SPECIAL SPECIFICATION
3786
Ultra Thin Hot Mix Bonded Wearing Course

1. Description. This Item will govern for the construction of a surface treatment composed of the application of a warm polymer-modified asphalt emulsion membrane followed immediately with an ultra thin placement of hot, plant-mixed paving mixture, in accordance with the details shown on the plans and the requirements herein. Spray apply the emulsion immediately prior to the application of the hot asphalt concrete overlay so as to produce a homogeneous wearing surface that can be opened to traffic immediately upon sufficient cooling. The finished wearing course will have a minimum thickness of 1/2 in. for Type A and 3/4 in. for Type B and Type C.

2. Materials. Furnish materials to the project meeting the following requirements prior to mixing. Additional test requirements affecting the quality of individual materials or the paving mixture will be required when shown on the plans.

   (1) Aggregate. The aggregate will be composed of a coarse aggregate, a fine aggregate and, if required, a mineral filler, meeting the requirements below, and of such gradation that the master gradation requirements for the paving mixture will be met. Submit samples of each material for approval in accordance with Item 6, “Control of Materials”.

   (a) Coarse Aggregate. Coarse aggregate is defined as that part of the aggregate retained on the No. 4 sieve. The coarse aggregate will be of natural origin, of uniform quality throughout, and will be 100% crushed material, with a minimum 85% with 2 or more crushed faces.

       The coarse aggregate will have a Micro-Deval loss of 18% or less when tested in accordance with Test Method AASHTO TP 58-99.

       The aggregate will be subjected to 5 cycles of magnesium sulfate soundness testing in accordance with Test Method Tex-411-A. The loss will not exceed 18%, unless otherwise shown on the plans.

       The aggregate will have a 25% maximum 3:1 flat and elongated ratio when tested in accordance with Test Method ASTM D 4791.

   (b) Fine Aggregate. Fine aggregate is defined as that part of the aggregate passing the No. 4 sieve. The aggregate will be of uniform quality throughout.

       The fine aggregate, when tested alone, will have a sand equivalent value of not less than 45 when tested in accordance with Test Method Tex-203-F.
On fine aggregate materials passing the 200 sieve, the methylene blue will be no greater than 10, when tested in accordance with Test Method AASHTO TP 57-99.

The fine aggregate will have an uncompacted void content of no less than 40 when tested in accordance with Test Method AASHTO T 304-96.

(c) **Mineral Filler.** Mineral filler may be used as an option in meeting the combined gradation requirements. Hydrated lime, baghouse fines and Type 1 Portland cement are acceptable as mineral filler.

If mineral filler is used, 100% will pass the No. 30 sieve, and 75 to 100% will pass the No. 200 sieve.

Proportion the mineral filler into the mix by a vane meter or an equivalent acceptable metering device. Use a hopper or other acceptable storage system to maintain a constant supply of mineral filler to the measuring device.

(2) **Asphaltic Material.**

(a) **Paving Mixture.** The Performance Graded Asphalt Binder for the paving mixture will be of the grade conforming to the climate and traffic conditions at the project site, as shown on the plans or as designated by the Engineer and will meet requirements of Item 300, “Asphalts, Oils and Emulsions”. Notify the Engineer of the source of supply of the asphaltic material prior to beginning production. The source of supply will not be changed during the course of the project without the authorization of the Engineer.

(b) **Polymer Modified Emulsion Membrane.** The emulsion will be Polymer Modified Emulsion meeting the requirements of Table 1.
Table 1
Polymer Modified Emulsion

The emulsion will be smooth and homogeneous and conform to the following requirements:

<table>
<thead>
<tr>
<th>Test On Emulsion</th>
<th>Test Method</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity @ 77°F, SSF</td>
<td>Tex-513-C</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>Tex-521-C</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>24-Hour Storage Stability, % (Note 1)</td>
<td>Tex-521-C</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Residue from Distillation @400°F, % Oil portion from distillation, ml of oil per 100 g emulsion (Note 2)</td>
<td>Tex-521-C</td>
<td>63</td>
<td>2</td>
</tr>
</tbody>
</table>

Test On Emulsion From Pump Stability Test

| Sieve Test, %                                                                   | Tex-521-C   | 0.05|     |

Test On Residue From Distillation

| Solubility in TCE, % (Note 3)                                                   | Tex-507-C   | 97.5|     |
| Elastic Recovery @50°F, % (Note 4)                                              | Tex-539-C   | 58  |     |
| Penetration @ 77°F, 100 g, 5 sec, dmm                                           | Tex-502-C   | 60  | 150 |

Note 1: After standing undisturbed for 24 hours, the surface will show no white, milky colored substance, but shall be a smooth homogeneous color throughout.

