2007 MAJOR AND COLLECTOR STREET OVERLAY PROGRAM

Work will include placing of rubber modified asphalt overlay on various City streets. Total area to be overlaid is approximately 354,000 S.Y., with 26,000 Tons of rubberized asphalt concrete and approximately 186,000 S.Y. of milling.

GENERAL REQUIREMENTS

A. SCOPE OF WORK

The 2006 Major and Collector Street Overlay Program consists of placing a rubber modified asphalt concrete overlay surface treatment on existing streets within the City of Phoenix. The work shall consist of placing a minimum 1¼-inch compacted rubber modified asphalt concrete overlay on all streets listed in these specifications or as directed by the Engineer.

Application and testing will be in accordance with MAG Standard Specifications section 321 and 332 and these specifications. For estimating purposes the percent of asphalt binder in the modified asphalt concrete mix shall be 8%.

The apparent low bidder shall submit the name of the hot mix supplier and a description of the materials of the modified asphalt concrete mix to the Materials Lab (1034 E. Madison St. Phoenix, AZ. @ 602-495-2050) within two weeks upon request from the Material Lab.

The City of Phoenix Materials Lab will provide a Job Mix Formula with aggregate gradation target and the bands. The City of Phoenix Materials Lab will also provide the binder target.

Three weeks prior to construction the Contractor shall submit 3 (three) gallons of the asphalt rubber binder and sufficient aggregate for a mix design to be performed in accordance with AASHTO T-245. The results of the mix design shall be utilized to establish the target values for the Job Mix Formula Binder that does not conform to MAG 717 or these specifications will not be utilized on the project. The use of diesel, silicon, or other admixtures will not be allowed without the prior approval of the Engineer.

The Contractor will place the compacted overlay, from gutter lip to gutter lip, to 1/4-inch above the existing gutter lip, where applicable. If no gutter line or curb and gutter exists, the asphalt concrete overlay shall be applied to the edge of pavement. The overlay shall be feathered as necessary at catch basins to provide drainage and driving comfort. Compaction, rolling, and finishing the new surface course shall be in accordance with MAG section 321 and these specifications.

The existing drainage of the roadway shall be preserved or improved. Particular care will be taken to ensure that existing asphalt valley gutters are replaced to the proper grade. Questions regarding drainage conditions and requirements will be directed to the Street Maintenance Division of the Street Transportation Department through the Project Engineer. The City of Phoenix will patch and crack seal in selected areas prior to start of construction. The Contractor will then be responsible for milling, cleaning, tack coat, overlaying and post-sweeping the streets in the project.

After installation of the overlay course, all necessary frame and cover adjustments for manholes, valves, survey monuments, sewer clean-outs, etc., shall be completed by the Contractor within the given segments being surfaced. Straddles for survey frames and covers will be placed by the City. Any bench marks or City of Phoenix monuments disturbed by the Contractor shall be re-established. The Contractor shall replace in kind survey monument frames and covers damaged during construction at the Contractor's expense.
The Contractor shall notify the City of Phoenix Street Transportation Department Traffic Signal Shop prior to and after completion of paving at signalized intersections. The Contractor shall also notify the City of Phoenix Striping Shop (602-262-6235) prior to and after completion of any overlay work on each street.

B. Test Strip

On the first day of construction, the first 1000 tons of asphalt concrete shall be placed as a test strip. This test strip will be used to establish a rolling pattern for compaction, calibration for densities, and to verify mix design. Construction will not proceed until the rolling pattern for compaction has been accepted by the Engineer.

.06 SECTION 321 - ASPHALT CONCRETE PAVEMENT: Modify the Standard Specifications to add the following:

A. ASPHALT CONCRETE OVERLAY SURFACE COURSE

Special rubberized asphalt concrete surface course, hereinafter asphalt concrete, will be applied to seal the roadway for the entire project. A MINIMUM 1½-inch compacted rubber asphalt concrete will be applied on all streets unless otherwise directed.

Application and testing will be in accordance with MAG 322 and 321. For estimating purposes the percent of asphalt binder in the modified mix shall be 8%. The modified asphalt binder in the mix shall comply with MAG 717 and these specifications.

The handling of asphaltic concrete shall at all times be such as to minimize segregation. Any asphalt concrete which displays segregation shall be removed and replaced.

Before asphaltic concrete is placed, the surface to be paved shall be cleaned of all objectionable material and tacked with a light coat of emulsified asphalt cement. The cleaning of the surface, the tacking of the surface, and the amount and grade of asphalt cement used shall be as directed by and acceptable to the Engineer.

A light coat of emulsified asphalt tack coat as per MAG 329 shall be applied as directed to edges or vertical surfaces against which asphaltic concrete is to be placed.

The surface upon which the asphaltic concrete is to be placed shall be prepared in accordance with the applicable requirement for the material involved and maintained in a smooth and firm condition until placement. Asphaltic concrete shall not be placed on a frozen or excessively wet surface.

All asphaltic concrete shall be placed either as leveling course or as a surfacing course. Leveling courses are defined as courses placed for the primary purpose of raising an existing paved or unpaved surface to a smooth plane. Surfacing courses are defined as courses placed to serve either as the traffic surface or as a surface upon which a finishing course or seal coat is to be placed.

Thickness of leveling and surfacing courses will be as directed by the Engineer. No change in thickness will be allowed without the written approval of the Engineer.

