ARHM-GG shall conform to the provisions for Type "A" asphalt concrete in Section 39, "Asphalt Concrete," of the State Standard Specifications and these Special Provisions.

Binder for ARHM-GG shall be, at the Contractor's option, Type 1 or Type 2 asphalt-rubber binder as specified in these Special Provisions.

The asphalt used in asphalt-rubber binder shall be, at the asphalt-rubber suppliers option, either paving grade AR-2000 or AR-4000.

The amount of asphalt used in asphalt-rubber binder to be added to the aggregate shall be between 6.7% and 8.7% by dry weight of the aggregate. The amount used will be determined by the Engineer. The temperature of the aggregate at the time the asphalt-rubber binder is added shall be not more than 350°F.

Rubber for use in asphalt-rubber binder shall be free of loose fabric, wire and other contaminants except that up to 4 percent (by weight of rubber) calcium carbonate or talc may be added to prevent rubber particles from sticking together. The rubber shall be sufficiently dry so as to be free flowing and not produce foaming when blended with the hot asphalt. The Contractor shall furnish a "Certificate of Compliance" as outlined in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications.

A sample of the asphalt-rubber binder proposed for use on the project, consisting of four one-quarter cans, together with the proposed formulation of the binder shall be furnished to the Engineer at least two weeks before ARHM-GG pavement construction is scheduled to begin. These samples will be held at the County Lab for comparison to material in the field, if necessary.

The method and equipment for combining the rubber and asphalt shall be so designed and accessible that the Engineer can readily determine the percentage by weight for each material being incorporated into the mixture.

Equipment utilized in the production and proportioning of the asphalt-rubber binder shall include the following:

- An asphalt heating tank with hot oil heat transfer to heat the asphalt to the necessary temperature before blending with the granulated rubber. This unit shall be equipped with a thermostatic heat control device.

- A mechanical blender for proper proportioning and thorough mixing of the asphalt and rubber. This unit shall have both an asphalt totalizing meter (gallons or liters) and a flow rate meter (gallons per minute or liters per minute).

- An asphalt-rubber supply system equipped with a pump and metering device capable of adding the binder by volume to the aggregate at the percentage specified.

The swell, moisture vapor susceptibility, and the stabilometer value requirement in Section 39-2.02, "Aggregate," of the State Specifications shall not apply to ARHM-GG.

Before opening a traffic lane to public traffic the Engineer may direct a sand cover be spread uniformly over areas where ARHM-GG has been placed.

Sand shall be free from clay or organic material and shall be of such size that from 90% to 100% will pass a No. 4 sieve and not more than 5% will pass a No. 200 sieve.

Sand shall be spread at the approximate rate of one to two pounds per square yard.
TRAFFIC SHALL NOT BE ALLOWED ON THE ARHM-GG FOR AT LEAST ONE HOUR AFTER FINAL ROLLING OPERATIONS HAVE BEEN COMPLETED. ALLOWING TRAFFIC ON COMPLETED PAVEMENT TOO SOON MAY RESULT IN FLUSHING.

IT IS IMPORTANT THAT THE BREAKDOWN ROLLER COMPACT THE MAT WHILE THE ARHM IS WARM. A COOL MAT WILL BE RESISTANT TO COMPACTION. IT IS RECOMMENDED THAT TWO (2) VIBRATORY ROLLERS BE USED TO INSURE TIMELY COMPACTION.

Pneumatic tired rollers shall not be used to compact ARHM-GG.

The asphalt-rubber mixture shall not be used as a binder after it has been retained for more than 48 hours.

**Type 1 Asphalt-Rubber Binder** - Type 1 asphalt-rubber binder shall be a uniform reacted mixture of compatible paving grade asphalt and reclaimed vulcanized rubber.

The reclaimed vulcanized rubber shall be produced primarily from the processing of automobile and truck tires. The rubber shall be produced by ambient temperature grinding process only.

The specific gravity of the rubber shall be between 1.10 and 1.20 and shall conform to the following gradation when tested in accordance with ASTI C 136:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 10</td>
<td>100</td>
</tr>
</tbody>
</table>

The length of the individual rubber particles shall not exceed 3/16 inch.

The asphalt-rubber mixture shall contain between 14 percent and 20 percent rubber by weight of the total asphalt-rubber mixture.

The temperature of the asphalt shall be between 350EF and 425EF at the time the rubber is blended with the asphalt. The asphalt and rubber shall be combined and mixed together in a blender unit, pumped into the agitated storage tank, and then reacted for a minimum of 45 minutes from the time the rubber is added to the asphalt. The temperature of the asphalt-rubber mixture shall be maintained between 325EF and 375EF during the reaction period and shall possess the following physical property after the reaction period:

- **Viscosity, 350EF(ASTI D 2196)** 1500 cp minimum (Brookfield)

After the material has reacted for at least 30 minutes, the asphalt-rubber shall be metered into the mixing chamber of the asphalt concrete production plant at the percentage specified or designated by the Engineer.

