SPECIAL SPECIFICATION

3372

Ultra Thin Hot Mix Bonded Wearing Course

1. Description. This Item shall 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. The emulsion shall be spray applied 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 shall have a minimum thickness of 1/2 in. for Type A and 3/4 in. for Type B and Type C.

2. Materials. The Contractor shall 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 shall be required when shown on the plans.

   (1) Aggregate. The aggregate shall 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. Samples of each material shall be submitted 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 shall be of natural origin, of uniform quality throughout, and shall be 100% crushed material, with a minimum 85% with 2 or more crushed faces.

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

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

       The aggregate shall 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 shall be of uniform quality throughout.

       The fine aggregate, when tested alone, shall 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 shall be no greater than 10, when tested in accordance with Test Method AASHTO TP 57-99.

The fine aggregate shall 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% shall pass the No. 30 sieve, and 75 to 100% shall pass the No. 200 sieve.

The mineral filler shall be proportioned into the mix by a vane meter or an equivalent metering device acceptable to the Engineer. A hopper or other acceptable storage system shall be required 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 shall 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 shall meet requirements of Item 300, “Asphalts, Oils and Emulsions”. The Contractor shall notify the Engineer of the source of supply of the asphaltic material prior to beginning production, and the source of supply shall not be changed during the course of the project without the authorization of the Engineer.

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

The emulsion shall 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 shall 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 50ºF.

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

   (1) **Mixture Design**. The Contractor shall formulate and submit a mix design for approval by the Engineer and furnish the Engineer with 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 shall 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>ASTM</th>
<th>MM</th>
<th>Design General Limits % Passing</th>
<th>Production Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 in.*</td>
<td>19</td>
<td></td>
<td>100</td>
<td>+/-4</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>12.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/8 in.</td>
<td>9.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.75</td>
<td>40-55</td>
<td></td>
<td>+/-4</td>
</tr>
<tr>
<td>8</td>
<td>2.36</td>
<td>22-32</td>
<td></td>
<td>+/-4</td>
</tr>
<tr>
<td>16</td>
<td>1.18</td>
<td>15-25</td>
<td></td>
<td>+/-3</td>
</tr>
<tr>
<td>30</td>
<td>0.60</td>
<td>10-18</td>
<td></td>
<td>+/-3</td>
</tr>
<tr>
<td>50</td>
<td>0.30</td>
<td>8-13</td>
<td></td>
<td>+/-3</td>
</tr>
<tr>
<td>100</td>
<td>0.15</td>
<td>6-10</td>
<td></td>
<td>+/-2</td>
</tr>
<tr>
<td>200</td>
<td>0.075</td>
<td>4-7</td>
<td></td>
<td>+/-2</td>
</tr>
</tbody>
</table>

Asphalt Content, % 5.0-5.8

Draindown Test
Tex-235-F 0.10% max

Moisture Sensitivity
Tex-531-C** 80% Min.

Table 2B
Mixture Requirements Composition by Weight Percentages

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

Asphalt Content, % 4.8-5.6

Draindown Test
Tex-235-F 0.10% max

Moisture Sensitivity
Tex-531-C** 80% Min.
Table 2C
Mixture Requirements Composition by Weight Percentages

<table>
<thead>
<tr>
<th>Seives</th>
<th>ASTM</th>
<th>MM</th>
<th>Design General Limits</th>
<th>Production Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>% Passing</td>
<td></td>
</tr>
<tr>
<td>3/4 in.*</td>
<td>19</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2 in.</td>
<td>12.7</td>
<td>85-100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/8 in.</td>
<td>9.5</td>
<td>60-80</td>
<td></td>
<td>+/- 5</td>
</tr>
<tr>
<td>4</td>
<td>4.75</td>
<td>28-38</td>
<td></td>
<td>+/- 4</td>
</tr>
<tr>
<td>8</td>
<td>2.36</td>
<td>25-32</td>
<td></td>
<td>+/- 4</td>
</tr>
<tr>
<td>16</td>
<td>1.18</td>
<td>15-23</td>
<td></td>
<td>+/- 3</td>
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<tr>
<td>30</td>
<td>0.60</td>
<td>10-18</td>
<td></td>
<td>+/- 3</td>
</tr>
<tr>
<td>50</td>
<td>0.30</td>
<td>8-13</td>
<td></td>
<td>+/- 3</td>
</tr>
<tr>
<td>100</td>
<td>0.15</td>
<td>6-10</td>
<td></td>
<td>+/- 2</td>
</tr>
<tr>
<td>200</td>
<td>0.075</td>
<td>4-7</td>
<td></td>
<td>+/- 2</td>
</tr>
<tr>
<td>Asphalt Content, %</td>
<td></td>
<td>4.6-5.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Draindown Test
Tex-235-F
0.10% max

Moisture Sensitivity
Tex-531-C**
80% Min.