Note 2: ASTM D244 with modifications to include a 400°F +/- 10°F maximum temperature to be held for a period of 15 minutes.

Note 3: 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 4: ASTM D5976, “Standard Specification for Type 1 Polymer Modified Asphalt Cement for Use in Pavement Construction”, Section 6.2 with exception that the elongation is 20 cm and the test temperature is 50°F.

3. Paving Mixture. The paving mixture will consist of a uniform mixture of aggregate, hot asphalt cement and additives if allowed or required.

(1) Mixture Design. Formulate and submit a mix design for approval and furnish representative samples of the materials to be used in production. The proportioning of the aggregate will be such that the job-mix formula percentages fall within the master gradation limits given in Table 2. Unless otherwise shown on the plans, the gradation of the aggregate will be determined in accordance with Test Method Tex-200-F, Part II (Wet Sieve Analysis). The Performance Graded Asphalt Binder will compose from 4.6 to 5.8% by weight of the mixture, as indicated in Table 2, and as selected by the Engineer.
Table 2A
Mixture Requirements Composition by Weight Percentages

<table>
<thead>
<tr>
<th>Seives</th>
<th>Type A</th>
<th>1/4 In.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MM</td>
<td>Design General</td>
<td>Limits % Passing</td>
<td>Production</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limits</td>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td>3/4 in.*</td>
<td>19</td>
<td>40-55</td>
<td>+/-4</td>
<td></td>
</tr>
<tr>
<td>1/2 in.</td>
<td>12.7</td>
<td>22-32</td>
<td>+/-4</td>
<td></td>
</tr>
<tr>
<td>3/8 in.</td>
<td>9.5</td>
<td>15-25</td>
<td>+/-3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.75</td>
<td>10-18</td>
<td>+/-3</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2.36</td>
<td>8-13</td>
<td>+/-3</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>1.18</td>
<td>6-10</td>
<td>+/-2</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0.60</td>
<td>4-7</td>
<td>+/-2</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>0.30</td>
<td>5-0.5-8</td>
<td>0.10% max</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>0.15</td>
<td>80% Min.</td>
<td>80% Min.</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>0.075</td>
<td>4.8-5.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Asphalt Content, %
Draindown Test
Tex-235-F
Moisture Sensitivity
Tex-531-C**

Table 2B
Mixture Requirements Composition by Weight Percentages

<table>
<thead>
<tr>
<th>Seives</th>
<th>Type B</th>
<th>3/8 In.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MM</td>
<td>Design General</td>
<td>Limits % Passing</td>
<td>Production</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limits</td>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td>3/4 in.*</td>
<td>19</td>
<td>85-100</td>
<td>+/-5</td>
<td></td>
</tr>
<tr>
<td>1/2 in.</td>
<td>12.7</td>
<td>28-38</td>
<td>+/-4</td>
<td></td>
</tr>
<tr>
<td>3/8 in.</td>
<td>9.5</td>
<td>25-32</td>
<td>+/-4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.75</td>
<td>15-23</td>
<td>+/-3</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2.36</td>
<td>10-18</td>
<td>+/-3</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>1.18</td>
<td>8-13</td>
<td>+/-3</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0.60</td>
<td>6-10</td>
<td>+/-2</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>0.30</td>
<td>4-7</td>
<td>+/-2</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>0.15</td>
<td>4.8-5.6</td>
<td>0.10% max</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>0.075</td>
<td>80% Min.</td>
<td>80% Min.</td>
<td></td>
</tr>
</tbody>
</table>

Asphalt Content, %
Draindown Test
Tex-235-F
Moisture Sensitivity
Tex-531-C**
### Table 2C
Mixture Requirements Composition by Weight Percentages

