 1.5 inch averaged compacted layer depth.

Question: Is a rubber tire roller required if the operation uses a “mill head” system?

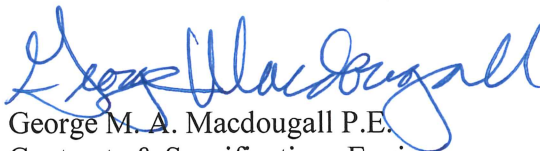
Response: Yes. The Department has added the requirement to use a pneumatic roller to aid in compaction and tighten the surface texture of the HIPR pavement. The addition was made after reviewing technical documents developed by the Asphalt Recycling and Reclaiming Association (ARRA) and FHWA, as well as speaking to other Transportation Agencies that have performed this process successfully.

Question: What does the Department mean by an “enclosed auger” system?

Response: The reference to the “enclosed auger” was made in error. Clarification has been made in a revised Special Provision.

Consider these changes and information prior to submitting your bid on **February 7, 2018**.

Sincerely,



George M. A. Macdougall P.E.
Contracts & Specifications Engineer

SPECIAL PROVISION
SECTION 312
HOT IN-PLACE RECYCLING

312.01 Description This work shall consist of hot in-place recycling (HIPR) the existing hot mix asphalt (HMA) surface layers in a continuous multi-step process of heating, scarifying, remixing and blending with an added rejuvenator, the reshaping, and compacting of the recycled blended mixture to the depths, lines, grades, and dimensions shown on the plans or established by the Department.

MATERIALS

312.020 Recycling Agent A recycling agent meeting the requirements of ASTM D 4552 grades RA25 or ERA25 (an emulsified RA25) petroleum-based recycling agents specifically designed as a rejuvenator meeting the requirements outlined in Table 1. The Department may consider an equivalent recycling agent as requested by the Contractor prior to the beginning of production. The Contractor shall provide written request of the change to the Department 30 days prior to the scheduled recycling start date; the Department reserves the right to reject the requested change. At the start of production and during, the Contractor shall provide certified test results and documented quantities to the Resident for each shipment of recycling agent. Acceptance of this material is based on a signed Manufacturer’s Certification stating conformance with this specification or a Department approved alternative. The use of any other grade of recycling agent requires prior approval from the Department.

Table 1 – Recycling Agent Requirements

Test Requirements	Test Method	Minimum	Maximum
Tests of Residue from Distillation:			
Viscosity, 140°F, cSt	T 201	901	4500
Flash Point, CSC, °F	T 48	215	-
Tests on Residue from RTFO, 325°F:			
Viscosity Ratio	T 240	-	3
Weight Change, ±, %		-	4
Specific Gravity	T 228	Report	
Saybolt Furol Viscosity @ 77°F, 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

EQUIPMENT

312.030 The HIPR train consists of 1 or more preheater units, a main recycling unit with a conventional free floating, power extendible paver screed, 1 steel drum vibratory roller and 1 pneumatic tire roller (see 312.037 Rollers). The Contractor shall utilize equipment having the capability to heat, scarify, blend and process the existing pavement to produce a treated, finished and compacted layer depth of 1.5 inches. The heater assembly shall be adjustable to heat between 8 feet and 14 feet in width. The entire heating unit shall be enclosed to contain the heat and vented in a manner to prevent damage to adjacent pavement, structures and landscape.

312.031 Preheater Units The self-contained units shall generate sufficient heat to soften the asphalt pavement to the depth required. Precautions must be taken not to overheat the existing pavement thereby softening the underlying asphalt pavement layers not to be scarified. The preheating machines shall be self-propelled and completely self-contained units capable of operating at speeds from 10 feet to 25 feet per minute while uniformly heating the existing surface of the asphalt. The burner assembly shall be adjustable to heat between 8 feet and 14 feet in width. The entire heating unit shall be enclosed and equipped with skirting to contain the heat and vented in a manner to prevent damage to adjacent properties and landscape.

