

**605 - SURFACE RECYCLED ASPHALT CONSTRUCTION**

**SECTION 605**

**SURFACE RECYCLED ASPHALT CONSTRUCTION**

**605.1 DESCRIPTION**

Construct the hot-in-place recycling of the existing asphalt surface as specified in the Contract Documents. The activities associated with this work include heating the existing pavement, scarifying and/or hot milling the existing surface, adding a rejuvenating agent, mixing, spreading, leveling and compacting the recycled material. This process is referred to as Hot In-Place Recycled Asphalt Pavement (HIR). The term surface recycling and HIR are synonymous in the specification.

**BID ITEMS**

Surface Recycling (\*)  
Asphalt Rejuvenating Agent  
\*Thickness

**UNITS**

Station  
Ton

**605.2 MATERIALS**

**a. Asphalt Rejuvenating Agent (ARA).** Provide ARA that complies with **DIVISION 1200**.

**b. Contractor Mix Design.** When the specified thickness of the HIR is greater than or equal to 2 inches, submit a mix design complying with **TABLE 605-1**.

In the mix design, analyze the mixture at a minimum of 3 different ARA contents starting with 0.5% at the low end. Run the indirect tensile strength test (KT-60) at the lowest ARA content. Run the Asphalt Pavement Analyzer (AASHTO T 340) at the highest ARA content.

<b>TABLE 605-1: SURFACE RECYCLE MIX DESIGN REQUIREMENTS</b>		
<b>Property</b>	<b>Test Method</b>	<b>Limits</b>
Air Voids at 30 gyrations, (%)	KT-58, KT-15, & KT-39	Report
Tensile Strength, (psi min)	KT-56	75
Retained Strength based on cured stability, (% min)	KT-56	80
Rut Resistance, (mm max)	AASHTO T 340	8
Thermal Cracking, (°C max)	KT-60	-22

Testing procedures:

- Core the pavement to obtain Reclaimed Asphalt Pavement (RAP) for the mix design.
- Break down the RAP (representing the depth of the HIR) to a maximum particle size of 1 inch.
- The compaction temperature range for KT-58 is 200°F to 250°F.
- Perform all tests on plugs that are compacted to 30 gyrations, thus the air void criteria stated in KT-56, KT-60 and AASHTO T 340 are waived.
- Use procedure III when performing KT-15.

**605.3 CONSTRUCTION REQUIREMENTS**

**a. Pavement Preparation.** Before commencing surface recycling, remove all material from the surface of the pavement which would be detrimental to the HIR or would not comply with the design criteria of **subsection 605.2b**.

**b. Heating and Scarifying Operations.** Use a series of heaters, milling units and/or scarifiers to uniformly heat and recycle the existing pavement to the specified depth. Flames on the pavement can be prevented by heating the roadway more slowly using additional heaters. Intermittent or occasional flaming on the roadway or in the windrow that extinguishes on its own within 10 seconds is permissible, but if in the opinion of the Engineer it is detrimental to the final product, production will cease. In addition, production will cease when smoke is being produced continuously. (Smoke caused when the heaters pass over a maintenance patch is excluded from this

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clause.) The Contractor and Engineer will agree to a course of action to prevent this overheating before production is resumed. If flames or excessive smoke persists, then production is ceased until the Contractor modifies the operation and can demonstrate acceptable results without excessive smoke or flames on the pavement or in the windrows. When the depth of the HIR is more than 1 inch, heat the material in lifts not more than ¾ inches. When heating in multiple lifts, remove each lift at a uniform depth across the full width of the recycled pavement. This material may be windrowed when heating the next lift. Use equipment complying with **SECTION 155**. Provide adequate provisions for equipment calibration. Remove from the roadway milled or scarified material that can not be placed with a paving unit due to equipment breakdown or malfunction. Bring these removed areas to grade using a HMA approved by the Engineer.

### c. Process Control.

(1) Depth Check. The Engineer will determine the depth per KT-47. The moving average of 3 consecutive tests shall equal or exceed the contract depth. If the 3-point moving average is less than the contract depth, KDOT will assess a Surface Recycling Pay Adjustment using Equation 1. The pay adjustment will correspond to those segments within the 3-point moving average that were deficient in depth.

$$\text{Equation 1: } P = 400 (S) \left( 1 - \frac{M}{T} \right)$$

Where: P is the Surface Recycling Pay Adjustment, (\$0.00)  
S is the number of stations (single lane) in penalty, (0.00)  
M is the Measured Depth 3-point moving average, (0.000 feet or 0.00 inches)  
T is the Plan Depth, (0.000 feet or 0.00 inches). T and M shall be the same unit of measure.