<table>
<thead>
<tr>
<th>Seives</th>
<th>1/2 In.</th>
<th>-Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM</td>
<td>MM</td>
<td>Design General Limits</td>
</tr>
<tr>
<td>3/4 in.*</td>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>12.7</td>
<td>85-100</td>
</tr>
<tr>
<td>3/8 in.</td>
<td>9.5</td>
<td>60-80 +/-5</td>
</tr>
<tr>
<td>4</td>
<td>4.75</td>
<td>28-38 +/-4</td>
</tr>
<tr>
<td>8</td>
<td>2.36</td>
<td>25-32 +/-4</td>
</tr>
<tr>
<td>16</td>
<td>1.18</td>
<td>15-23 +/-3</td>
</tr>
<tr>
<td>30</td>
<td>0.60</td>
<td>10-18 +/-3</td>
</tr>
<tr>
<td>50</td>
<td>0.30</td>
<td>8-13 +/-3</td>
</tr>
<tr>
<td>100</td>
<td>0.15</td>
<td>6-10 +/-2</td>
</tr>
<tr>
<td>200</td>
<td>0.075</td>
<td>4-7 +/-2</td>
</tr>
<tr>
<td>Asphalt Content, %</td>
<td>4.6-5.6</td>
<td></td>
</tr>
<tr>
<td>Draindown Test Tex-235-F</td>
<td>0.10% max</td>
<td></td>
</tr>
<tr>
<td>Moisture Sensitivity Tex-531-C**</td>
<td>80% Min.</td>
<td></td>
</tr>
</tbody>
</table>

Asphalt Grade Conforming to PG for Climate and Traffic Conditions

* A target of 100% passing the 5/8 in. is recommended. Mixtures containing 5/8 in. aggregate size will require greater paving thickness.

** Mixture and compaction temperatures will be as recommended by the binder supplier. Unless otherwise shown on the plans, the mixture of aggregate, asphalt and additives proposed for use will be evaluated in the design stage for moisture susceptibility as indicated in Table 2 above.

(2) **Tolerances.** The gradation of the aggregate and the asphalt cement content of the produced paving mixture will not vary from the job-mix formula percentages by more than the tolerances given in Table 2 when tested in accordance with Test Method Tex-210-F or Test Method Tex-228-F.

If 3 consecutive tests indicate that the material produced exceeds the tolerances on any individual sieve, or if 2 consecutive tests indicate that the asphalt content tolerance is exceeded, stop production and do not resume until test results or other information indicate that the next mixture to be produced will be within the above tolerances.

4. **Equipment.**

(1) **General.** Maintain all equipment for the handling of all materials, mixing, placing and compacting of the paving mixture in good repair and operating condition and subject to the approval. Any equipment found to be defective and potentially having a negative effect on the quality of the paving mixture will not be allowed.

(2) **Mixing Plants.** Mixing plants may be the weigh-batch type, the modified weigh-batch type, or the drum-mix type. All plants will be equipped with satisfactory conveyors, power units, mixing equipment, aggregate handling equipment, bins and dust collectors.

Automatic proportioning devices are required for all plants and will be in accordance with Item 520, “Weighing and Measuring Equipment”.
Provide safe and accurate means to enable inspection forces to take all required samples, to provide permanent means for checking the output of any specified metering device, and to perform calibration and weight checks.

When using fuel oil heavier than Grade No. 2, or waste oil, insure that the fuel delivered to the burner is at a viscosity of 100 SSU or less, when tested in accordance with Test Method Tex-534-C, to insure complete burning of the fuel. Higher viscosity will be allowed if recommended by the burner manufacturer. If necessary, preheat the oil to maintain the required viscosity.

Provide means for obtaining a sample of the fuel, just prior to entry into the burner, in order to perform the viscosity test. Perform this test or provide a laboratory test report that will establish the temperature of the fuel necessary to meet the viscosity requirements. There will be an in-line thermometer to check the temperature of the fuel delivered to the burner.

Regardless of the burner fuel used, the burner or combination of burners and types of fuel used will provide a complete burn of the fuel and not leave any fuel residue that will adhere to the heated aggregate.

(a) Weigh-Batch Type.

**Cold Aggregate Bin Unit and Proportioning Device.** The cold aggregate bin unit will have a separate bin for each aggregate which is of sufficient size to store the amount of aggregate required to keep the plant in continuous operation and of proper design to prevent overflow of material from one bin to another. There will be vertical partitions between each bin and on each end of the bins of sufficient height so that any overflow will be to the front and back, and not allow overflow to the sides or between bins. Overflow that might occur will not fall onto any feeder belt. The proportioning device will provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. Proportion each aggregate from a separate bin.