B. The asphalt concrete overlay shall be applied (the placing and finishing of asphalt concrete) in accordance with Section 321 and 322, except as modified herein:
1. **MAG 321.3 - WEATHER AND MOISTURE CONDITIONS**: Revise to add the following:

Asphalt concrete shall be placed only when the surface is dry. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base on which the material is to be placed contains moisture in excess of the optimum. Asphalt concrete shall be placed only when the engineer determines that weather conditions are suitable.

Asphaltic concrete shall be placed only when the temperature of the surface on which the asphalt concrete is to be placed is at least 55 degrees F and rising.

At any time the Engineer may require that the work cease or that the work day be reduced in the event of weather conditions which would have an adverse effect upon the asphaltic concrete.

2. **MAG 321.5 - PLACING, SPREADING, AND FINISHING**: Revise to add the following:

   a. Delivering, Handling, and Placing:

   Asphalt concrete shall be delivered and placed at a temperature no higher than necessary for placing, finishing and spreading, but shall be high enough to accomplish this work. The minimum temperature of the asphalt concrete, taken at a point 6-inches below the exposed top surface in the truck, shall not be less than 250 F. Asphalt concrete found deficient in temperature shall be rejected and removed from the job site at no cost to the Contracting Agency. No excess release agent shall be present in the truck bodies at the time of asphalt concrete loading. Diesel fuel shall not be used as a release agent.

   The handling of the completed mixture shall at all times be such as to prevent segregation, and the material as spread shall be free from areas of excess coarse, or fine material. Float rock developed in the process of raking shall be placed on an underlying course or otherwise disposed of. In no case shall it be scattered over the surface of a final course.

   Placing shall begin on pavements at points farthest from the source of supply, and progress continuously toward the source of supply, unless otherwise ordered by the Engineer, and no more than one day's delivery to the project shall be placed in any one lane in advance of the other lanes, unless otherwise approved by the Engineer. The end of each lane shall be staggered in relation to the adjacent lane.

   At locations where the mixture is to be placed over areas inaccessible to the required spreading or compacting equipment or over areas where the use of the required spreading and compacting equipment would not be practicable, the mixture may be spread or compacted by other methods as approved by the Engineer.

   b. Placing and Finishing Asphaltic Concrete by Means of Self-Propelled Paving Machines:

   Self-propelled paving machines shall spread the mixture without segregation or tearing within the specified tolerances, true to the line, grade, and crown indicated on the project plans. Pavers shall be equipped with hoppers and augers which will distribute the mixture uniformly in front of adjustable screeds.

   Screeds shall include any strike-off device operated by tamping or vibrating action which is effective without tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.
Tapered sections not exceeding eight feet in width, or widened sections not exceeding four feet in width may be placed and finished by other means approved by the Engineer.

c. Automatically Actuated Control System:

Except under certain conditions or at certain locations where the Engineer deems the use of automatic controls impracticable, all courses of asphaltic concrete shall be placed and finished by means of self-propelled paving machines equipped with an automatically actuated control system.

The control system shall control the elevation of the screed at each end indirectly either through controlling the transverse slope or alternately when directed, by controlling the elevation of each end independently.

The controls shall be capable of working in conjunction with a ski-type device attachment of not less than 12 (twelve) feet in length.

3. MAG 321.5.2(A) - Spreading and Finishing EQUIPMENT: Revise the first paragraph to add the following:

Windrowing is not an acceptable method of construction on this project.

It shall be the Contractor's responsibility to immediately clean up any spillage or tracking which may occur. Failure to prevent spillage and keep the job site, haul routes, and adjacent streets clean shall be justification to stop work until adequate procedures and resources are provided to resolve the problem. Any costs associated with this work shall be considered incidental to the contract.

On streets where there is no curb and gutter, special care is required to completely clean all dirt tracking on the street surface immediately before overlay.

If the asphaltic concrete is dumped from the hauling vehicles directly into the paving machine from trucks, care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the trucks. Trucks, while dumping, shall be securely attached to the paving machine.

The spreading equipment, in accordance with Section 321.5.2 shall be equipped with a ski-type control device of not less than 30-feet in length or other method of control approved by the Engineer.

4. MAG 321.5.4 - ASPHALT BASE AND SURFACE COURSE: Revise to add the following:

a. General Requirements:

The asphalt concrete overlay shall be applied from gutter lip to gutter lip except the edges shall be feathered as necessary. If no gutter line or curb and gutter exists, the asphalt concrete overlay shall be applied to the edge of pavement.

The Contractor will place the compacted overlay to 1/4-inch above the existing gutter lip, where applicable.

The overlay shall be feathered as necessary at catch basins to provide drainage and driving comfort.

The existing drainage of the roadway shall be preserved or improved. Particular care will be taken to ensure that existing asphalt valley gutters are replaced to the proper grade. Questions regarding
drainage conditions and requirements will be directed to the Street Maintenance Division of the Street Transportation Department through the Project Engineer.

Any bench marks or City of Phoenix monuments disturbed by the Contractor shall be re-established. The Contractor shall replace in kind survey monument frames and covers damaged during construction at the Contractor's expense.

