SPECIAL SPECIFICATION

3236

Cold Central Plant Recycling of Asphalt Millings

1. Description. Furnish materials, equipment and labor to treat and recycle reclaimed asphalt pavement (RAP) by cold mixing in a central recycling plant (pugmill) to produce either Cold Central Plant Recycling of Asphalt Millings (Short Term) or Cold Central Plant Recycling of Asphalt Millings (Long Term).

   Cold Central Plant Recycling of Asphalt Millings (Short Term) is defined as processed material to be used within 14 days of production.

   Cold Central Plant Recycling of Asphalt Millings (Long Term) is defined as material designed to remain workable for approximately six months after production but will begin to set immediately after compaction.

2. Materials. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

   A. RAP. RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement. Crush and process RAP material to the following gradation prior to the addition of emulsion or additives

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
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<tbody>
<tr>
<td>1.0 inch</td>
<td>100</td>
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</table>

   Use of Contractor-owned RAP including HMA plant waste is permitted, unless otherwise shown on the plans. Department-owned RAP stockpiles are available for the Contractor’s use when the stockpile locations are shown on the plans.

   Determine asphalt content and gradation of RAP stockpiles for mixture design purposes in accordance with Tex-236-F. Do not use Department- or Contractor-owned RAP if the decantation value exceeds 5% and the plasticity index is greater than 8. Test the stockpiled RAP for decantation in accordance with Tex-406-A, Part I. Determine the plasticity index in accordance with Tex-106-E if the decantation value exceeds 5%. The decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction or ignition.

   Do not intermingle Contractor-owned RAP stockpiles with Department-owned RAP stockpiles.
B. **Field Sand.** Field sand must meet the gradation requirements in Table 1. Supply field sand that is free from organic impurities. The Engineer may test the material in accordance with Tex-408-A to verify the material is free from organic impurities.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing by Weight or Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>100</td>
</tr>
<tr>
<td>#8</td>
<td>70 - 100</td>
</tr>
<tr>
<td>#200</td>
<td>0 - 15</td>
</tr>
</tbody>
</table>

C. **Asphalt Emulsion.** Furnish the type and grade of asphalt specified on the plans. Unless otherwise shown on the plans or approved, furnish a CMS-2S or CMS-2 in accordance with Item 300, “Asphalts, Oils, and Emulsions.” The emulsion must have greater than 60 percent residual asphalt of the combined weight of asphalt, water, rejuvenator, and other additives.

3. **Equipment.** Provide required or necessary equipment in accordance with Item 320, “Equipment for Hot-Mix Asphalt Materials.”

A. Set up the cold central recycling plant at the location the RAP stockpile will be processed. Use the following equipment to produce the RAP material:

1. A material sizing unit having screening and crushing capabilities to reduce 100 percent of the reclaimed bituminous material to the size required by this specification, prior to mixing with sand and asphalt emulsion.

   If the crushed RAP material is stockpiled before introducing into the recycling/mixing unit, it will be screened through a 3/4 inch screen on the mixing plant to ensure that larger clumps of crushed RAP material are sufficiently broken apart prior to mixing with other materials.

2. Process the crushed material through a mixing unit capable of thoroughly mixing the processed bituminous material, asphalt emulsion, sand, and other additives to a homogenous mixture at a minimum rate of 100 tons per hour.

   Equip the mixing unit with a belt scale for the continuous weighing of the crushed and sized bituminous material and a coupled/interlocked computer controlled liquid asphalt additive metering device certified and meeting the requirements of Item 520, “Weighing and Measuring Equipment”.

   a. The liquid asphalt additive metering device will be capable of automatically adjusting the flow of asphalt emulsion and other liquid additives to compensate for any variation in the weight of pulverized material coming into the mixer.

   b. The metering device will deliver the amount of asphalt emulsion or other liquid additive to within 0.2 percent of the required mix design percentage by weight of processed bituminous material.
3. Automatic digital readings must be displayed for both the flow rate of asphalt emulsion and total amount of processed bituminous material in appropriate units of weight and time.

4. **Construction.** Produce, haul, place, and compact the specified paving mixture. On or before the first day of paving, it is mandatory to schedule and participate in a pre-paving meeting with the Engineer unless otherwise shown on the plans. The purpose of the meeting is to discuss additional information regarding the contractor’s quality control plan, wherein the contractor and TxDOT will identify specific goals, strategies and activities planned for meeting particular project objectives.