**Dryer.** The dryer will continually agitate the aggregate during heating. Control the temperature so that the aggregate will not be damaged in the drying and heating operations. The dryer will be of sufficient size to keep the plant in continuous operation.

**Screening and Proportioning.** The screening capacity and size of the hot aggregate bins will be sufficient to screen and store the amount of aggregate required to properly operate the plant and keep the plant in continuous operation at full capacity. Construct the hot bins so that oversize and overloaded material will be discarded through overflow chutes. Provisions will be made to enable inspection forces to have easy and safe access to the proper location on the mixing plant where representative samples may be taken from the hot bins for testing.
Aggregate Weigh Box and Batching Scale. The aggregate weigh box and batching scales will be of sufficient capacity to hold and weigh a complete batch of aggregate and will conform to the requirements of Item 520, “Weighing and Measuring Equipment”.

Asphaltic Material Measuring System. If an asphaltic material bucket and scales are used, they will be of sufficient capacity to hold and weigh the necessary asphaltic material for one batch. The bucket and scales will conform to the requirements of Item 520, “Weighing and Measuring Equipment”.

If a pressure type flow meter is used to measure the asphaltic material, the requirements of Item 520, “Weighing and Measuring Equipment”, will apply. Include an automatic temperature compensation device to insure a constant percent by weight of asphaltic material in the paving mixture.

Make provisions of a permanent nature for checking the accuracy of the asphaltic material-measuring device. Protect the asphalt line to the measuring device with a jacket of hot oil or other approved means to maintain the temperature of the line near the temperature specified for the asphaltic material.

Mixer. The mixer will be of the pugmill type and have a capacity of not less than 3,000 lb. (of natural-aggregate mixture) in a single batch, unless otherwise shown on the plans. Do not use any mixer that has a tendency to segregate the aggregate or fails to secure a thorough and uniform mixture with the asphaltic material. Provide all mixers with an automatic timer that will lock the discharge doors of the mixer for the required mixing period. The dump door or doors and the shaft seals of the mixer will be tight enough to prevent spilling of aggregate or mixture from the pugmill.

Surge-Storage System and Scales. A surge-storage system may be used to minimize the production interruptions during the normal day’s operations. Use a device such as a gob hopper or other approved device to prevent segregation in the surge-storage bin. The paving mixture will be weighed upon discharge from the surge-storage system.

When a surge-storage system is used, scales will be standard platform truck scales or other equipment such as weigh hopper (suspended) scales and will conform to Item 520, “Weighing and Measuring Equipment”. If truck scales are used, place at an approved location. If other weighing equipment is used, weight checks by truck scales may be required for the basis of approval of the equipment.

Recording Device and Record Printer. The paving mixture will be weighed for payment. If a surge-storage system is used, provide an automatic recording device and a digital record printer to indicate the date, project identification number, vehicle identification, total weight of the load, tare weight of the vehicle, the weight of paving mixture in each load and the number of loads for the day, unless otherwise indicated on the plans. When surge-storage is not used, batch weights will be used as the basis for payment and automatic recording devices and
automatic digital record printers in accordance with Item 520, “Weighing and Measuring Equipment”, will be required.

(b) Modified Weigh-Batch Type.

General. This plant is similar to the weigh-batch type plant. Remove the hot bin screens and place the aggregate control at the cold feeds. The cold feed bins will be the same as those required for the drum-mix type plant.

Cold-Aggregate Bin Unit and Feed System. The number of bins in the cold-aggregate bin unit will be equal to or greater than the number of stockpiles of individual materials to be used.

The bins will be of sufficient size to store the amount of aggregate required to keep the plant in continuous operation and of proper design to prevent overflow of material from one bin to another. There will be vertical partitions between each bin and on each end of the bins of sufficient height so that any overflow will be to the front and back and not allow overflow to the sides or between bins. Overflow that might occur will not fall onto any feeder belt. The feed system will provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. Furnish a chart indicating the calibration of each cold bin Scalping Screen. A scalping screen will be required after the cold feeds and ahead of the hot aggregate surge bins.

Dryer. The dryer will continually agitate the aggregate during heating. Control the temperature so that the aggregate will not be damaged in the drying and heating operations. The dryer will be of sufficient size to keep the plant in continuous operation.