The Contractor shall notify the City of Phoenix Street Transportation Department Traffic Signal Shop prior to and after completion of paving at signalized intersections. The Contractor shall also notify the City of Phoenix Striping Shop (602-262-6235) prior to and after completion of any overlay work in each 1/4 section.

b. Joints:

Longitudinal joints of each course shall be staggered a minimum of one foot with relation to the longitudinal joint of the immediate underlying course.

The Contractor shall schedule his paving operations to minimize exposed longitudinal edges. Unless otherwise approved by the Engineer, the Contractor shall limit the placement of asphaltic concrete courses, in advance of adjacent courses, to one shift of asphaltic concrete production. The Contractor shall schedule his paving operations in such a manner to eliminate exposed longitudinal edges over weekends or holidays.

Longitudinal joints shall be located within one foot of the center of a lane or within one foot of the centerline between two adjacent lanes.

Before a surface course is placed in contact with a cold traverse construction joint, the cold existing asphaltic concrete shall be trimmed to a vertical face by cutting the existing asphaltic concrete back for its full depth and exposing a fresh face. After placement and finishing of the new asphaltic concrete, both sides of the joint shall be dense and the joint shall be well sealed. The surface in the area of the joint shall conform to the requirements hereinafter specified for surface tolerances when tested with the straightedge placed across the joint.

c. Compaction:

Compaction, rolling, and finishing the new surface course shall be in accordance with MAG 321 with the following exception:

i. General Requirements:

The temperature of asphaltic concrete just prior to compaction shall be at least 250 degrees F.

The wheels of compactors shall be wetted with water or, if necessary, soapy water to prevent mix pick-up during rolling. The Engineer may change the rolling procedure if in his judgment the change is necessary to prevent picking up of the asphaltic concrete. The density of the compacted mixture, at construction, shall not be less than 95 % of the Marshall Unit Weight composed of the same mixture compacted in the laboratory by the 75 blow method of AASHTO –T245 bulk maximum density. The method and equipment to be used for compaction, rolling and finishing shall be submitted to the Engineer for approval. Additional rollers will be required, if deemed necessary by the Engineer, to meet the required compaction. The cost for additional rollers shall be included in the cost of overlay.

ii. Equipment:
The compactors shall be self-propelled and shall be operated with the drive wheel in the forward position. All rollers shall be equipped with pads and a watering system to prevent sticking of the asphaltic concrete mix to the steel wheels.

iii. Compaction Pay Factor:

Pay factor shall be in accordance with MAG Standard Specifications Section 321 and as specified in these specifications.

d. Surface Requirements and Tolerances:

All courses of asphaltic concrete shall be compacted as required, smooth and reasonably true to the required lines, grades, and dimensions.

Leveling course surfaces shall not vary more than 1/4 inch from the lower edge of a ten-foot straightedge when the straightedge is placed parallel to the center line of the roadway.

Surfacing course surfaces shall not vary more than 1/8 inch from the lower edge of a ten-foot straightedge when the straightedge is placed parallel to the center line of the roadway.

An acceptable surface in the transverse direction shall not vary more than plus-minus 1/2-inch from the grade of the crown.

5. MAG 321.6 - CORRECTIVE REQUIREMENTS FOR DEFICIENCIES: Revise to add the following:

Replace "chip seal using precoated chips complying with section 330" with "microseal in accordance with City of Phoenix Supplements Section 361".

Where the pavement thickness is less than one (1)-inch, payment will be reduced as follows:

<table>
<thead>
<tr>
<th>Mat Thickness</th>
<th>Reduction in Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; (&lt; ) 3/4&quot;</td>
<td>50%</td>
</tr>
<tr>
<td>3/4&quot; (\leq ) 1/2&quot;</td>
<td>No Payment-Remove overlay and repave, No Payment for removal.</td>
</tr>
<tr>
<td>1/2&quot; (\leq )</td>
<td>No Payment, Overlay 1&quot;</td>
</tr>
</tbody>
</table>

When the deficiency of the pavement thickness exceeds 3/4 inch, the pavement shall be overlaid on the area affected, but in no case less than one City block, or 660 feet, whichever is less in length, for the width of a paving pass, with a new mat of material specified by the Engineer, thickness to be one (1)-inch. Any additional milling to blend in the new mat will be at the contractor’s expense. Where the density is deficient by more than 1 percent point, and the Contractor is unable to correct the deficiency, payment will be reduced as follows:
When the compaction deviation is more than 5 percentage points the area shall be removed and replaced with new overlay over the area involved, but not less than one City block, or 660 feet, whichever is less, at no additional cost to the Contracting Agency.

When the asphalt cement content exceeds the limits established in these special provisions, additional nuclear or core tests, as determined by the Engineer, will be made for each deficient test taken, and the average of all tests taken shall be used to determine the asphalt cement content.

When the average asphalt cement content is in excess of that permitted, for that day's lot, the Contractor shall remove any areas of bleeding, as directed by the Engineer, and replace the affected material with new material meeting the specification requirements for the mix type involved. This shall be done any time within a period of 1 year, until the bleeding has been corrected, at no additional cost to the Contracting Agency. Should the stability of the mix be effected by the excess asphalt cement to such an extent that the pavement is displaced under normal traffic loads, within a period of 1 year, the areas affected shall be removed and replaced with new material, at no additional cost to the Contracting Agency.