   A. **Mixture Design.** Working with the emulsion supplier, submit a mix design to TxDOT for written approval prior to processing any material. The mix design should include a job-mix formula, which shows the percentage (by weight) of all materials used including water; the lab molded density, percent air voids, long-term Hveem stability, retained Hveem stability, and percent retained Hveem stability, according to Table 3.

   Use the target values in Table 2 when designing Cold Central Plant Recycling of Asphalt Millings.

<table>
<thead>
<tr>
<th>Material</th>
<th>Target Range (%)</th>
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<tbody>
<tr>
<td>RAP</td>
<td>90 - 92</td>
</tr>
<tr>
<td>Field Sand</td>
<td>4 - 5</td>
</tr>
<tr>
<td>Emulsion (short term mix)</td>
<td>2.5 ± 0.25</td>
</tr>
<tr>
<td>Emulsion (long term mix)</td>
<td>3.0 ± 0.25</td>
</tr>
<tr>
<td>Water</td>
<td>2.0</td>
</tr>
</tbody>
</table>

1. Produce the mixture design within these parameters, demonstrating that the optimum Hveem Stability is attained. Field sand may be reduced in order to improve stability, but the 2.75 percent emulsion for short term mix and the 3.25 percent emulsion for medium term mix should not be exceeded. Any reduction of field sand shall require the TxDOT Engineer’s approval in writing.

2. Use emulsified asphalt for recycling with rejuvenator added as needed for the mix design in order to meet the requirements of Table 3. Include other additives needed to improve stockpile life with the asphalt for design purposes.

   a. Designs using alternate asphalt types may be submitted for approval by the Engineer. Accompany such submittals with compacted specimens and lab test results showing various percentage emulsion along with accompanying density and percentage retained Hveem stability data, in accordance with Table 3, demonstrating that maximum retained stability is achieved by the mix.

   b. After evaluation of mix designs, TxDOT may accept an alternate design submitted by the Contractor for all or part of the mix to be produced. However, the bid should be based on one of the above listed asphalt types.
3. Add water to the raw RAP + sand mix, as needed to produce minimum moisture content of 2 percent, by weight, prior to the addition of emulsified asphalt. Protect RAP and sand stockpiles from precipitation events to insure that the moisture of combined sand and RAP does not exceed 8 percent.

<table>
<thead>
<tr>
<th>Table 3. Laboratory Mixture Design Properties</th>
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<tbody>
<tr>
<td>Property</td>
</tr>
<tr>
<td>Compaction, Texas Gyratory Compactor</td>
</tr>
<tr>
<td>Moisture Content, %</td>
</tr>
<tr>
<td>Theoretical Maximum Specific (Rice) Gravity</td>
</tr>
<tr>
<td>Laboratory Molded Bulk Specific Gravity</td>
</tr>
<tr>
<td>Laboratory Molded Density, %</td>
</tr>
<tr>
<td>Unconditioned Hveem Stability, min.*</td>
</tr>
<tr>
<td>Conditioned Hveem Stability Ratio, % min.**</td>
</tr>
</tbody>
</table>

*Long term stabilities tested on compacted specimens after curing to constant weight in a 140 degree F oven.

**23 hours soak at 77 degrees F followed by 1 hour soak at 104 degrees F.

B. Production Operations. Produce a cold-mixed asphalt paving material using a combination of processed RAP millings, field sand, water, emulsified asphalt and additional additives as required by the plans and specifications and at the rates shown in the approved mix design. The Engineer may require adjustments in the rate of asphalt emulsion or water. Once the rate is set, maintain the rate to an allowable tolerance of ±0.2 percent by weight of the asphalt emulsion unless otherwise directed by the Engineer. Produce the following two types of recycled RAP mix as directed by the Engineer.

1. Design Cold Central Plant Recycling of Asphalt Millings (Short Term) to be used within 14 days of production. This mix must set up within 2 hours of placement.

2. Design Cold Central Plant Recycling of Asphalt Millings (Long Term) to remain usable for approximately six months and set up within 4 hours of placement.

C. Notify the Engineer a minimum of 24 hours prior to moving the recycling plant to the site to begin production.

1. It is Engineer’s intent to allow the contractor to produce the mix in a continuous expeditious manner until all the mix is stockpiled at the mixing site.

2. Once the work commences at the designated site, proceed until all work is completed and approved, unless otherwise directed by the Engineer.