After reaching the desired consistency the asphalt-rubber mixture shall not be held at temperatures over 325EF for more than 4 hours.

The Contractor shall provide to the Engineer confirmation of viscosity test results from the asphalt-rubber tank. The test shall be, in the opinion of the Engineer, sufficient to verify that the viscosity of the entire tank is homogenous during the asphalt concrete production.

**Type 2 Asphalt-Rubber Binder** - Type 2 asphalt-rubber binder shall be a uniform reacted mixture of compatible paving grade asphalt, extender oil, and granulated reclaimed vulcanized rubber.
Extender oil shall be resinous, high flash point aromatic hydrocarbon conforming to the following:

- Viscosity, SUS @ 100EF (ASTM D 88): 2500. min
- Flash Point, COC, EF (ASTM D 92): 390. min
- Molecular Analysis (ASTM D 2007):
  - Asphaltness, % by weight: 0.1 max
  - Aromatics, % by weight: 55.0 min

The asphalt and extender oil, when combined shall form a material that is chemically compatible with the rubber.

The rubber used in Type 2 asphalt-rubber binder shall be reclaimed vulcanized rubber and shall contain between 20 percent and 30 percent by weight, natural rubber when tested in accordance with ASTM D 297. The rubber shall conform to the following grading when tested in accordance with ASTM C 136:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 8</td>
<td>100</td>
</tr>
</tbody>
</table>

The rubber shall contain no particles longer than 1/4 inch in length.

The extender oil shall be added to the asphalt at a rate between 2 percent and 6 percent by weight of the asphalt, the exact amount shall be determined by the asphalt-rubber supplier. The asphalt shall be at a temperature of not less than 350°F nor more than 425°F when the extender oil is added.

The asphalt-extender oil blend and rubber shall be combined and mixed together in the blender unit to produce a homogeneous mixture.

The amount of rubber to be added to the asphalt-extender oil blend shall be between 17 percent and 23 percent by weight of the total combined mixture of asphalt, extender oil, and rubber. The exact amount shall be determined by the asphalt-rubber supplier. The asphalt-extender oil blend shall be at a temperature of not less than 350°F nor more than 425°F when the rubber is added. After the material has reacted for at least 30 minutes, the asphalt-rubber shall be metered into the mixing chamber of the asphalt concrete production plant at the percentage specified or ordered.

The asphalt-rubber mixture shall be reacted for a minimum of 30 minutes from the time the rubber is added to the asphalt-extender oil blend. The temperature of the asphalt-rubber mixture shall be maintained between 375°F and 425°F during the reaction period.

The asphalt-rubber mixture shall possess the following physical property after the reaction period:

- Viscosity at 400EF (ASTM D 2196) (Brookfield): 600 to 2,000 cp

The asphalt-rubber mixture after reaching the desired consistency shall not be held at temperatures over 375°F for more than 4 hours.

The Contractor shall provide to the Engineer confirmation of viscosity test results from the asphalt-rubber tank. The tests shall be, in the opinion of the Engineer, sufficient to verify that the viscosity of the entire tank is homogenous during the asphalt concrete production.
**General Requirements** - The aggregate for ARHM-GG shall conform to the following gradation and shall meet the quality requirements for "Type A" as specified in Section 39-2.02, "Aggregate" of the State Specifications.

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>LIMITS OF PROPOSED GRADATION</th>
<th>OPERATING RANGE</th>
<th>CONTRACT COMPLIANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>90-100</td>
<td>90-100</td>
<td></td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>79-87</td>
<td>X±5</td>
<td>X±7</td>
</tr>
<tr>
<td>#4</td>
<td>32-40</td>
<td>X±5</td>
<td>X±7</td>
</tr>
<tr>
<td>#8</td>
<td>18-24</td>
<td>X±4</td>
<td>X±5</td>
</tr>
<tr>
<td>#30</td>
<td>9-12</td>
<td>X±4</td>
<td>X±5</td>
</tr>
<tr>
<td>#200</td>
<td>2-7</td>
<td>0-8</td>
<td></td>
</tr>
</tbody>
</table>

The stabilometer value requirement in Section 39-2.02, "Aggregate" of the State Standard Specifications shall not apply to ARHM-GG.

The Los Angeles Rattler requirement in Section 39-2.02, "Aggregate" of the State Standard Specifications shall be amended to read "40 percent maximum loss at 500 revolutions."