When the average asphalt cement content is from 0.0 to 1.0 percent, for that day's lot, by weight of the total mixed material, less than the minimum permitted in these specifications, payment to the Contractor for asphalt concrete pavement will be reduced as follows:

<table>
<thead>
<tr>
<th>Deviation from that Permitted</th>
<th>Payment Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 0.2% points</td>
<td>2%</td>
</tr>
<tr>
<td>Over 0.2% to 0.5% points</td>
<td>5%</td>
</tr>
<tr>
<td>Over 0.5% to 1.0% points</td>
<td>10%</td>
</tr>
</tbody>
</table>

When the deviation is more than 1.0 percent the Contractor shall place a micorseal over the area involved, but not for less than one City block, or 660 feet, whichever is less, at no additional cost to the Contracting Agency.

When the mineral aggregate gradation, or plastic index of the aggregate, deviates from the requirements of this specification in an amount which, in the opinion of the Engineer, will affect the stability or durability of the mix, the Contractor shall, as directed by the Engineer, either remove the asphalt concrete and replace it with material which meets the requirements of this specification, or place an additional mat of such thickness and gradation as required by the Engineer which will, in the opinion of the Engineer, correct the deficiency.

The above corrective work due to deviations from the requirements for mineral aggregate, shall be done at no additional cost to the Contracting Agency.
6. The tack coat shall be per MAG 329 unless directed otherwise by the Engineer.

C. MILLING

The Contractor will mill existing material adjacent to existing gutters to a point approximately one-inch below the gutter lip. Depth of grinding shall be measured from the top of the concrete gutter. The grinding will taper to 0" at a line 12-feet from the gutter lip, see S.D.-1. All existing material built up over the gutter shall be removed as part of this bid item.

The Contractor will mill a 24-foot width across intersecting streets (including termini, valley gutters, and all interior intersecting streets) in the same manner using the extended gutter line to ensure a smooth transition, see S.D.-1. All asphalt valley gutters shall be milled in the same manner as above to insure proper drainage and to ensure a smooth transition.

The Contractor shall be required to protect all milled surfaces from deterioration and repair subsequent damage prior to seal coating. The Contractor shall protect all adjacent properties from damage that might be caused by loose tailings. Portions of the roadway with no curb and gutter may NOT require edge milling.

Utility companies are not required to lower their appurtenances to facilitate edge milling or cul-de-sac milling.

The Contractor shall notify the City of Phoenix Street Transportation Department, Traffic Signal Shop, (602-262-6204), and the Project Engineer, prior to milling at signalized intersections or any location where signal loop detectors may be damaged by the milling operation. Each signalized intersection shall be reviewed and the milling operation may be modified or reduced, including using smaller milling heads, to avoid damage to signal loops. The cost associated with this shall be included in the unit bid price for "Milling". The Contractor will be responsible for the cost of replacement for damaged signal loops that were not brought to the attention of the Project Engineer.

Prior to milling, the Contractor shall use a metal detector to assure that no uncovered utility appurtenances exist that could be damaged by the milling process. The cost of this work shall be included in the cost of the milling.

Payment for milling existing pavement will be made at the unit price bid for "MILLING" and shall include clean-up and delivery of the tailings to the designated locations. For tailings north and on Camelback RD, the Contractor shall deliver the tailings to City of Phoenix North Service Center located at 138 East Union Hills Drive. Contact Harry Holder at 602-262-6922. For tailings south of Camelback Rd, the Contractor shall deliver the tailings to City of Phoenix Glenrosa Service Center located at 4020 W. Glenrosa Ave. Contact Maran Corrinne at 602-262-6719. The Yard Supervisor will assign an Inspector who will have access to the locked gate at the Yard and will have overall responsibility for monitoring the operations. The Contractor will be required to place a person at the Yard to continuously monitor access to the Yard when hauling millings. The monitoring of the Yard by the Contractor will be included in the cost of milling as set forth in the bid proposal No material other than asphalt millings from City projects may be brought to the Yard. Additional Yard may be provided at Skunk Creek Landfill when the North Service Center is full.

Other areas - Some additional milling may be required as called for by the Engineer. This grinding shall include grinding to match overlay with existing pavements at side streets, end of projects, obstructions, etc. Also, high points, as called for by the Engineer, will be ground down to provide a smoother overlay. Payment for additional milling will be made at the unit bid price for "Milling (Full WIDTH with 1" depth)"

Overruns greater than 1/4-inch on all milling depths shall be measured and the corresponding quantity of asphalt shall be deducted from the contract prior to paving.
Concrete streets encountered will be brought to the attention of the Engineer. The asphalt on concrete streets may require milling, but the concrete portion of the street will not require milling.

D. **BLOTTER MATERIAL**

A lime water blotter material will be applied prior to opening the streets to traffic.

The Contractor must submit the method of application and equipment for approval at the time of the pre-job. A lime water solution shall be applied at the rate of 0.5 to one (1) gallon per square yard, a minimum of three (3) complete coverage shall be applied to the new pavement surface. The lime shall be mixed using a minimum of one (1) bag per 3,000 gallons of water. The quantity of lime shall be increased or decreased to provide a white color to the asphalt surface to the satisfaction of the Engineer at no additional cost to the City. A water flush shall be applied to the completed paved streets to wash off the lime residue.

Measurement and payment of blotter material will be made at the unit bid price per square yard.