Screening and Proportioning. The hot aggregate will not be separated into sizes after being dried. Provide one or more surge bins between the dryer and the weigh hopper. Surge bins will be of sufficient size to hold enough combined aggregate for one complete batch of paving mixture.

Aggregate Weigh Box and Batching Scale. The aggregate weigh box and batching scales will be of sufficient capacity to hold and weigh a complete batch of aggregate and will conform to the requirements of Item 520, “Weighing and Measuring Equipment”.

Asphaltic Material Measuring System. If an asphaltic material bucket and scales are used, they will be of sufficient capacity to hold and weigh the necessary asphaltic material for one batch. The bucket and scales will conform to the requirements of Item 520, “Weighing and Measuring Equipment”.

If a pressure type flow meter is used to measure the asphaltic material, the requirements of Item 520, “Weighing and Measuring Equipment”, will apply.

Include an automatic temperature compensation device to insure a constant percent by weight of asphaltic material in the mixture.
Make provisions of a permanent nature for checking the accuracy of the asphaltic material-measuring device. Protect the asphalt line to the measuring device with a jacket of hot oil or other approved means to maintain the temperature of the line near the temperature specified for the asphaltic material.

**Mixer.** The mixer will be of the pugmill type with a capacity of not less than 3,000 lb. (of natural-aggregate mixture) in a single batch, unless otherwise shown on the plans. Do not use any mixer that has a tendency to segregate the aggregate or fails to secure a thorough and uniform mixture with the asphaltic material. Provide all mixers with an automatic timer that will lock the discharge doors of the mixer for the required mixing period. The dump door or doors and the shaft seals of the mixer will be tight enough to prevent spilling of aggregate or mixture from the pugmill.

**Surge-Storage System and Scales.** A surge-storage system may be used to minimize the production interruptions during the normal day’s operations. Use a device such as a gob hopper or other approved device to prevent segregation in the surge-storage bin. The paving mixture will be weighed upon discharge from the surge-storage system.

When a surge-storage system is used, scales will be standard platform truck scales or other equipment such as weigh hopper (suspended) scales and conform to Item 520, “Weighing and Measuring Equipment”. If truck scales are used, they will be placed at an approved location. If other weighing equipment is used, weight checks by truck scales may be required for the basis of approval of the equipment.

**Recording Device and Record Printer.** The paving mixture will be weighed for payment. If a surge-storage system is used, provide an automatic recording device and a digital record printer to indicate the date, project identification number, vehicle identification, total weight of the load, tare weight of the vehicle, the weight of paving mixture in each load and the number of loads for the day, unless otherwise indicated on the plans. When surge-storage is not used, batch weights will be used as the basis for payment and automatic recording devices and automatic digital record printers in accordance with Item 520, “Weighing and Measuring Equipment”, will be required.

(c) **Drum-Mix Type.**

**General.** The plant will be adequately designed and constructed for the process of mixing aggregates and asphalt. The plant will be equipped with satisfactory conveyors, power units, aggregate-handling equipment and feed controls.

**Cold-Aggregate Bin Unit and Feed System.** The number of bins in the cold-aggregate bin unit will be equal to or greater than the number of stockpiles of individual materials to be used.

The bins will be of sufficient size to store the amount of aggregate required to keep the plant in continuous operation and of proper design to prevent overflow of material from one bin to another. There will be vertical partitions between each bin and on each end of the bins of sufficient height so that any overflow will be to the
front and back and not allow overflow to the sides or between bins. Overflow that might occur will not fall onto any feeder belt. The feed system will provide a uniform and continuous flow of aggregate in the desired proportion to the mixer. Furnish a chart indicating the calibration of each cold bin.

The system will provide positive weight measurement of the combined cold aggregate feed by use of belt scales or other approved devices.

Make provisions of a permanent nature for checking the accuracy of the measuring device as required by Item 520, “Weighing and Measuring Equipment”. When a belt scale is used, paving mixture production will be maintained so that the scale normally operates between 50% and 100% of its rated capacity. Belt scale operation below 50% of the rated capacity may be allowed if accuracy checks show the scale to meet the requirements of Item 520, “Weighing and Measuring Equipment”, at the selected rate. Satisfactorily demonstrate that paving mixture uniformity and quality have not been adversely affected.