D. Place the Cold Central Plant Recycling of Asphalt Millings mix in neatly maintained stockpiles not to exceed ten feet in height without placing any equipment (e.g., bulldozer) on the recycled mixture. A front end loader or conveyor belt may be used to build the stockpiles.

E. Weather Limitations. Do not produce Cold Central Plant Recycling of Asphalt Millings during rainy or foggy weather or when atmospheric temperature measured in the shade and away from artificial heat is below 60 degrees Fahrenheit.
F. **Site Maintenance.** Maintain the recycling and stockpile site in a neat and orderly manner at all times.

1. Arrange for a dumpster or other container(s) for the disposal of all trash. Construct a small berm of RAP around the asphalt transport parking area and around the recycling plant, of sufficient height to contain any unintentional spillage of asphalt or additives. Remove the berm to the raw RAP stockpile and blade the production site to a relatively smooth contour upon completion of the project.

2. Remove any trash resulting from the operation by a trash disposal service or carry to an approved landfill. Provide all permits required for the mixing plant and trash removal to an approved landfill.

G. **Hauling Operations.** Before use, clean all truck beds to ensure that mixture is not contaminated. When a release agent is necessary, use a release agent on the approved list maintained by the Construction Division to coat the inside bed of the truck.

Use only equipment for hauling as defined in Section 3224.4.G.3.d, “Hauling Equipment.” Other hauling equipment may be used when allowed by the Engineer.

H. **Placement Operations.** Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly.

1. **Weather Conditions.** Place mixture when the roadway surface temperature is 60°F or higher, unless otherwise approved or as shown on the plans. Measure the roadway surface temperature with a handheld infrared thermometer. The Engineer may allow mixture placement to begin prior to the roadway surface reaching the required temperature requirements, if conditions are such that the roadway surface will reach the required temperature within 2 hours of beginning placement operations. Unless otherwise shown on the plans, place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable in the opinion of the Engineer.

2. **Tack Coat.** Clean the surface before placing the tack coat. Unless otherwise approved, apply tack coat uniformly at the rate directed by the Engineer. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply the tack coat in a uniform manner such that streaks and other irregular patterns are avoided. Apply a thin, uniform tack coat to all contact surfaces of curbs, structures, and all joints. Allow adequate time for emulsion to break completely prior to placing any material. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. Roll the tack coat with a pneumatic-tire roller to remove streaks and other irregular patterns when directed. The Engineer may use Tex-243-F to verify that the tack coat has adequate adhesive properties. The Engineer may suspend paving operations until there is adequate adhesion.
I. **Compaction.** Uniformly compact the pavement to the density requirements of the specification. Do not use pneumatic-tire rollers if excessive pickup of fines by roller tires occurs. Unless otherwise directed, use only water or an approved release agent on rollers, tamps, and other compaction equipment.

Where specific air void requirements are waived, furnish and operate compaction equipment as approved. Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

J. **Quality Control.** Control the quality of the cold recycling process and the completed recycled material as follows:

1. Emulsified Asphalt. Sample the emulsion from each transport load and deliver to the Engineer for testing. Additionally, the emulsified asphalt supplier will sample the emulsion at the mixing site and test once per day.
   a. Sample according to Tex-500-C.
   b. Test according to AASHTO T 59 and T 72.

2. Take belt samples of combined sand & RAP mixture, prior to the addition of water or emulsion every 1500 tons and check moisture content according to test method Tex-212-F. Make adjustments to moisture content or the operation accordingly to ensure acceptable performance of the mixture.

3. Asphalt Content. Check and verify the emulsion percentage a minimum of once per day by tank gauging, truck weighing, or meter readings. Check the processed bituminous mixture weight by belt scale once per day.

5. **Measurement.** Measure Cold Central Plant Recycling of Asphalt Millings (Short Term) and Cold Central Plant Recycling of Asphalt Millings (Long Term) by the ton of mix produced for each type, according to certified mixing plant belt scales.

6. **Payment.** The work performed and materials furnished in accordance with this Item as provide under “Measurement” will be paid for at the unit price bid for “Cold Central Plant Recycling of Asphalt Millings (Short Term)” or “Cold Central Plant Recycling of Asphalt Millings (Long Term)”. These prices are full compensation for materials including tack coat, hauling, placement, equipment, labor, tools, and incidentals.

   Surface preparation will be paid for under other applicable Items.