| TYPE | YEAR | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| RESURF. | 2014 | HSIP-211(13) | 4B |

SPECIAL NOTES REGARDING

HOT IN PLACE RECYCLED ASPHALT- REMIX PROCESS

## DESCRIPTION:

This work shall consist of Hot In Place Recycling of the existing bituminous pavement in a continuous multi-step process of heating, scarifying or milling, remixing, blending of the dislodged material with an asphalt rejuvenating agent, spreading, reshaping, leveling, and compacting the asphalt pavement. All work shall be performed in accordance with the Standard and Supplemental Specifications, 407 except as modified herein and in reasonably close conformity to the lines and grades shown on the plans or as directed by the engineer.

## MATERIALS:

An asphalt rejuvenating agent with 3% polymer (ARA-3P) shall be uniformly dispersed and blended into the hot recycled material at a rate between 0.10 to 0.30 gallons per square yard. The exact rate shall be determined by TDOT based on the in situ volumetrics and/or stiffness of the asphalt pavement. The Contractor shall provide and deliver samples of the proposed ARA-3P to the Regional Lab at least 21 days prior to beginning the work in order for tests to be performed and completed. Submitted samples will also be used to perform verification test on the properties of the material.

The ARA-3P shall be capable of increasing the ductility and lowering the viscosity of the asphalt binder in the existing pavement to be recycled. The ARA-3P shall be composed of a polymer modified asphalt emulsion containing a minimum of 3.0% SBS polymer blended to an asphalt base stock. The polymer modified base stock shall be further blended with process oils and other additives before emulsification to achieve the desired finished product properties.

The Producer/Supplier shall manufacture the ARA-3P in compliance with TDOT Standard Operating Procedure (SOP) 3-2, Certified Supplier Requirements. The manufacture shall issue with each load a manufactures certification and certified weight using TDOT form DT-0293 Emulsion. A unit weight (pounds per gallon) shall be included with each certification.

Material unused in storage tanks shall be transferred into tankers for re-weighing. Certificated weights less reweights shall be comparable to the accumulated gallons used that are provided by the Contractor.

The ARA-3P material shall meet the following requirements;

| PROPERTY | METHOD | Min. | Max. |
|---|---|---|---|
| Viscosity @ 25°C, Sec | AASHTO T-59 | 15 | 100 |
| Sieve Test, % | AASHTO T-59 | | 0.10 |
| 24-Hour Storage Stability, % (Note 1) | AASHTO T-59 | | 1.0 |
| Residue by Distillation, % (Note 2) | AASHTO T-59 | 60 | |
| Oil Distillate, % by Volume | AASHTO T-59 | | 2.0 |
| Particle Charge | AASHTO T-59 | Positive | |
| Pump Stability Test @ 140°F (Note 3) | TM 101 | 3 Passes | |

**TEST ON EMULSION FROM PUMP STABILITY TEST**

| | | | |
|---|---|---|---|
| Sieve Test, % | ASTM D244 | | 0.10 |

**TEST ON RESIDUE FROM DISTILLATION: (Note 2)**

| | | | |
|---|---|---|---|
| Solubility in TCE, % (Note 4) | ASTM D2042 | 97.5 | |
| Elastic Recovery @ 4°C, % (Note 5) | AASHTO T-301 | 58 | |
| Penetration @ 4°C, 100 g, 5 sec, dmm | ASTM D5 | 60 | 150 |
| Asphaltenes, % (Note 6) | KT-MR20 | | 25 |

Note 1: After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.
Note 2: 1 Use distillation temperature of 350°F with a 20 minute hold.
Note 3: TM 101 is identified within these specifications or plan notes.
Note 4: ASTM D5546, "Test Method for Solubility of Polymer-Modified Asphalt Materials in 1,1,1-Trichloroethane" may be substituted where polymers block the filter in Method D2042.
Note 5: The elongation is 20 cm, the test temperature is 4°C and the relaxation time is 5 minutes.
Note 6: KT-MR20 is identified within these specifications or plan notes.

Other ARAs may be submitted for consideration of use in lieu of the above. The request must be in writing and approved by the Engineer. All tests must be completed for certification of material by supplier and test results must accompany delivered material.

## CONSTRUCTION REQUIREMENTS:

### A. EQUIPMENT

All equipment necessary for the satisfactory performance of this work shall be on hand and approved prior to the beginning of construction. Processing equipment shall be capable of uniformly heating the existing pavement, homogenously mixing ARA-3P to the scarified or milled recycle material, distributing the mixture uniformly over the width and depth being processed, and finishing and compacting the recycled pavement so as to produce a uniform cross section and surface of the required evenness and texture without tearing, shoving or gouging.

Heating units shall be self-propelled rigid sections of indirect radiant or infrared heaters that will uniformly heat the existing pavement to a temperature sufficient to allow milling, scarifying, or dislodging the material to the specified depth without fracturing the aggregate, burning petroleum distillates in the asphalt binder, subjecting the existing surface to an open flame, or producing undesirable pollutants. An adequate number of self-propelled pre-heating units of sufficient length shall be utilized to comply with these requirements. Pavement sections shall be heated approximately 4 inches beyond the width of scarifying or milling. The heating units shall have enclosed or shielded hoods.