.08 **SECTION 710- ASPHALT CONCRETE: Modify the Standard Specifications to add the following:**

Asphaltic Concrete, hereinafter known as asphalt concrete, shall consist of furnishing all materials, mixing at a plant, hauling, and placing a mixture of aggregate materials, mineral admixture, and modified binder material (asphalt-rubber) to form a minimum 1¼ -inch thick pavement course, in accordance with the requirements of these specifications, and as directed by the Engineer.

The Contractor shall be responsible for all adjustments to his equipment necessary to properly accommodate the use of modified asphalt as a bituminous material.

The base asphalt for the asphalt concrete shall comply with PG (Performance Grade) graded standards.

A. **ASPHALT CONCRETE MIX DESIGN CRITERIA:**

The Job Mix Formula shall be provided by the City of Phoenix Materials Lab.

Mix designs will be performed in accordance with AASHTO T-245, compacted at 290 ± 5° f, modified as necessary for Asphalt Concrete. Mix designs shall meet the criteria in Table 1.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Binder Content, Percent, Range.</td>
<td>8.2 - 7.6</td>
</tr>
<tr>
<td>2. Effective Voids, Percent Range.</td>
<td>5.0 ± 1.0</td>
</tr>
<tr>
<td>3. Aggregate Voids,(VMA) Percent Range.</td>
<td>19 minimum</td>
</tr>
<tr>
<td>4. Stability, lbs.</td>
<td>800 minimum</td>
</tr>
</tbody>
</table>
The quantities shown in the bidding schedule shall be calculated based on the following data:

**Asphalt Concrete**

143 Unit Weight, Pounds per Cubic Foot

Percent, Binder Material  8% asphalt-rubber

1. GENERAL REQUIREMENTS

The Job Mix Formula of the modified asphalt concrete shall be provided by the City of Phoenix Materials Lab.

The modified asphalt Supplier shall supply the Engineer three gallons of the modified asphalt binder for testing at least two weeks before construction is scheduled to begin. The Contractor's Supplier shall also submit the following certification and information:

a. Aggregate

   Source and identification (for each material used)
   Gradation (for each material used)
   Blend percentage
   Mixture gradation

b. Modified binder

   Source and grade of asphalt cement
   Source and type of extender oil
   Source and identification of asphalt modifier
   Modifier percentage for the modified asphalt binder
   Type and amount of additive(s), if required
   Temperature when added to aggregate
   Specific gravity

c. Modified binder content by weight of total mix

d. Physical properties of the blend

If ground rubber from more than one source is utilized, the above information will be required for each ground rubber used. The Contractor shall have a nuclear asphalt content gauge, a Haake Viscometer, and a technician, that is a qualified operator, available at all times on the project site to perform tests when requested by the Engineer or his representative. The cost associated with this shall be included as part of quality control and shall be included in the bid item for asphalt concrete. An inline temperature gauge and a sampling port, for checking viscosities safely and accurately, shall be provided from the storage tank to the asphalt plant.

B. MINERAL AGGREGATE SOURCE:

The Contractor shall provide a source in accordance with the requirements of Section 701 of the Standard Specifications.

When the Contractor selects a source, or sources, he shall notify the Engineer. The Contractor shall be solely responsible for assuring that the mineral aggregate meets all requirements and, when processed,
is fully capable of providing asphaltic concrete which meets all the requirements of MAG and these specifications.

1. Mineral Aggregate:

Coarse and intermediate mineral aggregate shall consist of crushed gravel, crushed rock, or other approved inert materials with similar characteristics, or a combination thereof, conforming to the requirements of MAG 701 and 710 and these specifications.

Gradations of mineral aggregate shall be as follows:

**TABLE 2**

**MIX DESIGN GRADATION LIMITS**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
<th>Job Mix Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 inch</td>
<td>100</td>
<td>+ 7</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>82-88</td>
<td>+ 7</td>
</tr>
<tr>
<td>No. 4</td>
<td>32-38</td>
<td>+ 7</td>
</tr>
<tr>
<td>No. 8</td>
<td>13-19</td>
<td>+ 5</td>
</tr>
<tr>
<td>No. 30</td>
<td>6-10</td>
<td>+ 5</td>
</tr>
<tr>
<td>No. 200</td>
<td>2-6</td>
<td>+ 2</td>
</tr>
</tbody>
</table>

* single test

In order to meet this gradation, separation of the aggregate into a minimum of two stock piles may be necessary.

Mineral aggregate shall conform to the requirements in Table 3 when tested in accordance with the applicable test methods.

**TABLE 3**

**MINERAL AGGREGATE CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Bulk Specific Gravity</td>
<td>Arizona Test Method 815</td>
<td>2.35 - 2.85</td>
</tr>
<tr>
<td>Combined Water Absorption</td>
<td>Arizona Test Method 815</td>
<td>0 - 2.5</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>AASHTO T-176</td>
<td>Minimum 65%</td>
</tr>
<tr>
<td>Crushed Faces(Retained on #8 sieve, at least one crushed face, Produced by crushing)</td>
<td>Arizona Test Method 212</td>
<td>Minimum 85%</td>
</tr>
<tr>
<td>Abrasion</td>
<td>AASHTO T-96</td>
<td>100 Rev., Max. 9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500 Rev., Max. 40%</td>
</tr>
</tbody>
</table>

Tests on aggregates outlined in Table 3, other than abrasion, shall be performed on materials furnished for mix design purposes and composited to the mix design gradation. Abrasion shall be performed separately on samples from each source of mineral aggregate. All sources shall meet the requirements for abrasion.

