

A GUIDE
FOR THE PREPARATION OF
A SPECIFICATION

**HOT IN-PLACE
ASPHALT RECYCLING**

Prepared by

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ITEM 405 HOT IN-PLACE RECYCLING

405.01 DESCRIPTION

The work under this item shall consist of softening the existing asphalt pavement with heat, milling/scarifying the top 1.5 to 2.5 inches and thoroughly remixing, leveling and compacting the milled/scarified material. The work items shall include the addition and mixing of recycling agents and the addition and mixing of new hot mix asphalt as required by the engineer. The work shall be accomplished by a single pass of an equipment train which is capable of cleaning, heating, milling/scarifying, mixing, re-leveling, and compaction.

405.02 MATERIALS

- 405.02.01 Asphalt Cement The asphalt cement used in new hot mix asphalt shall conform to one of the following specifications:
- Penetration graded ASTM D946 AASHTO M20
 - Original viscosity ASTM D3381 AASHTO M226
 - Aged viscosity ASTM D3381
- 405.02.02 Recycling Agent The recycled agent used in this item shall conform to ASTM D4552.
- 405.02.03 Aggregate The aggregate used in new hot mix or as an addition without coating with asphalt cement shall conform to ASTM D692 and D103.
- 405.02.04 Hot Mix Asphalt New hot mix asphalt used in this item shall conform to ASTM 3515 with an exception for gradation as required by the engineer.
- 405.02.05 Recycled Hot Mix Asphalt The completed hot in-place recycled hot mix asphalt shall meet the requirements of ASTM D3515.

405.03 MIXTURE DESIGN

405.03.01 Approval Process The contractor shall submit the proposed, completed, recycled, mixture design to the engineer for approval. The contractor shall allow fourteen (14) working days for approval dated from time of receipt of the mixture design by the headquarters' materials laboratory.

405.03.02 Design Information The mixture design submitted shall include the following information:

1. Asphalt binder content of the asphalt pavement to be recycled.
2. Penetration at 77°F and viscosity at 140°F of asphalt cement contained in the asphalt pavement to be recycled.
3. Gradation of the asphalt pavement to be recycled.
4. Gradation of new aggregate (as required).
5. Percent asphalt cement added to the new aggregate (as required).
6. Type and amount of recycling agent (as required).
7. Penetration at 77°F and viscosity at 140°F and 275°F of recycled mixture (includes asphalt from pavement to be recycled, new asphalt cement and recycling agent).
8. Aggregate gradation of recycled mixture (includes aggregate in pavement to be recycled and new aggregate).
9. Stability and volume analysis information as described in the Asphalt Institute Manual, Series (MS-2).

405.04 EQUIPMENT

405.04.01 General The contractor should indicate at the pre-construction conference the type of equipment intended for use. The equipment

shall be on the project in general operating condition in sufficient time for evaluation by the engineer. The equipment used must be capable of performing the completed work at a minimum rate of 750 square yards per hour of operation to the depth shown on the plans.

- 405.04.02 Heating Unit(s) One or more heating units, consisting of clusters of radiant heaters shall be used. These units shall impart thermal energy to the asphalt pavement without charring the asphalt binder and without producing 1) unacceptable health risks to the contractor's workforce and citizenry, 2) unacceptable air quality, 3) direct flames on the pavement surface and 4) breaking aggregate particles. The heating unit shall be so equipped that heat application shall be under an enclosed or shielded hood. Each heating unit shall contain safety equipment to minimize workforce injury.
- 405.04.03 Milling/Scarification Unit(s) One or more pavement removal units capable of removing the pavement to the desired depth shall be used. These units shall contain a rotating drum with cutting teeth and/or an acceptable scarifier which uniformly loosens the heated asphalt pavement to the depth specified. Automatic grade and cross slope controls are required on the final pavement removal unit in the equipment train. The equipment shall be capable of height adjustments in order to clear utility hardware and other obstructions in the pavement surface.
- 405.04.04 Distribution and Blending Unit(s) Units capable of uniformly distributing recycling agents and mixing hot mix asphalt shall be integral components of this equipment. This mixing equipment shall be capable of uniformly mixing recycling agent, hot mix asphalt and other materials as specified by the engineer. This equipment shall be capable of providing the following:
1. Positive feed and shut-off of the recycling agent linked to the movement of the machine.
 2. Control of the quantity of the recycling agent to + or - 0.05 gallons per square yard of surface treated with a recycling

agent application range of from 0.1 to 2.0 percent recycling agent by weight of recycled mixture.