The heating units shall consist of multi-rows of burners or an enclosed radiant heat unit of a type specifically designed for and capable of producing heat equivalent to 48 million BTUH; LPG will be used for the heating fuel in compliance with the State of Maine's standard Air Pollution Control Laws. The BTUH production rate is based upon heating 12 feet wide. If the Contractor opts to use a burner system, the burners shall be located on the front of the heater boxes spaced no more than 10-inches apart to achieve proper heat penetration at the required temperature while causing no injury due to overheating the asphaltic surface.

The entire heating unit assembly shall be so designed so that it may be raised or lowered by a single control and capable of articulation. The heater assembly shall be adjustable in width from 8 feet to 14 feet. The entire heating unit shall be enclosed and vented to contain the heat and prevent damage to plant material or any structures along the roadway. Each unit shall be equipped with an on-board water system sufficient in size to be used to adequately reduce the temperature of the exhaust in the venting system thereby preventing desiccation of trees and shrubs by evapotranspiration due to high heat. Hand hoses with adjustable nozzles will be placed on each unit to allow for pre-wetting of specific plants or objects.

312.032 Heater-Scarifier The heater-scarifier machine shall be a self-contained machine specifically designed to reprocess upper layers of existing asphalt pavements. The heater-scarifier machine shall be a self-propelled and completely self-contained unit capable of operating at speeds from 10 feet to 25 feet per minute while uniformly heating the pavement to the required depth, scarifying, applying rejuvenator, mixing, and screeding the reheated pavement the required depth at the required temperature of 275 - 330°F.

The heating unit shall consist of multi-rows of burners or an enclosed radiant heat unit of a type specifically designed for and capable of producing heat equivalent to 48 million BTUH; LPG will be used for the heating fuel in compliance with the State of Maine's standard Air Pollution Control Laws. The BTUH production rate is based upon heating 12 feet wide. For a burner system, the burners shall be located on the front of the heater boxes spaced no more than 10-inches apart to achieve proper heat penetration at the required temperature while causing no injury due to overheating the asphaltic surface. The entire heater assembly shall be so designed so that it may be raised or lowered by a single control and capable of articulation. The heater assembly shall be adjustable in width from 8 feet to 14 feet. The entire heating unit shall be enclosed and vented to contain the heat and prevent damage to plant material or any structures along the roadway. The entire heating unit shall be equipped with a skirting or shield system so that the flames do not damage any adjacent pavement, structures and landscape. The skirting shall be adjusted to minimize the visibility and exposure of the heat and flames to traffic. All equipment shall conform to Federal, State and local DOT and Fire Marshall regulations, and laws relative to the transportation of LPG.

312.033 Scarifying Unit The scarifying unit consists of no less than 2 rows of spring loaded, carbide tipped teeth capable of complete penetration into the layer being treated. They shall be adjustable in total width from 8 feet to 14 feet, spaced in increments of 1 inch and constructed in 1 foot sections to conform to the pavement contour to insure penetration of the teeth and prevent damage to utility structures. The scarifier teeth shall be adjustable to account for wear, and shall be maintained to supply consistent, uniform pressure at each tip onto the surface being recycled.

312.034 Spraying Unit An application of a polymer modified rejuvenator shall be applied to the remixed material during the scarifying process. 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. The tank on the machine shall be heated, and the heating unit on the storage tank for rejuvenator shall be thermostatically controlled to maintain an even specified temperature. This unit shall be equipped with an electronic digital measuring system, which shall be able to maintain 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. This device will be calibrated to show gallons used to the nearest tenth. The Contractor shall calibrate the electronic digital measuring system in the presence of the Resident or designee. Approved calibrations shall be done for each project. Work shall not progress until the calibration has been completed and verified. Material type or methods of introduction that result in bleeding, streaking, fat spots, or excessive softening of the recycled material shall be replaced or modified immediately before work progresses.

312.035 Mill/Remixer Unit Immediately following the application of the recycling agent, the Contractor shall thoroughly mix the rejuvenating agent with the scarified material to the required depth. This process shall be completed with the use of a dual-drum enclosed mill head and tines configured in a manner to perform proper and continuous blending. This remixer system shall be an integral part of the scarifying machine and shall be located between the rejuvenator spraying system and the screed. The supplied unit shall be extendible from 8 feet to 14 feet wide. In addition, this unit shall be able to break in the center to allow for quarter point and crown control. The dual-drum enclosed mill unit shall be operated hydraulically and able to work at variable speeds from 0 rpm to 120 rpm. Equipment, material type, or methods that result in bleeding, streaking, fat spots, or excessive softening of the recycled material shall be removed, replaced or modified immediately before work progresses. Should defects continue the contractor shall stop work until it can be demonstrated that the work can be accomplished with existing, modified or replacement equipment, materials or methods.