2. Mineral Admixture:
An approved mineral admixture will be required. The amount shall be 1.5 percent, by weight of the mineral aggregate and shall be either portland cement type II or hydrated lime, conforming to the requirements of Table 4.

<table>
<thead>
<tr>
<th>Material</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Type II</td>
<td>ASTM C-150</td>
</tr>
<tr>
<td>Hydrated Lime</td>
<td>ASTM C-1097</td>
</tr>
</tbody>
</table>

3. Mix Design Revisions:

If, during production, the Engineer on the basis of testing, determines that a change in the mix design is necessary, he will issue a revised mix design. Should these changes require revisions to the Contractor's operations which result in additional cost to the Contractor, the Contractor will be reimbursed for these costs. However, the Engineer reserves the right to modify the binder or modifier content within the limit of 8.2% without compensation being made to the Contractor involving additional operation costs.

C. ACCEPTANCE OF MATERIALS:

1. General:

The Contractor's attention is directed to the requirements of the Standard Specifications under Subsection 105.11 - Removal of Unacceptable and Unauthorized Work and Subsection 106.7 - Unacceptable Materials.

If the production of asphaltic concrete is stopped either for failure to meet the requirements specified hereinafter under Asphalt Concrete, or because changes are made in the mix design, samples will be taken for re-calibration before production resumes or after the changes in the mix design have been made. The acceptance of the mineral aggregate gradation and the bituminous material content will be determined on the basis of the tests as hereinafter specified under Asphalt Concrete. The Engineer reserves the right to increase the frequency of sampling and testing upon the resumption of asphalt concrete production.

2. Mineral Aggregate:

Aggregate shall be free of deleterious materials, clay balls, and adhering films or other material that prevent the thorough coating with the bituminous material.

At the direction of the Engineer, and witnessed by an authorized representative, the Contractor shall secure one representative sample of each days production from each stockpile. These samples will be tested for conformance with the mineral aggregate gradation in accordance with the requirements of Arizona Test Method 201. These samples will also be composited to the specified stockpile percentages by the Engineer and tested for sand equivalent in accordance with AASHTO T 176, and the percent of crushed faces in accordance with the requirements of Arizona Test Method 212.

Should testing indicate results not meeting the requirements of Table 2 for gradation, and Table 3 for sand equivalent and crushed faces, material represented by failing test results will be rejected.

3. Mineral Aggregate Gradation:
For each approximate 500 tons of asphaltic concrete, at least one sample of mineral aggregate will be taken. Samples will be taken in accordance with the requirements of Arizona Test Method 105 on a random basis, by means of a sampling device which is capable of producing samples which are representative of the mineral aggregate. The device, which shall be approved by the Engineer, shall be furnished by the contractor. In any shift that the production of asphaltic concrete is less than 500 tons, at least one sample will be taken.

Samples will be tested for conformance with the mix design gradation in accordance with the requirements of Arizona Test Method 201. If the sample does not include mineral admixture, the gradation results will be adjusted to reflect the addition of mineral admixture. Should testing indicate results not meeting the requirements of Table 1 for asphaltic concrete mix design criteria, the Engineer shall make the necessary adjustments.

4. Production Plant:

Sufficient notice will be provided by the Contractor and approved by the Engineer if the Contractor plans to change the production plant. Approval by the Engineer will also be required if materials from two different plants are placed at the same location in the field.

D. CONSTRUCTION REQUIREMENTS:

1. Quality Control:

Quality control shall be the responsibility of the Contractor. The Contractor shall use an approved City of Phoenix certified Laboratory. The Engineer reserves the right to obtain samples of any portion of any material at any point of the operations for his own use.

2. Stockpiling:

The Contractor will not be allowed to feed the hot plant from stockpiles containing less than two full days of production unless only two days production remain to be done or special conditions exist where the Engineer deems this requirement waived.

Mineral aggregate shall be separated and stockpiled so that segregation is minimized. An approved divider of sufficient size to prevent intermingling of stockpiles shall be provided.

3. Proportioning:

A positive signal system and a limit switch device shall be installed in the plant at the point of introduction of the admixture. The positive signal system shall be placed between the metering device and the drum drier, and utilized during production whereby the mixing shall automatically be stopped if the admixture is not being introduced into the mixture.

If a batch plant is used, the mineral admixture shall be added and thoroughly mixed in the pugmill prior to adding modified asphalt.

The Contractor shall furnish daily documentation to the Engineer that the required amount of mineral admixture has been incorporated into the asphaltic concrete. No fine material which has been collected in the dust collection system shall be returned to the mixture unless the Engineer, on the basis of tests, determines that all or a portion of the collected fines can be utilized. If the Engineer so determines, he will authorize in writing the utilization of a specific proportion of the fines; however, authorization will not be granted unless the collected fines are uniformly metered into the mixture.
Mineral aggregate, mineral admixture, and asphalt-rubber shall be proportioned by volume, by weight, or by a combination of volume and weight.