**Scalping Screen.** A scalping screen will be required after the cold feeds and ahead of the combined aggregate belt scales.

**Asphaltic Material Measuring System.** An asphaltic material measuring device meeting the requirements of Item 520, “Weighing and Measuring Equipment”, will be placed in the asphalt line leading to the mixer so that the cumulative amount of asphalt used can be accurately determined. Make provisions of a permanent nature for checking the accuracy of the measuring device output. Protect the asphalt line to the measuring device with a jacket of hot oil or other approved means to maintain the temperature of the line near the temperature specified for the asphaltic material. The measuring system will include an automatic temperature compensation device to maintain a constant percent by weight of asphaltic material in the paving mixture.

**Synchronization Equipment for Feed-Control Systems.** Couple the asphaltic material feed-control with the total aggregate weight-measuring device to automatically vary the asphalt-feed rate in order to maintain the required proportion.

**Mixing System.** The mixing system will control the temperature so that the aggregate and asphalt will not be damaged in the drying, heating and mixing operations. Provide a continuously recording thermometer which will indicate the temperature of the paving mixture as it leaves the mixer.

**Surge-Storage System and Scales.** Use a surge-storage system to minimize the production interruptions during the normal day's operations. Use a device such as a gob hopper or other approved device to prevent segregation in the surge-storage bin shall be used. The paving mixture will be weighed upon discharge from the surge-storage system.

Scales will be standard platform truck scales or other equipment such as weigh hopper (suspended) scales and conform to Item 520, “Weighing and Measuring Equipment”. If truck scales are used, place at an approved location. If other
weighing equipment is used, checks by truck scales may be required for the basis of approval of the equipment.

**Recording Device and Record Printer.** Provide automatic recording and automatic digital record printers to indicate the date, project identification number, vehicle identification, total weight of the load, tare weight of the vehicle, the weight of paving mixture in each load and the number of loads for the day in accordance with Item 520, “Weighing and Measuring Equipment”, unless otherwise shown on the plans.

(3) **Asphaltic Material Heating Equipment.** Asphaltic material heating equipment will be adequate to heat the required amount of asphaltic material to the desired temperature. Equip the heating apparatus with a continuously recording thermometer with a 24-hour chart that will record the temperature of the asphaltic material at the location of highest temperature.

(4) **Bonded Wearing Course Paver.** The paver will be approved meet the following requirements. The self-priming machine will be capable of spraying the Polymer Modified Emulsion Membrane, applying the hot asphalt concrete overlay and leveling the surface of the mat in one pass. The self-priming paving machine will incorporate a receiving hopper, feed conveyor, insulated storage tank for Polymer Modified Emulsion, Polymer Modified Emulsion Membrane spray bar and a variable width, heated, combination vibratory-tamping bar screed.

(a) **Screed Unit.** The screed will have the ability to be crowned at the center both positively and negatively and have vertically adjustable extensions to accommodate the desired pavement profile. Equip the paver with a heated screed. It will produce a finished surface meeting the requirements of the typical cross sections.

Extensions added to the screed will be provided with the same heating capability as the main screed unit, except for use on variable depth tapered areas and/or as approved. The screed, with extensions if necessary, will be of such width as to pave an entire lane in a single pass.

(b) **Asphalt Distribution System.** Provide a metered mechanical pressure sprayer on the paver to accurately apply and monitor the rate of application of the Polymer Modified Emulsion Membrane. The rate will be uniform across the entire paving width. Apply immediately in front of the screed unit.

(c) **Tractor Unit.** The tractor unit will be equipped with a hydraulic hitch sufficient in design and capacity to maintain contact between the rear wheels of the hauling equipment and the pusher rollers of the finishing machine while the paving mixture is being unloaded.

The asphalt paver will support no portion of the weight of hauling equipment, other than the connection. No vibrations or other motions of the loading equipment, which could have a detrimental effect on the riding quality of the completed pavement, will be transmitted to the paver.
(5) **Rollers.** Maintain rollers in reliable operating condition and equip with functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums. Supply adequate roller units so the compaction will be accomplished promptly following the placement of the material. A non-petroleum release agent (added to the water system) may be required to prevent adhesion of the fresh mix to the roller drum and wheels. Compaction will normally be done in the static mode. Rollers provided will meet the requirements for their type as follows:

(a) **Two-Axle Tandem Roller.** This roller will be an acceptable self-propelled tandem roller.