312.036 Screed The heated, remixed scarified material shall be uniformly distributed to the desired longitudinal and transverse section by utilizing augers mounted in front of a heated, free floating, power extendible vibratory screed. Temperature of the hot scarified material shall be maintained at 275°F minimum to 330°F maximum. The screed shall be equipped with an adjustable crown control, adjustable extensions that allow for differing lane or shoulder break points, and each end of the screed shall have hand wheel adjusting screws for providing the desired depth, longitudinal grade and transverse slope.

312.037 Rollers All rollers shall conform to this specification and the requirements of Section 401.10 - Rollers.

MIX DESIGN

The Contractor 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. These cores will be taken 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 determine the application rate of the recycling agent such that the penetration value of the recovered binder from the loose mix samples taken during the heater scarification process is at least 30% or more of the average penetration value of the recovered asphalt binder from existing pavement cores. Testing of all samples for the penetration values required during production shall be performed in accordance with AASHTO T 49.

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 Resident requesting permission for coring. 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 asphalt 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. After a test strip has been completed or as the work progresses, it may be necessary for the Resident to make necessary adjustments to the mix design.

CONSTRUCTION REQUIREMENTS

312.04 Weather Limitations Any HIPR work shall be performed when;

- a. HIPR operations will be allowed between May 15th and September 15th inclusive in Zone 1 - Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais.
- b. The atmospheric temperature, as determined by an approved thermometer placed in the shade at the recycling location, is 50⁰F and rising.
- c. When there is no standing water on the surface.
- d. During generally dry conditions, or when weather conditions are such that proper heating, scarifying, adding, mixing, and placement can be obtained using proper procedures, and when compaction can be accomplished as determined by the Resident.
- e. When the surface is not frozen and when overnight temperatures are expected to be above 32°F.

312.05 Surface Tolerance The complete surface of the HIPR course shall be shaped and maintained to a tolerance, above or below the required profile or cross sectional shape, of $\frac{3}{8}$ -inch in 12 feet. The Contractor may, at their option, add HMA meeting the requirements of an approved MaineDOT 50 gyration JMF to any take-off areas to aid in meeting the surface tolerance requirements. The nominal maximum aggregate size shall match the predominant nominal maximum aggregate size of the existing pavement surface. Areas found to exceed $\frac{3}{8}$ -inch will require corrective action by means of milling, or placement of HMA shim. Any areas requiring corrective action will not be paid for directly, but will be considered incidental in the 312.20 unit price.

312.06 HIPR Recycling Procedure The Contractor shall blend the milled asphalt pavement and rejuvenating agent to produce a homogenous HMA recycled mix. The Contractor shall use the application rates of the rejuvenator as determined by the mix design. The Contractor shall be responsible for cleaning the existing pavement and shoulder to be hot in-placed recycled by using mechanical sweepers, hand brooms, or other effective means until the surface is free of all material which might interfere with the milling process. The existing pavement shall be heated, scarified and mixed to a depth of 1.5 inches.

The heating system shall be regulated so that excessive heating and burning of the asphaltic surface does not occur. The existing surface shall be radiantly heated and no open flame shall be permitted. The Contractor shall be responsible to repair any heat-damaged areas immediately at no additional cost to the Department. Under no circumstances shall the scarifying teeth penetrate the existing base. The heated polymer modified rejuvenator shall be applied immediately in a uniform, continuous pattern over the area to be treated following the scarifying teeth. The polymer modified rejuvenator is specifically formulated for use with the hot in-place recycling, and therefore, shall not be substituted unless approved by the Department. The hot scarified material shall then be milled/remixed immediately following the application of the recycling agent to eliminate premature compaction of the hot recycled asphalt, resulting in final differential compaction to the desired longitudinal and transverse section by the use of an attached, free floating, heated, auger fed screed.