When mineral aggregate, mineral admixture, and asphalt-rubber are proportioned by weight, all boxes, hoppers, buckets, or similar receptacles used for weighing materials, together with scales of any kind used in batching materials, shall be insulated against the vibration or movement of the rest of the plant due to the operation of any equipment so that the error in weighing with the entire plant operating shall not exceed two percent for any setting nor one and one half percent for any batch. Bituminous material shall be weighed in ahead, insulated bucket suspended from a springless dial scale system.

When mineral aggregate, mineral admixture, and modified asphalt binder are proportioned by volume, the correct portion of each mineral aggregate size introduced into the mixture shall be drawn from the storage bins by an approved type of continuous feeder which will supply the correct amount of mineral aggregate in proportion to the bituminous material and so arranged that the proportion of each mineral aggregate size can be separately adjusted. The continuous feeder for the mineral aggregate shall be mechanically or electrically actuated.

The introduction of asphalt-rubber shall be controlled by an automated system fully integrated with the controls for mineral aggregate and mineral admixture.

4. Drying and Heating:

A recording pyrometer or other approved recording thermometric instrument sensitive to a rate of temperature change not less than ten degrees F. per minute shall be so placed at the discharge chute of the drier in order to record automatically the temperature of the asphaltic concrete or mineral aggregate. A copy of the recording shall be given to the Engineer at the end of each shift.

The moisture content of the asphaltic concrete immediately behind the pavers shall not exceed one percent. The moisture content will be determined in accordance with Arizona Test Method 406. Drying and heating shall be accomplished in such a manner as to preclude the mineral aggregate from becoming coated with fuel oil or carbon.

5. Mixing:

The production of the plant shall be governed by the rate required to obtain a thorough and uniform mixture of the materials. Mixing shall continue until the uniformity of coating, when tested in accordance with the requirements of AASHTO T-195, is at least 100 percent.

A positive signal system shall be provided to indicate the low level of mineral aggregate in the bins. The plant will not be permitted to operate unless this signal system is in good working condition. Each bin shall have an overflow chute or a divider to prevent material from spilling into adjacent bins.

The temperature of asphaltic concrete upon discharge from the mixer shall not exceed 335 degrees F. If the asphaltic concrete is discharged from the mixer into a hopper, the hopper shall be constructed so the segregation of the asphaltic concrete will be minimized.

E. MODIFIED ASPHALT BINDER CONTENT:

During production of asphaltic concrete, the contractor shall maintain at the plant site a nuclear asphalt content gauge calibrated in accordance with the gauge manufacturer’s recommendations, on the material being tested. The modified asphalt binder content shall be measured by the Contractor by means of the nuclear asphalt content gauge a minimum of one every 300 tons whichever is greater. Production of asphaltic concrete shall cease immediately and the plant re-calibrated if the Engineer determines the percent of asphalt-rubber has varied by either an amount greater than ± 0.5 percent for any single
reading or an amount greater than ± 0.4 percent for the average day's production from the amount required by the Job Mix Formula.

F. ACCEPTANCE:

Asphaltic concrete will be accepted complete in place, if, in the judgment of the Engineer, the asphaltic concrete reasonably conforms to the requirements specified herein. Asphaltic concrete that is not acceptable and is rejected shall be replaced to the satisfaction of the Engineer and at no expense to the Contracting Agency.

G. METHOD OF MEASUREMENT:

Asphaltic concrete will be measured by the ton for the mixture actually used, which will include the weight of mineral aggregate, mineral admixture, and asphalt-rubber. Measurement will include any weight used in construction of intersections, turnouts, or other miscellaneous items or surfaces.

H. BASIS OF PAYMENT:

The accepted quantities of asphaltic concrete, measured as provided above, will be paid for at the contract unit price per ton, which price shall be full compensation for the work, complete in place, as specified herein.

No payment will be made for any overrun in quantity of modified asphalt concrete in excess of 25 percent based on actual field measurement of the area covered, the design thickness, and the unit weight of mix (pounds per cubic foot), per the submitted mix design.

10 SECTION 717- ASPHALT-RUBBER: Modify the Standard Specifications to add the following:

A. BITUMINOUS MATERIAL:

Bituminous material shall be asphalt-rubber (vulcanized) conforming to the requirements of MAG Section 335 and 717 of the Standard Specifications, except for the following:

The asphalt-rubber shall conform to the following:

Asphalt Rubber binder composition:

20 ± 3 % ground rubber
80 ± 3 % asphalt cement

Type II Ground Tire Rubber Gradation:

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RUBBER MODIFIED ASPHALT SPECIFICATIONS (HOT CLIMATE)

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<th>SPEC. LIMITS</th>
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Boilerplate Revision 1/2006
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<td>Flash Point, °f</td>
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**Aged Asphalt (RTFO)**

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<tr>
<td>Ductility Retention, 39.2 °f, %</td>
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<tr>
<td>Ground Tire Rubber, % of total asphalt binder by weight</td>
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The asphalt cement shall be modified by the addition of a minimum of 17 percent of granulated rubber, by total weight of the asphalt binder.

The base paving grade asphalt used with the Rubber Modified Asphalt binder, shall meet the requirements of PG (Performance Grade) graded standards; the grade shall be determined by the mix design and binder test results. Every 500 to 800 tons of asphalt-rubber blend shall be certified, by the supplier, for compliance and verified by the City of Phoenix Materials Lab.