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 shall require greater paving thickness.

** Mixture and compaction temperatures shall 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 shall 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, production shall stop and not resume until test results or other information indicate, to the satisfaction of the Engineer, that the next mixture to be produced will be within the above tolerances.

4. Equipment.

(1) General. All equipment for the handling of all materials, mixing, placing and compacting of the paving mixture shall be maintained in good repair and operating condition and subject to the approval of the Engineer. 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 shall 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 shall be in accordance with Item 520, “Weighing and Measuring Equipment”.

Asphalt Content, %

Draindown Test
Tex-235-F
0.10% max

Moisture Sensitivity
Tex-531-C**
80% Min.
It shall be the Contractor's responsibility to 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 as required by the Engineer.

When using fuel oil heavier than Grade No. 2, or waste oil, the Contractor shall 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, the Contractor shall preheat the oil to maintain the required viscosity.

The Contractor shall provide means for obtaining a sample of the fuel, just prior to entry into the burner, in order to perform the viscosity test. The Contractor shall perform this test or provide a laboratory test report that will establish the temperature of the fuel necessary to meet the viscosity requirements. There shall 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 shall 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 shall 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 shall 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 shall not fall onto any feeder belt. The proportioning device shall provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. Each aggregate shall be proportioned from a separate bin.

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

**Screening and Proportioning.** The screening capacity and size of the hot aggregate bins shall 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. The hot bins shall be constructed so that oversize and overloaded material will be discarded through overflow chutes. Provisions shall 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 batch ing scales shall be of sufficient capacity to hold and weigh a complete batch of aggregate. The weigh box and scales shall 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 shall be of sufficient capacity to hold and weigh the necessary asphaltic material one batch. The bucket and scales shall 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”, shall apply. This system shall include an automatic temperature compensation device to ensure a constant percent by weight of asphaltic material in the paving mixture.

Provisions of a permanent nature shall be made for checking the accuracy of the asphaltic material-measuring device. The asphalt line to the measuring device shall be protected 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 shall be of the pugmill type and shall have a capacity of not less than 3,000 lb. (of natural-aggregate mixture) in a single batch, unless otherwise shown on the plans. Any mixer that has a tendency to segregate the aggregate or fails to secure a thorough and uniform mixture with the asphaltic material shall not be used. All mixers shall be provided 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 shall 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. A device such as a gob hopper or other device approved by the Engineer to prevent segregation in the surge-storage bin shall be used. The paving mixture shall be weighed upon discharge from the surge-storage system.

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

Recording Device and Record Printer. The paving mixture shall be weighed for payment. If a surge-storage system is used, an automatic recording device and a digital record printer shall be provided 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 shall 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”, shall be required.

(b) Modified Weigh-Batch Type.

General. This plant is similar to the weigh-batch type plant. The hot bin screens shall be removed and the aggregate control is placed 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 shall be equal to or greater than the number of stockpiles of individual materials to be used.

The bins shall 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 shall 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 shall not fall onto any feeder belt. The feed system shall provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. The Contractor shall furnish a chart indicating the calibration of each cold bin Scalping Screen. A scalping screen shall be required after the cold feeds and ahead of the hot aggregate surge bins.

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

Screening and Proportioning. The hot aggregate shall not be separated into sizes after being dried. There shall be 1 or more surge bins provided between the dryer and the weigh hopper. Surge bins shall be of sufficient size to hold enough combined aggregate for 1 complete batch of paving mixture.

Aggregate Weigh Box and Batching Scale. The aggregate weigh box and batching scales shall be of sufficient capacity to hold and weigh a complete batch of aggregate. The weigh box and scales shall 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 shall be of sufficient capacity to hold and weigh the necessary asphaltic material for one batch. The bucket and scales shall 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”, shall apply.

This system shall include an automatic temperature compensation device to insure a constant percent by weight of asphaltic material in the mixture.
Provisions of a permanent nature shall be made for checking the accuracy of the asphaltic material-measuring device. The asphalt line to the measuring device shall be protected 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 shall be of the pugmill type and shall have a capacity of not less than 3,000 lb. (of natural-aggregate mixture) in a single batch, unless otherwise shown on the plans. Any mixer that has a tendency to segregate the aggregate or fails to secure a thorough and uniform mixture with the asphaltic material shall not be used. All mixers shall be provided 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 shall 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. A device such as a gob hopper or other device approved by the Engineer to prevent segregation in the surge-storage bin shall be used. The paving mixture shall be weighed upon discharge from the surge-storage system.