The Contractor shall 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 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 Contractor shall control the width of each pass to provide proper placement of longitudinal joints including a 3-inch overlap onto adjacent lane passes. At all manholes, valve boxes, etc., the finished grade of the heater-scarifying process shall be transitioned to blend into the existing grade.

Equipment, material type, or methods that result in bleeding, streaking, fat spots, or excessive softening of the recycled material, shall be removed, replaced, or modified immediately before work progresses. Should defects continue, the contractor shall cease work until it is demonstrated that the work can be accomplished with existing, modified or replacement equipment, materials or methods and approved by the Department.

312.07 Compaction The Contractor shall compact the mixture using a minimum roller train consisting of 10-ton vibratory roller and 12-ton pneumatic tire roller. Generally, the 10-ton vibratory roller will initially compact the recycled layer, followed by the pneumatic roller. The Contractor may change the sequence of rollers if it results in more uniform density, or improved ride quality. Compaction of the mixture shall be in accordance with Section 401.16. The processed material shall be compacted to a minimum density of 98% of the target density as determined in the test strip. The temperature of the scarified mixture shall be maintained between 275°F and 330°F prior to initial compaction.

TESTING REQUIREMENTS

312.08 Quality Control The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the contract requirements. The QCP shall meet the requirements of Section 106.4 - Quality Control and this Section. The Contractor shall not begin recycling operations until the Department approves the QCP in writing.

Prior to performing any recycling process, the Department and the Contractor shall hold a Pre-recycle conference to discuss the recycling schedule, type and amount of equipment to be used, sequence of

operations, and traffic control. A copy of the QC random numbers to be used on the project shall be provided to the Resident. All field supervisors including the responsible onsite recycling process supervisor shall attend this meeting.

The QCP shall address any items that affect the quality of the Recycling Process including, but not limited to, the following:

- a. Make and type of all HIPR equipment to be utilized by the Contractor.
- b. Description of heating system – Radiant Heat or Burner System – including the heating equivalency.
- c. The auger/mill/remixing system – enclosed auger, mill or mixing tines– Including drum speeds, operation, & tine type, spacing, and formation.
- d. Project-specific HIPR mix design.
- e. Method for eliminating / reducing damage to adjacent property and landscape from the HIPR process (prewetting, etc.).
- f. Make and type of rollers including weight, weight per inch of steel drums, and average contact pressure for pneumatic tired rollers.
- g. Proposed roller patterns to achieve density.
- h. Testing Plan.
- i. Recycling operations including recycling speed, methods to ensure that the required 1.5-inch treatment depth is obtained, segregation is minimized plus screed finishing and compacting operations.
- j. Methods for protecting the finished product from damage and procedures for any necessary corrective action.
- k. Method of grade control checks.
- l. Examples of Quality Control forms.
- m. Name, responsibilities, and qualifications of the Responsible Onsite Recycling Supervisor experienced and knowledgeable with the process.
- n. A note that all testing will be done in accordance with AASHTO and MAINEDOT/ACM procedures.

The Project Superintendent shall be named in the QCP, and the responsibilities for successful implementation of the QCP shall be outlined. The Contractor shall sample, test, and evaluate the HIPR process in accordance with the following minimum frequencies:

MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Density	1 per 1000 feet / lane	ASTM D 2950
Air Temperature	4 per day at even intervals	
Surface Temperature	At the beginning and end of each days operation	
Yield of recycling agent used	1 per 1000 ft/lane	
Penetration of recovered PG binder of recycled mixture	At the end of the first day of operation and 1 per 10000 ft/lane thereafter	AASHTO T 49

The Contractor will be required to determine the penetration of the PG binder recovered from the recycled mixture in accordance with AASHTO T 49 at the frequency established above. The mix design for the HIPR

process may be adjusted if the penetration value is not more than 30% greater than the average original penetration value used in mix design or the penetration value exceeds 100.

The Department may view any QC test and request a QC test at any time. The Contractor shall submit all QC test reports and summaries in writing, signed by the appropriate technician, to the Department's onsite representative by 1:00 P.M. on the next working day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make all test results, including randomly sampled densities, available to the Department onsite.