(b) **Three-Wheel Roller.** This roller will be an acceptable self-propelled three-wheel roller.

(c) **Three-Axle Tandem Roller.** This roller will be an acceptable self-propelled three-axle roller.

(6) **Straightedges and Templates.** When directed, provide acceptable 10 ft. straightedges for surface testing. Provide satisfactory templates as required.

(7) **Alternate Equipment.** When permitted, equipment other than that specified herein which will consistently produce satisfactory results may be used.

5. **Stockpiling, Storage and Mixing.**

(1) **Stockpiling of Aggregates.** Prior to stockpiling of aggregates, clean the area of trash, weeds, grass and the area will be relatively smooth and well drained. Stockpile in a manner that will minimize aggregate degradation, segregation, mixing of one stockpile with another, and will not allow contamination with foreign material.

The plant will have at least a 2 day supply of aggregates on hand before production can begin and at least a 2 day supply will be maintained through the course of the project, unless otherwise directed.

No stockpile will contain aggregate from more than 1 source.

When required, additional material will not be added to stockpiles that have previously been sampled for approval.

Furnish equipment of an acceptable size and type to work the stockpiles and prevent segregation and degradation of the aggregates.

(2) **Storage and Heating of Asphaltic Materials.** The asphaltic material storage capacity will be ample to meet the requirements of the plant. Do not heat the asphalt to a temperature in excess of that specified in Item 300, “Asphalts, Oils and Emulsions”. All equipment used in the storage and handling of asphaltic material will be kept in a clean condition at all times and operated in such a manner that there will be no contamination with foreign matter.

(3) **Feeding and Drying of Aggregate.** Feed the various sizes of aggregate to the dryer through the cold aggregate bins and the proportioning device in such a manner that a
uniform and constant flow of materials in the required proportions will be maintained. Dry and heat the aggregate to the temperature necessary to produce a paving mixture seal having the specified temperature.

(4) Mixing and Storage.

(a) Weigh-Batch Plant. In introducing the batch into the mixer, all aggregate will be introduced first and mixed thoroughly for a minimum period of 5 seconds to uniformly distribute the various sizes throughout the batch before the asphaltic material is added. Add the asphaltic material and continue mixing for a wet mixing period of not less than 15 seconds. The mixing period will be increased if the paving mixture is not uniform or the aggregates are not properly coated.

Temporary storing or holding of the paving mixture by the surge-storage system will be permitted during the normal day's operation. The paving mixture coming out of the surge-storage bin will be of equal quality to that coming out of the mixer.

(b) Modified Weigh-Batch Plant. The mixing and storage requirements will be the same as is required for a standard weigh-batch plant.

(c) Drum-Mix Plant. The amount of aggregate and asphaltic material entering the mixer and the rate of travel through the mixing unit will be so coordinated that a uniform mixture of the specified grading and asphalt content will be produced.

Temporary storing or holding of the paving mixture by the surge-storage system will be required during the normal day's operation. The paving mixture coming out of the surge-storage bin will be of equal quality to that coming out of the mixer.

6. Construction Methods. Place the Polymer Modified Emulsion Membrane and paving mixture only when the temperature of the surface to be overlaid is 50°F or more, and the air temperature is above 50°F and rising, but will not be placed when the air temperature is below 60°F and falling. The air temperature will be taken in the shade away from artificial heat. Place the Polymer Modified Emulsion Membrane or paving mixture only when the humidity, general weather conditions and moisture condition of the pavement surface are suitable.

(1) Surface Preparation. The following items will be performed prior to the commencement of paving operations.

Protect manhole covers, drains, grates catch basins and other such utility structures and cover with plastic or building felt prior to paving and clearly reference for location and adjustment after paving.

Remove thermoplastic traffic markings if greater than 1/4 in. thickness.

Clean and fill pavement cracks and joints greater than 1/4 in. wide using an approved material and method.

Fill surface irregularities greater than 1 in. deep with an approved material.
Thoroughly clean the entire pavement surface to be overlaid giving specific attention to accumulated mud and debris. Pressurized water and/or vacuum systems may be required to insure a clean surface.