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

**Recording Device and Record Printer.** The paving mixture shall be weighed for payment. If a surge-storage system is used, an automatic recording device and a digital record printer shall be provided 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 shall 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”, shall be required.

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

**General.** The plant shall be adequately designed and constructed for the process of mixing aggregates and asphalt. The plant shall 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 shall be equal to or greater than the number of stockpiles of individual materials to be used.

The bins shall 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 shall 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 shall not fall onto any feeder belt. The feed system shall provide a uniform and continuous flow of aggregate in the desired proportion to the mixer. The Contractor shall furnish a chart indicating the calibration of each cold bin.

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

Provisions of a permanent nature shall be made 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 shall 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 by the Engineer if accuracy checks show the scale to meet the requirements of Item 520, “Weighing and Measuring Equipment”, at the selected rate. It shall be satisfactorily demonstrated to the Engineer that paving mixture uniformity and quality have not been adversely affected.

**Scalping Screen.** A scalping screen shall 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”, shall be placed in the asphalt line leading to the mixer so that the cumulative amount of asphalt used can be accurately determined. Provisions of a permanent nature shall be made for checking the accuracy of the measuring device output. The asphalt line to the measuring device shall be protected 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 shall 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.** The asphaltic material feed-control shall be coupled 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 shall control the temperature so that the aggregate and asphalt will not be damaged in the drying, heating and mixing operations. A continuously recording thermometer shall be provided which will indicate the temperature of the paving mixture as it leaves the mixer.

**Surge-Storage System and Scales.** A surge-storage system shall be used to minimize the production interruptions during the normal day's operations. A device such as a gob hopper or other device approved by the Engineer to prevent segregation in the surge-storage bin shall be used. The paving mixture shall be weighed upon discharge from the surge-storage system.
Scales shall be standard platform truck scales or other equipment such as weigh hopper (suspended) scales and shall conform to Item 520, “Weighing and Measuring Equipment”. If truck scales are used, they shall be placed at a location approved by the Engineer. If other weighing equipment is used, the Engineer may require weight checks by truck scales for the basis of approval of the equipment.

**Recording Device and Record Printer.** Automatic recording and automatic digital record printers shall be provided 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 shall be adequate to heat the required amount of asphaltic material to the desired temperature. The heating apparatus shall be equipped 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 shall be approved by the Engineer and shall meet the following requirements. The self-priming machine shall 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 shall 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 shall have the ability to be crowned at the center both positively and negatively and have vertically adjustable extensions to accommodate the desired pavement profile. The paver shall be equipped with a heated screed. It shall produce a finished surface meeting the requirements of the typical cross sections.

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

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

(c) **Tractor Unit.** The tractor unit shall 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 shall 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, shall be transmitted to the paver.

(5) **Rollers.** Rollers shall be well maintained, in reliable operating condition and be equipped with functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums. Adequate roller units shall be supplied 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 shall normally be done in the static mode. Rollers provided shall meet the requirements for their type as follows:

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

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

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

(6) **Straightedges and Templates.** When directed by the Engineer, the Contractor shall provide acceptable 10 ft. straightedges for surface testing. Satisfactory templates shall be provided as required by the Engineer.

(7) **Alternate Equipment.** When permitted by the Engineer, 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, the area shall be cleaned of trash, weeds, grass and shall be relatively smooth and well drained. The stockpiling shall be done 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 shall have at least a 2 day supply of aggregates on hand before production can begin and at least a 2 day supply shall be maintained through the course of the project, unless otherwise directed by the Engineer.

No stockpile shall contain aggregate from more than 1 source.

When required by the Engineer, additional material shall not be added to stockpiles that have previously been sampled for approval.

Equipment of an acceptable size and type shall be furnished to work the stockpiles and prevent segregation and degradation of the aggregates.

(2) **Storage and Heating of Asphaltic Materials.** The asphaltic material storage capacity shall be ample to meet the requirements of the plant. Asphalt shall not be heated 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 shall be kept in a
clean condition at all times and shall be operated in such a manner that there will be no contamination with foreign matter.

