SPECIAL SPECIFICATION

3064

Engineered Emulsion Treatment (Road-Mixed)

1. **Description.** Mix and compact water, emulsion, and base (with or without asphalt concrete pavement) in the roadway.

2. **Materials.** Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer will verify that the specification requirements are met before the sources can be used. The Engineer may sample and test project materials at any time before compaction. Use Tex-100-E for material definitions.

   A. **Asphalt Material.** Furnish the type and grade of asphalt emulsion specified on the plans or as approved. Provide asphalt emulsion that meets the requirements of Item 300, “Asphalts, Oils, and Emulsions.” A representative from the asphalt emulsion supplier must check the mixing and setting properties at the beginning of the project, and must make adjustments to the asphalt emulsion formulation, if necessary.

   B. **Flexible Base.** Furnish base material that meets the requirements of Item 247, “Flexible Base,” for the type and grade shown on the plans, before the addition of emulsion.

   C. **Water.** Furnish water free of industrial waste and other objectionable material.

   D. **Recycled Materials.** The use of recycled materials is allowed only when shown on the plans. Crushed concrete, RAP (except for Department furnished RAP), and other recycled materials must meet the requirements of this Article. Request approval to blend 2 or more sources of recycled materials.

      1. **Limits on Percentage.** When RAP is allowed by the plans, use no more than 30% unless otherwise shown on the plans. The percentage limitations for other recycled materials will be as shown on the plans.

      2. **Recycled Material (Including Crushed Concrete) Requirements.**

         a. **Contractor Furnished Recycled Materials.** When the Contractor furnishes the recycled materials, including crushed concrete, the final product will be subject to the requirements of this Article and Table 2 for the grade specified. Certify compliance with DMS-11000, “Evaluating and Using Nonhazardous Recyclable Materials Guidelines,” for Contractor-furnished recycled materials. In addition, recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5% deleterious material when tested in accordance with Tex-413-A. The unblended recycled materials (crushed concrete and RAP) must not exceed the decantation shown in Table 1. Test RAP without removing the asphalt. Do not use RAP that is contaminated by...
dirt or other objectionable material. Crushed concrete must be managed in a way to provide for uniform quality. The Engineer may require separate dedicated stockpiles in order to verify compliance.

When more than 30% Contractor-owned recycled materials is allowed and used, the individual materials are subject to the requirements of Table 1.

b. Department Furnished Required Recycled Materials. When the Department furnishes and requires the use of recycled materials, unless otherwise shown on the plans:
   • Department required recycled material will not be subject to the requirements in Table 1,
   • Contractor furnished materials are subject to the requirements in Table 1 and this Item, and
   • the final product, blended or unblended, will be subject to the requirements in Table 2.

Crush Department-furnished RAP so that 100% passes the 2 in. sieve. The Contractor is responsible for uniformly blending to meet the percentage required.

c. Department Furnished and Allowed Recycled Materials. When the Department furnishes and allows the use of recycled materials or allows the Contractor to furnish recycled materials, the final blended product is subject to the requirements of this Article, Table 2, and the plans.

3. Recycled Material Sources. Department-owned recycled material is available to the Contractor only when shown on the plans. The location, approximate asphalt content, and approximate gradation will be shown on the plans for Department-owned RAP sources in a stockpile condition prior to Contract Execution. Assume that required Department-owned RAP meets Table 1 requirements. Return unused Department-owned recycled materials to the Department stockpile location designated by the Engineer unless otherwise shown on the plans.

The use of Contractor-owned recycled materials is allowed when shown on the plans. Contractor-owned surplus recycled materials remain the property of the Contractor. Remove Contractor-owned recycled materials from the project and dispose of it in accordance with federal, state, and local regulations before project acceptance. Do not intermingle Contractor-owned recycled material with Department-owned recycled material unless approved by the Engineer.

D. Mix Design. Submit a mix design to the Engineer, prior to the start of the project. Perform additional mix designs based on road variability, as directed by the Engineer. The road mix must meet the material requirements in Table 1 for the mix design, with or without added aggregate and prior to adding emulsion.