(2) **Polymer Modified Emulsion Membrane.** Before the membrane and paving mixture are applied, thoroughly clean the surface upon which the membrane is to be placed. A metered mechanical pressure spray bar at a temperature of 140ºF to 180ºF will spray the Polymer Modified Emulsion Membrane. The sprayer will accurately and continuously monitor the rate of spray and provide a uniform application across the entire width to be overlaid. The rate of spray will be in the range of 0.15 to 0.30 gallons per square yard as determined by the mix design. Base adjustments to the spray rate on the existing pavement surface conditions and recommendations of the emulsion supplier.

No wheel or other part of the paving machine will come in contact with the Polymer Modified Emulsion Membrane before the hot mix asphalt concrete wearing course is applied.

(3) **Transporting Paving Mixture.** The paving mixture, prepared as specified above, will be hauled to the work site in tight vehicles previously cleaned of all foreign material. Covers and insulated truck beds will be required, unless otherwise shown on the plans. If necessary to prevent the paving mixture from adhering to the bed, the inside of the truck bed will be given a light coating of a satisfactory release agent. Use of diesel will not be allowed.

(4) **Placing.** Apply the hot mix asphalt concrete at a temperature of 300ºF to 330ºF and spread over the Polymer Modified Emulsion Membrane immediately after the application of the membrane. Place the hot asphalt concrete wearing course over the full width of the emulsion with a heated, combination vibratory-tamping bar screed. Provide a continuous flow of material to the paver by means of a self-propelled wheel mounted material transfer vehicle (MTV). It will have an approximate storage capacity of 30 tons and be equipped with a pivoting Discharge Conveyor. The MTV will have a system of augers or other approved systems to remix the mixture during the transfer process. The hopper will be equipped with a separate surge storage insert with an approximate capacity of 20 tons in order to allow a non-stop placement of asphaltic concrete pavement for the surface courses on the mainlanes and shoulders. The MTV will be approved before use. This is required to minimize segregation and improve ride quality. In addition, the paver will be equipped with electronic grade and slope control devices to monitor and control the lift thickness and smoothness of the surface course. Spread the paving mixture on the membrane surface in such a manner that, when properly compacted, the finished surface will be smooth and of uniform texture and density. Operate the paver at a satisfactory speed. If sporadic delivery of paving mixture adversely affects the quality of the work or unduly lengthens the time the traffic is restricted from full use of the through lanes, cease laying operations and fully restore traffic to the through lanes until consistent delivery of the paving mixture is provided. Take care to prevent splattering of adjacent pavement, curb and gutter and structures during paving operations.

(5) **Compaction.** Compaction of the wearing course will consist of a minimum of 2 passes with a steel double drum asphalt roller of minimum weight of 10 tons, before the
material temperature has fallen below 185°F. At no time will the roller or rollers be allowed to remain stationary on the freshly placed asphalt concrete. Compaction will immediately follow the placement of the Ultra Thin Bonded Wearing Course with an approved asphalt roller(s). Supply adequate roller units so the compaction will be accomplished promptly following the placement of the material. Compaction will normally be done in the static mode. The speed and motion of the rollers shall be such as to avoid displacement of the paving mixture. If any displacement occurs, it will be corrected. To prevent adhesion of the paving mixture to the roller, keep the wheels moistened with a soap-water solution. Take necessary precautions to prevent the dropping of gasoline, oil, grease or other foreign matter on the pavement, either when the rollers are in operation or when standing. Sprinkling of the fresh mat will be required when directed to expedite opening the roadway to traffic. Sprinkling will be with water or limewater solution as directed.

(6) Traffic Return. Because of the minimal depth of the hot mix asphalt concrete being poached, it may be damaged if opened to traffic too quickly. Therefore, the new pavement shall not be opened to traffic until the rolling operation is complete and the material has cooled sufficiently to resist damage. The cooling time will be brief due to the minimal depth of the mat.

7. Measurement. Measure the “Ultra Thin Hot Mix Bonded Wearing Course” by the ton of the composite hot mix asphalt of the type actually used, and by the gallon of the polymer-modified emulsion membrane, completed and accepted work in accordance with the plans and specifications for the project.

8. 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 “Hot Mix Asphalt” and “Polymer-Modified Emulsion Membrane” of the type specified. This price will be full compensation for all labor, materials, equipment and incidentals necessary to complete the work. All templates, straightedges, scales and other weighing and measuring devices necessary for the proper construction, measuring and checking of the work will be furnished, operated and maintained and will be considered subsidiary to this Item.