The Contractor shall cease recycling operations whenever one of the following occurs:

- a. The Contractor fails to follow the approved QCP.
- b. The Contractor fails to achieve 98 percent density after corrective action has been taken.
- c. The finished product is visually defective, as determined by the Resident.
- d. The computed yield differs from the mix design by 10 percent or more.
- e. The QC penetration values are not at least 30% or more than the average original penetration values specified in the mix design.
- f. The QC penetration values exceed 100.
- g. The recycled layer depth varies more than 1/4" across the mat when checked behind the screed, prior to compaction.
- h. The Contractor does not achieve the specified final treated, compacted average depth of 1.5-inches.

Recycling operations shall not resume until the Department approves the corrective action to be taken.

Recycling Layer Depth The Department may request at any time during recycling operations that the Contractor cut cores to determine the depth of the treated layer. A minimum of three core locations per 300 feet in length of a full lane-width (or a half-road width) with a maximum of 9 cores per 1000 feet shall be randomly determined by the Department. Should the Department determine that the Contractor has not met the specified average depth, the Contractor shall be permitted to make corrections over an additional 300-foot section and three additional cores shall be cut. Recycling Operations shall cease if the Contractor cannot achieve the specified average depth after the completion of the 300-foot section and shall not resume until the Department approves the corrective action to be taken. No additional costs will be associated with this work, but will instead be considered incidental to the 312 Item.

312.10 Test Strip The Contractor shall assemble all items of equipment for the HIPR operation on the first day of the recycling work. The Contractor shall construct a test strip for the project at a location approved by the Resident. The Responsible Onsite Recycling Supervisor will work with Department personnel to determine the suitability of the mixed material, moisture control within the mixed material, and compaction and surface finish. The test strip section is required to:

- a. Demonstrate that the equipment and processes can produce recycled layers to meet the requirements specified in these special provisions.
- b. Verify the percent recycling agent is sufficient to compact the HIPR material.
- c. Determine the sequence and manner of rolling necessary to obtain the compaction requirements and establish a target density.

The test strip shall be conducted when the atmospheric temperature, as determined by an approved thermometer placed in the shade at the recycling location, is 50 °F and rising. The test strip shall be at least

300 feet in length of a full lane-width (or a half-road width). HIPR production will not start until a passing test strip has been accomplished. If a test strip fails to meet the requirements of this specification, the Contractor will be required to repair or replace the test strip to the satisfaction of the Resident. Any repairs, replacement, or duplication of the test strip will be at the Contractor's expense.

The test strip shall then be rolled using the specified compaction equipment as directed until the density readings show an increase in dry density of less than 1 pcf for the final 4 passes of each roller. The Contractor and Department will each determine a target density by using their respective gauges, performing several additional density tests and calculating their respective averages. These averages will be used as the target density of the recycled material for QC/QA testing.

Once the test strip is compacted, the Contractor shall cut three 6-inch diameter cores at no additional cost to the Department. Core locations will be randomly determined by the Department within the test strip area. These cores will be used to determine if the final treated, compacted layer meets the Contract Requirements. Should the Contractor not meet the specified average depth, an additional 300-foot test strip shall be constructed. Recycling Operations shall cease if the Contractor cannot achieve the specified average depth after the completion of the second test strip and shall not resume until the Department approves the Contractor's written corrective action plan.

Following completion of the test strip, compaction of the material shall continue until a density of not less than 98 percent of the test strip target density has been achieved for the full width and depth of the layer. During the construction and compaction of the HIPR base, should three consecutive Quality Control test results for density fail to meet a minimum of 95 percent of the target density, or exceed 102 percent of target density, a new test strip shall be constructed.

312.11 Method of Measurement HIPR material will be measured by the square yard.

312.12 Basis of Payment The accepted quantity of HIPR material shall be paid for at the contract unit price per square yard, complete in place to the specified limits, which price shall be full compensation for furnishing all equipment and labor for heating, scarifying, blending, milling, placing, grading, compacting and for all incidentals necessary to complete the work.

Payments will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
312.20 Hot In-Place Recycling	Square Yard