ARHM-GG is particularly temperature sensitive and shall be spread at a temperature of not less than 285°F and not more than 325°F, measured in the hopper of the paving machine.

**Measurement** - The mixture of ARHM-GG will be measured by the ton in the same manner specified for asphalt concrete in Section 39-8.01, "Measurement," of the State Standard Specifications.

**Payment** - The contract unit price paid per ton for ARHM-GG shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in placing ARHM-GG complete in place, including furnishing and spreading sand cover if directed by the Engineer, as shown on the plan, as specified in the State Standard Construction Specifications and these Special Provisions, and as directed by the Engineer.

**EQUIPMENT**

**Haulers:** All trucks hauling asphalt concrete shall have tarps available and the loads shall be covered from the plant to the paving machine unless the ambient air temperature exceed 75°F, or the haul distance is less than 10 miles.

**Asphalt Heating Tank:** The asphalt heating tank shall be equipped with a hot oil heat transfer system or retort heating system capable of heating asphalt cement to the necessary temperature for blending with granulated rubber. This unit shall be capable of heating a minimum of 2,500 gallons of asphalt cement.

**Blender:** The asphalt-rubber mechanical blender shall have a to stage continuous mixing process capable of producing a homogenous mixture of asphalt cement and granulated rubber, at the mix design specified rations, as directed by the Engineer. This unit shall be equipped with a granulated rubber feed system capable of supplying the asphalt cement feed system, ass not to interrupt the continuity of the blending process. The maximum capacity of the primary blending vessel shall be 500 gallons. Both the primary and secondary blenders shall be equipped with an agitation device oriented horizontally in the blending vessel. The blending unit shall be capable of fully blending the individual rubber particles with the asphalt cement. A separate asphalt cement feed pump and
finished product pump are required. This unit shall have both an asphalt cement totalizing meter in gallons and a flow rate meter in gallons per minute.

**Storage/Reaction Tank:** The asphalt-rubber storage/reaction tank shall be equipped with a heating system capable of maintaining a temperature of 300°F to 375°F for reacting, pumping, and for adding the binder to the aggregate. The storage/reaction tank shall be separate from the primary blender and secondary blender of the blending unit. The maximum capacity of the storage/reaction unit shall be 8,00 gallons. This unit shall have an internal mixing device capable of maintaining a uniform mixture of asphalt cement and granulated rubber. The internal mixing device shall be oriented horizontally in the tank.

**Supply System:** The asphalt-rubber supply system shall be equipped with a pump and a direct interlock metering device capable of adding the binder by volume to the aggregate at the percentage required by the mix design.

**Temperature Gage:** An armored thermometer of adequate range in temperature reading shall be fixed in the asphalt-rubber feed line at a suitable location near the mixing unit.

A leveling course may be required. Leveling courses shall be Type - "A" asphalt concrete. A leveling course shall be required for all locations for which the difference in elevation between the existing pavement surface and the finished pavement surface, as indicated on the Contract plans, exceeds the thickness of the overlay designated for the associated areas of roadway by more than 0.02 feet. The total thickness for asphalt concrete leveling course varies. At locations where the leveling course thickness exceeds three (3) inches, the leveling course shall be placed in lifts not exceeding three inches.

The Contractor shall be responsible for furnishing and placing an asphalt emulsion tack coat in advance of the overlay as provided in Section SS-25 of the Standard Construction Specifications, except for payment.

The Contractor shall be responsible for removing all vegetation from the edge of pavement and sweeping and washing the pavement, if required, in advance of the overlay operation. It is recommended that a power water wash be used in the deceleration zones of intersections for the complete removal of dust that may cause overlay slippage. The Contractor shall remove and dispose of all pavement markers, temporary Type "B" Detector Handhole protection, and temporary traffic stripe (tape), if any, prior to the overlay, and remove and dispose of traffic bars as required by the Engineer.

All thermoplastic limit lines, crosswalks, and legends existing on the road surface shall be scarified prior to placing the overlay. Scarification shall be performed by grinding such that approximately 20% of the underlying pavement is exposed. All material resulting from the grinding operation shall be removed immediately from the right-of-way and shall be disposed of per Section SS3-12 of the Standard Construction Specifications.

All manhole and other utility covers encountered in the area to be overlaid with asphalt concrete shall be carefully referenced out by the Contractor and the locations of the cover painted on the surface immediately after paving. All storm drain and sewer manhole and monitoring well box adjustments shall be the responsibility of the contractor. Adjustment to grade of other utility covers shall be by others.

The unit price paid per ton for Asphalt Rubber Hot Mix - Gap Graded shall include all the work referenced in this section, except that Type - "A" A.C. leveling courses shall be paid per ton of Type - "A" A. C., and no additional compensation will be allowed therefor.