(3) **Feeding and Drying of Aggregate.** The feeding of various sizes of aggregate to the dryer shall be done 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. The aggregate shall be dried and heated 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 shall be introduced first and shall be mixed thoroughly for a minimum period of 5 seconds to uniformly distribute the various sizes throughout the batch before the asphaltic material is added. The asphaltic material shall then be added and the mixing continued for a wet mixing period of not less than 15 seconds. The mixing period shall be increased if, in the opinion of the Engineer, 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 shall be of equal quality to that coming out of the mixer.

(b) **Modified Weigh-Batch Plant.** The mixing and storage requirements shall 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 shall 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 shall be of equal quality to that coming out of the mixer.

6. **Construction Methods.** Polymer Modified Emulsion Membrane and paving mixture may be placed 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 shall 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. It is further provided that the Polymer Modified Emulsion Membrane or paving mixture shall be placed only when the humidity, general weather conditions and moisture condition of the pavement surface, in the opinion of the Engineer, are suitable.

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

Manhole covers, drains, grates catch basins and other such utility structures shall be protected and covered with plastic or building felt prior to paving and also shall be clearly referenced for location and adjustment after paving.

Thermoplastic traffic markings shall be removed if greater than 1/4 in. thickness.
Pavement cracks and joints greater than 1/4 in. wide shall be cleaned and filled using an approved material and method.

Surface irregularities greater than 1 in. deep shall be filled with a material approved by the Engineer.

The entire pavement surface to be overlaid shall be thoroughly cleaned, 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, the surface upon which the membrane is to be placed shall be cleaned thoroughly to the satisfaction of the Engineer. A metered mechanical pressure spray bar at a temperature of 140°F to 180°F shall spray the Polymer Modified Emulsion Membrane. The sprayer shall accurately and continuously monitor the rate of spray and provide a uniform application across the entire width to be overlaid. The rate of spray shall be in the range of 0.15 to 0.30 gallons per square yard as determined by the mix design. Adjustments to the spray rate shall be made based upon the existing pavement surface conditions and recommendations of the emulsion supplier.

No wheel or other part of the paving machine shall 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, shall be hauled to the work site in tight vehicles previously cleaned of all foreign material. Covers and insulated truck beds shall 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 shall be given a light coating of release agent satisfactory to the Engineer. Use of diesel will not be allowed.

(4) **Placing.** The hot mix asphalt concrete shall be applied at a temperature of 300°F to 330°F and shall be spread over the Polymer Modified Emulsion Membrane immediately after the application of the membrane. The hot asphalt concrete wearing course shall be placed over the full width of the emulsion with a heated, combination vibratory-tamping bar screed. The Contractor shall provide a continuous flow of material to the paver by means of a self-propelled wheel mounted material transfer vehicle (MTV). It shall have an approximate storage capacity of 30 tons and shall be equipped with a pivoting Discharge Conveyor. The MTV shall have a system of augers or other approved systems to remix the mixture during the transfer process. The hopper shall 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 shall be approved by the Engineer before use. This is required to minimize segregation and improve ride quality. In addition, the paver shall be equipped with electronic grade and slope control devices to monitor and control the lift thickness and smoothness of the surface course. The paving mixture shall be spread on the membrane surface in such a manner that, when properly compacted, the finished surface will be smooth and of uniform texture and density. The paver shall be operated at a speed satisfactory to the Engineer. If, in the opinion of the
Engineer, 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, laying operations shall cease and traffic shall be fully restored to the through lanes until consistent delivery of the paving mixture is provided by the Contractor. Care shall be taken to prevent splattering of adjacent pavement, curb and gutter and structures during paving operations.

(5) **Compaction.** Compaction of the wearing course shall 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 185ºF. At no time shall the roller or rollers be allowed to remain stationary on the freshly placed asphalt concrete. Compaction shall immediately follow the placement of the Ultra Thin Bonded Wearing Course with an approved asphalt roller(s). Adequate roller units shall be supplied so the compaction will be accomplished promptly following the placement of the material. Compaction shall 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 shall be corrected to the satisfaction of the Engineer. To prevent adhesion of the paving mixture to the roller, the wheels shall be kept thoroughly moistened with a soap-water solution. Necessary precautions shall be taken 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 shall be required, when directed by the Engineer, to expedite opening the roadway to traffic. Sprinkling shall be with water or limewater solution, as directed by the Engineer.

(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.** The “Ultra Thin Hot Mix Bonded Wearing Course” shall be measured 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 shall 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 shall be furnished, operated and maintained by the Contractor, but will not be paid for directly, but shall be considered subsidiary to this Item.