3. Proportional interlinking of the recycling agent application rates to the machine's processing rate.
4. Heating the recycling agent to within + or - 25°F of the temperature of the recycled material.
5. Measurement of the amount of recycling agent by means of a device capable of recording accumulated gallons to an accuracy of + or - 2 percent.
6. Uniform mixing of recycled pavement and new hot mix asphalt in a pugmill or continuous mixing chamber such that the specified proportion of new hot mix asphalt can be accommodated.

405.04.05 Spreading and Leveling Unit A unit capable of spreading and leveling the blended and mixed recycled material uniformly over the width being processed and to the finished grade and cross slope as specified on the plans shall be provided. This unit shall have characteristics equivalent to those associated with conventional hot mix asphalt laydown machines and shall contain automated grade and cross slope controls.

405.04.06 Compaction Compaction equipment shall be supplied in accordance with Item _____, "Hot Mix Asphalt Pavement".

405.05 CONSTRUCTION

405.05.01 General The hot in-place recycling shall be performed with self-propelled equipment that is capable of 1) softening the existing asphalt concrete surface by applying heat, 2) milling/scarifying the surface to the depth shown on the plans, 3) blending and mixing recycling agent and/or new hot mix asphalt and/or new aggregate, 4) spreading and leveling the heated material and 5) compacting the resulting mixture to the desired air void content. This

operation shall be accomplished with a single pass of the equipment train.

- 405.05.02 Cleaning of Existing Surface The existing paved surface to be recycled shall be cleaned of all dirt, fabric, thermoplastic markers, rubberized materials, oils and other objectionable materials by blading, brooming, flushing with water or other approved methods prior to beginning hot in-place recycling.
- 405.05.03 Heating and Milling/Scarifying The pavement surface shall be evenly heated, milled/scarified and reworked to the widths and depths shown on the plans. There shall be no burning or scorching of trees, shrubs or other items near the recycled pavement. It shall be the responsibility of the contractor to protect the adjacent landscape from damage by shielding and/or water spray or other methods approved by the engineer. The heated and milled/scarified materials shall have a temperature in a range between 230°F and 290°F as measured immediately behind the laydown machine. The temperature shall be selected within this range to provide for adequate compaction. This selected temperature shall not vary by more than + or - 20°F from this target value and shall always be above the lower limit of 230°F.
- 405.05.04 Blending, Mixing, Spreading and Leveling The recycled pavement materials, recycling agent (if required), new hot mix asphalt (if required), and new aggregate (if required), shall be fed into a mixing unit and thoroughly mixed. The resulting mixture shall be fed into a spreading and leveling unit.
- 405.05.05 Joints The heating unit shall supply heat a minimum of 4 inches beyond the width of recycling. When a pass is adjacent to a previously placed mat, the heating shall extend 6 inches into the adjacent mat and the joint shall be located a minimum of 4 inches into the previously placed mat.
- 405.05.06 Compaction The compaction operation shall meet the density/air void requirements of Item _____ “Hot Mix Asphalt Pavement”. Compaction shall be complete prior to the mixture temperatures reaching 170°F.

405.05.07 Regulation The contractor shall be required to meet all local, county, regional, state and federal air quality standards and all workforce health and safety standards.

405.05.08 Test Strip At the beginning of the hot in-place recycling operation, the contractor shall construct a test strip on the project a minimum of 0.1 miles but not more than 0.2 miles in length using the equipment and methods to be used for the remainder of the project. No further work shall be performed until the test strip is evaluated and the process approved by the engineer.