The Contractor may utilize individual multiple pass heating-milling units employing the windrowing process. Tunnel heaters shall be utilized that are capable of heating the underlying pavement while shielding the previously milled material from direct flame.

Milling/Scarifying units shall be capable of uniformly dislodging and removing the heated pavement to the desired depth for a full lane width of 12 feet without fracturing the aggregate. Automatic grade and slope control shall be utilized in this process. The units shall be height adjustable to clear obstructions in the existing pavement. Acceptable means of measurement shall be provided to verify that the desired recycling depth is obtained.

Distribution and blending units shall be a controlled system that is capable of uniformly adding, dispersing, blending, and mixing the ARA-3P at the established rate with the dislodged material either prior to or during remixing. The unit shall be so equipped to enable the contractor to provide documentation of the application rate of the added material(s). The system shall be calibrated and synchronized to the speed of the operation. The quantity of ARA-3P shall be controlled within –0.02 to +0.05 gallons per square yard of surface treated within the given application rate. The blending and mixing system shall consist of a twin shaft pugmill or an on board heated mixing drum capable of providing a uniform mix free of temperature and/or aggregate segregation whose binder content does not vary by more than 0.2% by total weight of the mix transversely across the recycled lane at any given section. The equipment shall include a devise that will measure and record the accumulated gallons of rejuvenating agent within an accuracy of 2%.

The spreading, leveling and paving unit shall meet the provisions of Standard Specification Subsection 407.06

Compaction of the recycled mat shall be accomplished with rollers that conform to Standard Specification Subsection 407.07.

### B. PREPARATION

Prior to heating, identified break-out repair shall be completed and the existing surface cleaned of all loose and objectionable material including thermoplastic and markers by blading, brooming, or other methods approved by the Engineer. Extraneous material shall be removed from all potholes and cracks in the existing surface. Any and all unsuitable, unwanted, or clean-out material shall be properly disposed of.

### C. WEATHER LIMITATIONS

The minimum surface temperature of the pavement prior to heating shall be 45ºF and the minimum ambient air temperature shall be 50ºF. Work is not permitted during foggy or raining conditions. Unless otherwise permitted in writing, hot in place recycling shall be limited to the period from April 1 to November 30. If a surface treatment is to be applied, the period limitations for the treatment as identified in the Standard Specifications shall apply.

### D. HEATING AND TEMPERATURE REQUIREMENTS

The entire lane width of the pavement surface being processed shall be uniformly heated with a series of heating units meeting the equipment requirements herein. The heating process shall be conducted utilizing indirect heat in such a manner that the mix is not subject to damage by temperature exposure of excessive intensity or prolonged heat durations. The maximum mix temperature shall not exceed 330ºF. The minimum temperature directly behind the screed shall not be less than 190ºF and/or at a temperature that will assure that the time available for compaction is achievable. Deductions for failure to meet densities will be applied. An adequate number of self-propelled pre-heating units of sufficient length shall be utilized to comply with these requirements. Pavement sections shall be heated approximately 4 inches beyond the width of scarifying or milling. Traverse temperature differentials behind the screed shall not exceed 25ºF.

If requested by the Contractor, the Department may consider the use of Warm Mix Technology and reestablish the mixing and compaction temperatures. The WMA additive shall be compatible with the ARA-3P and shall be on the Departments Qualified Products List.

Roadside vegetation protection utilizing a water spray system attached to the heating units shall be provided if deemed necessary by the Engineer.

### E. BLENDING AND REMIXING

The ARA-3P shall be applied uniformly to the dislodged, milled or scarified existing pavement at a rate of 0.10 to 0.30 gallons per square yard prior to remixing in a pugmill or mixing drum. The exact rate shall be determined by TDOT based on the in situ volumetrics and/or stiffness of the asphalt pavement. The Contractor shall provide and deliver samples of the proposed ARA-3P to the Regional Lab at least 21 days prior to beginning the work in order for tests to be performed and completed. The milled, scarified, or uniformly dislodged existing pavement treated with ARA-3P shall be conveyed into a mixing unit and thoroughly mixed to produce a consistent recycled mix. The ARA-3P shall be added with equipment meeting the requirements identified herein and shall be controlled through metering devices capable of adjusting for the variation of material fed into the mixing unit, the variation time of the mixing cycle, and/or the variation speed of the operation. The Contractor shall provide to the Engineer the accumulated gallons and application rates in gallons per square yard of the applied ARA-3P daily and at any time requested. The metering device(s) shall be calibrated in the presence of a TDOT representative. The Contractor shall provide written certification of the amounts used prior to payment.

Material unused in storage tanks shall be transferred into tankers for re-weighing. Certificated weights less reweights shall be comparable to the accumulated gallons used that are provided by the Contractor.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

SPECIAL NOTES
FOR
RECYCLED ASPHALT

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