If 4 consecutive 3-point moving average values are less than the contract depth, stop production and evaluate the process with the Engineer. Change the process to the satisfaction of the Engineer before production is resumed. If the next 2 tests are deficient in thickness, Equation 2 will be used for the remainder of the project. The Engineer reserves the option to terminate production until a satisfactory agreement is reached anytime the 3-point moving average value is less than the contract depth for more than 2 consecutive tests.

$$\text{Equation 2: } P = 900 (S) \left( 1 - \frac{M}{T} \right)$$

If both KDOT and the Contractor agree that recycling to the contract depth would be detrimental to the project, the unit price will be negotiated for the reduced depth before proceeding with the project, and the Engineer would create a change order (**SECTION 104**) for the item at the new unit price.

(2) Temperature Requirements: Heat the HMA being scarified and/or hot milled to a minimum of 190°F prior to scarifying and/or hot milling. Maintain the temperature of the HIR, directly behind the paver, between 190°F and 300°F. HIR temperatures taken within 2 feet of each other, transverse to the roadway, shall not vary by more than 30°F. HIR temperatures taken within 10 feet of each other, transverse to the roadway, shall not vary by more than 50°F. If these temperature requirements are not satisfied within 1 hour after a discrepancy is discovered, the HIR train will be stopped and the Engineer and Contractor will determine a course of action to correct the deficiency before the HIR train proceeds.

**d. Rejuvenating and Mixing Operations.** After heating and scarifying and/or hot milling, uniformly add the ARA and thoroughly mix the HIR. Include all of the previously scarified and/or hot milled material into the mixing operation.

**e. Spreading and Compacting Operations.** Immediately following heating, scarifying, adding ARA and mixing operations, begin work to fulfill the requirements of one of the following operations:

(1) Operation Number 1.

(a) Spread and finish the rejuvenated mixture with an acceptable paving unit.

(b) Provide density using an approved rolling procedure. Use a minimum of 2 Self-Propelled Smooth-Faced Steel Rollers complying with **SECTION 151**. The Engineer will determine the initial approved rolling procedure from densities obtained with various roller combinations.

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Density will be determined by using a nuclear gauge. Use the approved rolling procedure. Achieve the maximum density before the temperature of the HIR falls below 160°F. Do not crush the aggregate. When the mat temperature falls below 160°F, roller marks may be removed from the mat with a self-propelled Smooth-Faced Steel Roller operated in the static mode. If there is a significant change in factors affecting density, such as weather or compaction equipment, the Engineer will reevaluate and modify the rolling procedure as required. Stop the HIR operation whenever rolling is not being performed according to the approved rolling procedure.

(c) Maintain the rejuvenated pavement surface until the surface treatment shown in the Contract Documents is completed. When required, apply a tack coat before placing the surface treatment. If a seal coat, asphalt seal, micro-surfacing or ultra-thin bonded asphalt surface is included in the Contract Documents, allow the HIR surface to cure 1 week before sealing.

(2) Operation Number 2. Use an asphalt paver equipped with automatic grade control to spread and finish the amount specified of the new asphalt surface material. **SECTIONS 601** and **602** apply. If a HMA overlay is included in the contract, place the HMA and surface recycle concurrently, or the 2 materials may be blended and laid as 1 lift.

**f. Weather and Seasonal Limitations.** Construct surface recycling when the surface is dry, and the weather is not foggy or rainy. Only construct surface recycling between May 1 and September 30, when either the minimum ambient air temperature or the road surface temperature shown in **TABLE 605-2** is met.

<b>Existing Surface Type</b>	<b>Ambient Air Temperature (°F)</b>	<b>Road Surface Temperature (°F)</b>
On HMA Surface	50	55
On Asphalt Seal Surface	55	60

**g. Pavement Smoothness.** Evaluate pavement smoothness according to **SECTION 603**.

### 605.4 MEASUREMENT AND PAYMENT

The Engineer will measure surface recycling by the Station, along the centerline. On divided highways, the Engineer will measure surface recycling by the Station, along the centerline of each divided direction. This includes all widened and irregular areas and irregular variations in depth.

The Engineer will measure asphalt rejuvenating agent by the ton.

Payment for "Surface Recycling" and "Asphalt Rejuvenating Agent" at the contract unit prices is full compensation for the specified work.

The bid item Surface Recycling Pay Adjustment will be an item added to the contract.