405.06 ACCEPTANCE

405.06.01 General For the purpose of acceptance a lot will be considered one-half days production or any part thereof. Four sublots per lot will be sampled. The point of sampling of loose mixture shall be behind the laydown machine.

405.06.02 Temperature The temperature behind the laydown machine shall be selected to achieve the specified density/air voids and shall be between 230°F and 290°F. This selected temperature shall not vary by more than + or - 20°F from this target value and shall always be above the lower limit of 230°F.

405.06.03 Depth The depth shall be controlled by Test Method _____. The average of the 4 depth measurements per lot shall be equal to or greater than the specified value with no single value less than 1/2 inch below the specified value.

405.06.04 Gradation The resulting gradation shall meet the tolerances as specified in Item _____ "Hot Mix Asphalt Pavement".

405.06.05 Density/Air Voids The density/air void requirement of Item _____ "Hot Mix Asphalt Pavement" shall be met.

405.06.06 Binder The extracted binder shall meet the requirements specified by the engineer.

405.06.07 Smoothness The smoothness shall meet the tolerances as specified in Item _____ “Hot Mix Asphalt Pavement”.

405.07 MEASUREMENT

405.07.01 Hot In-Place Recycling Hot in-place recycling shall be measured by the square yard of surface area of completed and accepted work to the depth shown on the plans. This area shall not exceed that shown on the plans unless accepted by the engineer.

405.07.02 Recycling Agent Recycling agents shall be measured by the gallon.

405.07.03 Asphalt Cement Asphalt cement shall be measured by the ton.

405.07.04 Hot Mix Asphalt Hot mix asphalt shall be measured by the ton of aggregate contained in hot mix asphalt.

405.07.05 Aggregate Aggregate shall be measured by the ton.

405.07.06 Mobilization Mobilization shall be measured by the lump sum.

405.08 PAYMENT

405.08.01 Hot In-Place Recycling Recycling shall be paid by the unit price (square yard) bid for hot in-place recycling. This price shall be full compensation for cleaning existing pavement, all heating, milling/scarifying, mixing, relaying, compaction and all other manipulations, labour, tools, equipment traffic control and incidentals necessary to complete the work.

405.08.02 Recycling Agent Recycling agent shall be paid for at the unit price (gallon) bid for recycling agents of the type and grade specified. This price shall be full compensation for furnishing, hauling, dispersing, and for all other manipulations, labour, tools, equipment and incidentals necessary to complete the work.

- 405.08.03 Asphalt Cement Asphalt cement shall be paid for at the unit price (ton) bid for asphalt cement of the type and grade specified. This price shall be full compensation for furnishing, hauling, dispersing, and for all other manipulations, labour, tools, equipment and incidentals necessary to complete the work.
- 405.08.04 Hot Mix Asphalt Hot mix asphalt shall be paid for at the unit price (ton aggregate contained in hot mix asphalt) bid for hot mix asphalt for the type specified. This price shall be full compensation for producing, blending, mixing, hauling, laydown, compaction, and for all other manipulations, labour, tools, equipment and incidentals necessary to complete the work.
- 405.08.05 Aggregate Aggregate shall be paid for at the unit price (ton of aggregate) bid for hot mix asphalt. This price shall be full compensation for producing, blending, mixing, hauling, placing, and for all other manipulations, labour, tools, equipment and incidentals necessary to complete the work.
- 405.08.06 Mobilization Payment in the amount of 80 percent of the lump sum bid shall be paid on the first progress payment after the contractor's equipment is on site and hot in-place recycling is underway in accordance with the requirements of the contract. Payment of the remaining 20 percent will be authorized when all work on the project has been completed and clean-up is finished to the satisfaction of the engineer. The lump sum bid under this item shall not exceed 5 percent of the project price.

PAY ITEM	PAY UNIT
1. Hot In-Place Recycling	Square Yard
2. Recycling Agent	Gallon
3. Hot Mix Asphalt	
a Asphalt Cement	Ton
b Aggregate	Ton
4. Mobilization	Lump Sum

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