Use Tex-204-F, Part III and the materials proposed for the project to determine the target emulsion content required to produce a mixture meeting the requirements in Table 2. Determine the amount, type, and quality of emulsion, aggregate, and reclaimed material required to meet the mixture requirements in Table 2. Prepare 6 in. (150 mm.) diameter specimens with a Superpave gyratory compactor in accordance to Tex-241-F with a design number of gyrations of 30 at 1.25° angle and 87 psi. (600 kPa).
Table 1
Aggregate Quality Requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Specification Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size, % Passing by Weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1/2”</td>
<td>Tex-200-F</td>
<td>100</td>
</tr>
<tr>
<td>1”</td>
<td>Part 1</td>
<td>90-100</td>
</tr>
<tr>
<td>3/8”</td>
<td></td>
<td>45-70</td>
</tr>
<tr>
<td>No. 4</td>
<td></td>
<td>30-55</td>
</tr>
<tr>
<td>No. 40</td>
<td></td>
<td>15-30</td>
</tr>
<tr>
<td>Sand Equivalent, % min.</td>
<td>Tex-203-F</td>
<td>40</td>
</tr>
<tr>
<td>Liquid Limit, max</td>
<td>Tex-104-E</td>
<td>40</td>
</tr>
<tr>
<td>Plasticity Index, max</td>
<td>Test-106-E</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 2
Mixture Requirements

<table>
<thead>
<tr>
<th>Mixture Property</th>
<th>Test Method</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target laboratory-molded density, % min</td>
<td>Tex-207-F</td>
<td>95</td>
</tr>
<tr>
<td>Indirect Tensile Strength, psi., min</td>
<td>Tex-531-C</td>
<td>50</td>
</tr>
<tr>
<td>Tensile Strength Ratio, min</td>
<td>Tex-531-C</td>
<td>0.35</td>
</tr>
<tr>
<td>Hveem Stability, min</td>
<td>Tex-208-F</td>
<td>25</td>
</tr>
</tbody>
</table>

3. **Equipment.** Provide machinery, tools, and equipment necessary for proper execution of the work meeting the following minimum requirements.

A. **Reclaiming.** Provide a self-propelled reclaimer capable of fully reclaiming the existing road to the depth required, incorporate the asphalt emulsion and water, and mix the materials to produce a homogeneous material. The minimum power of the reclaimer is 400 hp. The machine must be capable of reclaiming not less than 8-ft. (2.4 m) wide and up to 12-in. deep in each pass. The reclaimer must have an automatic system which adjusts the addition of asphalt emulsion with the machine speed. The emulsion injection system must have capacity of incorporating up to 7 gallons per square yard of emulsion. Individual valves on the spray bar must be capable of being switched off, as necessary, to minimize emulsion overlap on subsequent passes.

B. **Shaping.** Provide a motor grader for pre-shaping, aerating, spreading and final shaping of the material. The motor grader must have a cross slope indicator.

C. **Compaction.** Provide the following required compaction equipment:
   - Vibratory pad foot roller with 84-in. wide drum and 10-ton minimum weight is required; a blade is recommended for back-dragging.
   - Pneumatic tire roller with 20-ton minimum weight, 90 psi tire pressure, and equipped with water spray system.
4. **Construction.** Work in the rain is prohibited. Work is prohibited when the weather forecast indicates freezing temperatures within 7 days of work or the historical weather database indicates freezing temperatures within 7 days after incorporation of the engineered emulsion based on 50 percent reliability. Written authorization by the Engineer is required to deviate from these climatic requirements.

A. **Pre-Shaping.** Shape the road by either or both a reclaimer and motor grader to the correct profile, crown, and contour, according to the plans, before the addition of emulsion.

Add water and new base according to the mixture design and work plan. When mixing new base material with existing base, deliver, place, and spread the new material in the required amount per station. Manipulate and thoroughly mix new base and water with existing material to provide a uniform mixture to the specified depth before shaping. Prior to emulsion addition, check the moisture content in accordance to Tex-103-E. The moisture content must be within 1 percentage point of the mix design recommendation. Aerate if the moisture content is high or add water if it is too low.

Compact the material to support equipment and traffic and to provide depth control during reclaiming. Compact with a steel wheel roller, unless otherwise directed.

B. **Reclaiming.** Complete the entire operation in multiple passes. Reclaim the existing road to the depth on the plans. In the first pass, bring the material to the moisture content directed and add new base if this has not been performed during pre-shaping. After completion of the first pass, shape the road with a motor grader and compacted with a steel roller to provide better depth control. After mixing, the Engineer will sample the mixture at roadway moisture and test in accordance with Tex-101-E, Part III, to determine compliance with the gradation requirements in Table 3.

**Table 3**

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Road Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/4 in.</td>
<td>100</td>
</tr>
<tr>
<td>3/8 in.</td>
<td>80</td>
</tr>
<tr>
<td>No. 4</td>
<td>50</td>
</tr>
</tbody>
</table>

In the second pass, add the required amount of asphalt emulsion. Use the amount of asphalt emulsion determined from the mix design. Check the percentage of emulsion added by using meter readings or truck weight tickets and by estimating the quantity of road reclaimed. Determine the emulsion content on the first emulsion transport as a minimum or as directed by the Engineer. Perform adjustments in equipment calibration, if necessary. Recheck the emulsion content, if adjustments are made.