**B. Asphalt-Rubber Mixing and Reaction Procedure**

1. **Asphalt Cement Temperature**: The temperature of the asphalt cement shall be between 375 and 425 degrees F. at the addition of the granulated rubber.

2. **Blending and Reacting**: The asphalt and granulated rubber shall be combined and mixed together in a blender unit, pumped into the agitated storage reaction tank, and then reacted for a minimum of 45 minutes from the time the granulated rubber is added to the asphalt cement. Temperature of the asphalt-rubber mixture shall be a minimum of 350 °F during the reaction period. The mixture of asphalt cement and rubber shall not be held at temperatures over 350 degrees F. for a period over 10 hours. The asphalt rubber may be allowed to cool to between 300 °F. and 350 °F. after it has reacted for the specified period.
3. Transfer: After the material has reacted for at least 45 minutes and the required viscosity is verified, the asphalt-rubber shall be metered into the mixing chamber of the asphalt concrete production plant at the percentage required by the Engineer.

4. Delays: When a delay occurs in binder use after its full reaction, the asphalt-rubber shall be allowed to cool. The asphalt-rubber shall be reheated slowly just prior to use to a temperature between 300°F and 400°F, and shall also be thoroughly mixed before pumping and metering into the hot plant for combination with the aggregate. The viscosity of the asphalt-rubber shall be checked by the supplier and verified by the Engineer. If the viscosity is out of the range specified, the asphalt-rubber shall be adjusted by the addition of asphalt cement or granulated rubber to produce a material with the appropriate viscosity and within the previously specified percent ground rubber range.

C. Asphalt-Rubber Equipment:

All equipment utilized in the production and application of the asphalt-rubber shall be described as follows and shall be equipped with calibrated functional thermometers:

1. Asphalt Heating Tank: An asphalt heating tank with a heating system capable of heating asphalt cement to the necessary temperature for blending with the granulated rubber. This unit shall be capable of heating a minimum of 2,500 gallons of asphalt cement.

2. Blender: The asphalt-rubber mechanical blender shall have a two stage continuous mixing process capable of producing a homogenous mixture of asphalt cement and granulated rubber, at the mix design specified ratios, as directed by the Engineer. This unit shall be equipped with a granulated rubber feed system capable of supplying the asphalt cement feed system, as not to interrupt the continuity of the blending process. An system that is capable of metering both the amount of granulated rubber specified and the amount of asphalt cement specified going into the primary blender shall be provided and maintained at all times. The maximum capacity of the primary blending vessel shall be 500 gallons, unless approved by the Engineer. The blender shall be equipped with an agitation device orientated to provide proper blending 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.

3. Storage/Reaction Tank: An asphalt-rubber storage/reaction tank equipped with a heating system to maintain a temperature of 300 - 400 °F for reacting, pumping, and for adding the binder to the aggregate. The storage/reaction tank shall be separate from the primary blender of the blending unit. This unit shall have an internal mixing device capable of maintaining a uniform mixture of asphalt cement and granulated rubber. The system shall be equipped with a device indicating which tank is supplying binder to the plant.

4. Supply System: An asphalt-rubber supply system equipped with a pump and a direct interlock metering device or any other system approved by the Engineer, capable of adding the rubber by weight to the asphalt at the percentage required by the job-mix formula.

5. Temperature Gauge: 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.

6. An inline temperature gauge and a sampling port, for checking viscosities safe and accurately, shall be provided from the storage tank to the asphalt plant.

D. Asphalt-Rubber/Aggregate Mixing Equipment:

The addition and mixing of the asphalt-rubber with the aggregate shall be accomplished with one of the following types of hot-mix asphalt plants:

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1. Batch Mixing: Batch mix plant consisting of cold aggregate storage and feed, drier, gradation control unit, hot aggregate storage bins, aggregate with-hoppers, and twin-shaft pugmill mixing unit. Also, the plant may be equipped with hot-mix surge or storage bins for short-term holding of the mixture until spreading.

2. Drier-Drum Mixing: Drier-drum mix plant consisting of cold aggregate storage and feed, automatic weighing system, drier-drum mixer and hot-mix surge or storage bins for short-term holding of the mixture until spreading.

The asphalt-rubber/aggregate mixing equipment shall be capable of producing a paving mixture meeting all of the requirements contained in these specifications, specifically the plant shall provide proper aggregate gradation, asphalt-rubber content and mixing temperature.

The use of silos and the storage of material should be in accordance with MAG 710.

E. Binder and Mix Acceptance Criteria:

The Contractor shall provide the Engineer with previous day's documentation prior to the start of each day's production. The documentation shall include the following:

1. The amount and temperature of the asphalt cement prior to the addition of rubber.
2. The amount (bags) of rubber added.
3. The viscosity of the asphalt-rubber just prior to the mixing with the aggregate and mineral admixture.
4. The time of the rubber additions and viscosity tests.

F. Aggregate Preparation:

The asphalt-rubber binder shall be at a temperature of 300 °F to 375 °F when pumped and metered into the mixing plant.

The aggregate shall be dried and heated to provide a paving mixture immediately after mixing, having a temperature not exceeding 335 °F and a moisture content not exceeding 1.0 percent by weight of mixture.

The mixing operation shall be sufficient to achieve a satisfactory mixture with 100% coated particles as determined by AASHTO T195 or ASTM D 2489