Monitor the required depth of reclamation regularly. If an additional pass of the reclaimer significantly improves dispersion of the emulsion, then this additional pass is required for
the entire project. The entire operation of reclaiming the existing road, incorporating new base, water, and asphalt emulsion can be completed in one pass if adequate mixing and emulsion dispersion is achieved, as approved by the Engineer.

C. **Compaction.** Compact the mixture in one lift using density control, unless otherwise shown on the plans. Determine the moisture content of the mixture at the beginning and during compaction in accordance with Tex-103-E.

Use the control strip method given in Tex-207-F, Part IV, to establish rolling patterns that achieve maximum compaction. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least one-half the width of the roller unit. On superelevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 MPH, as directed.

Perform initial compaction applying high amplitude and low frequency compaction with a padfoot roller. The breakdown roller (padfoot) must be within 500 ft. of the reclaimer at all times. Perform initial compaction with enough passes until the roller walks out of the material. Walking out for the padfoot roller is defined as light being clearly evident between all of the pads at the material–padfoot drum interface.

After the completion of padfoot rolling, remove remaining padfoot marks no deeper than the depth of the padfoot marks. Shape the desired slope and shape to the lines and grades shown in the plans. Compaction with a steel wheel roller of high frequency and low amplitude or pneumatic tire roller following the motor grader is recommended. Perform final surface shaping the same day the emulsion is incorporated into the roadway.

Compact the bladed material with a vibratory double-drum steel roller and pneumatic roller for final compaction. Use the best combination and order of passes and rollers to meet compaction requirements. Finish roll in static mode. Use a light spray of water to aid final compaction and appearance.

Remove areas that lose required stability, compaction, or finish. Replace with emulsion-treated mixture at the Contractor’s expense.

1. **Ordinary Compaction.** Roll with approved compaction equipment, as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and recompacting.

2. **Density Control.** Compact to at least 97% of the target laboratory-molded density determined in the mix design. The Engineer will determine roadway density in accordance with Test Method Tex-115-E. Remove material that does not meet density requirements. Remove areas that lose required stability, compaction, or finish. Replace with emulsion-treated mixture and compact and test in accordance with density control methods. The Engineer will accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.
D. Finishing. Immediately after completing compaction of the final course, clip, skin, or
tight-blade the surface of the emulsion-treated material with a maintainer or subgrade
trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of at
an approved location. Roll the clipped surface immediately with a pneumatic tire roller
until a smooth surface is attained. Add small amounts of water as needed during rolling.
Shape and maintain the course and surface in conformity with the typical sections, lines,
and grades shown on the plans or as directed.

E. Curing. Before placing any surfacing, cure the reclaimed base shall be allowed to cure
until the moisture content in the material is reduced to 2.5% or less, or as approved.
Surface the reclaimed base before winter. Proof roll the compacted material, as directed
by the Engineer. Truck traffic is only allowed on the reclaimed base, when approved by
the Engineer.

5. Measurement.

A. Emulsion. Emulsion will be measured by the gallon.

B. Emulsion Treatment. Emulsion treatment will be measured by the square yard of
surface area at the depth shown on the plans. The dimensions for determining the surface
area are established by the widths shown on the plans and lengths measured at placement.

6. Payment. The work performed and materials furnished in accordance with this Item and
measured as provided under “Measurement” will be paid for at the unit price bid for the
types of work shown below.

Furnishing and delivering new base will be paid for in accordance with Item 247, “Flexible
Base.” Mixing, spreading, blading, shaping, compacting, and finishing new or existing base
material will be paid for as “Emulsion Treatment.” Removal and disposal of existing
asphalt concrete pavement will be paid for in accordance with pertinent Items or Article 4.2,
“Changes in the Work.”

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be
subsidiary to this Item, unless otherwise shown on the plans. When proof rolling is shown
on the plans or directed by the Engineer, it will be paid for in accordance with Item 216,
“Rolling (Proof).”

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade
or existing base will be at the Contractor’s expense. Where subgrade is not constructed
under this Contract, correction of soft spots in the subgrade or existing base will be paid for
in accordance with pertinent Items or Article 4.2, “Changes in the Work.”

A. Emulsion. Emulsion will be paid for at the unit price bid for “Emulsion.” This price is
full compensation for materials, delivery, equipment, labor, tools, and incidentals.

B. Emulsion Treatment. Emulsion treatment will be paid for at the unit price bid for
“Emulsion Treatment” of the depth specified. No additional payment will be made for

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thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, providing emulsion, spreading, applying emulsion, compacting, finishing, curing, curing materials, blading, shaping, and maintaining shape, replacing mixture, disposing of loosened materials, processing, hauling, preparing secondary subgrade, water, equipment, labor, tools, and incidentals.