

East Valley Asphalt Committee HOT ASPHALT MIX CRITERIA

Effective Date: January 1, 2025

In an effort to standardize asphalt mix designs in the East Valley (*the Cities of Chandler, Mesa, Scottsdale, Tempe and the Towns of Gilbert and Queen Creek formed an East Valley Asphalt Committee (EVAC)*). The Committee initially established and has now revised the following procedures for submitting, reviewing and approving asphalt mixes. Once an asphalt mix design is approved, the mix may be used in any of the six communities per approved plans, details and specifications. The following is the procedure for asphalt producers to obtain approval of their asphalt mixes.

I. General Information:

- A. Many of the references provided herein are to Maricopa Association of Governments (MAG) Uniform Standard Specifications (Specification). The specification refers to the 2020 version including the latest revisions.
- B. Who needs to submit: All producers of hot asphalt concrete whose mixes may be placed within the rights-of-ways of the Cities of Chandler, Mesa, Scottsdale, Tempe and/or Towns of Gilbert and Queen Creek.
- C. Where to submit: Submit one (1) digital copy of each asphalt design report to the City of Mesa's Material Lab using the appropriate forms and cover sheet. Forms are located online at <https://www.mesaaz.gov/business/engineering/policies-forms> and email design reports to: mat.lab@mesaaz.gov. Once approved, mix designs will be active on the approved list for two (2) calendar years.
- D. When to submit: new approvals or re-approvals of asphalt mixes, hot mix facilities, and laboratory certifications will be conducted on an annual basis. Asphalt mixes will be accepted for review starting with the first business workday in October and no later than the last business workday in November in order to obtain approval by the first business workday of January annually. Submittals made after the last business workday in November may experience significant delays in the approval process. Additional submittals may be required when the committee, in their judgment, determines the product in the field is not meeting the approved mix design or as required in the following criteria.
- E. Bulk samples shall be submitted with the initial mix design for approval. Bulk sample requirements for EVAC communities other than Mesa will be per their standard specifications and requirements. *(Bulk samples should consist of one (1) blank sample and four (4) known samples)*
- F. If a supplier chooses to modify an existing approved product code, then the new material must be submitted for analysis.
- G. The asphalt mix design submittal will include the following information:

1. The mix design shall be stamped, signed and dated by the Professional Engineer (properly licensed and registered with the State of Arizona) who is responsible for the mix design.
2. A unique product code for each mix design.
3. Grade of asphalt binder, including type of modifiers if present.
4. Recommended asphalt binder content (See Targets for each mix category).
5. Asphalt binder test results shall be submitted for the material per MAG Specification Section 711. The test results shall be stamped, signed and dated by a Professional Engineer who is properly licensed and registered with the State of Arizona.
6. Gyrotory mix designs – Use Initial (Nin) as 8 gyrations and Design (Ndes) as 100 gyrations.
7. Anti-strip supplier with certifications for the material.
8. Method to add anti-strip agent to the asphalt binder or the aggregate.
9. Specific gravity for coarse and fine aggregates and of the composite gradation (bulk, bulk SSD, apparent and effective).
10. Specific gravity of anti-strip agent and asphalt binder.
11. Maximum theoretical specific gravity of asphalt mixture.
12. Bulk specific gravity of asphalt mixture.
13. Moisture sensitivity of asphalt mixture at the recommended design asphalt binder content.
14. Aggregate proportions (including anti-strip agent) based on bin percentages and composite gradation. The composite gradation plotted on a graph raised to 0.45-power gradation chart along with the applicable specification limits.
15. Sand Equivalent of the composite gradation.
16. Fractured face count for coarse aggregates.
17. Uncompacted void content for fine aggregates.
18. Plasticity Index.
19. Percent voids in mineral aggregate of asphalt mixture.
20. Percent voids filled with asphalt of asphalt mixture.
21. Percent effective air voids of asphalt mixture.
22. Dust proportion of asphalt mixture.
23. Film thickness of asphalt mixture.
24. Mixing and compaction temperatures of the asphalt binder.
25. Plant and Laboratory Certifications including addresses.

II. Requirements:

ASPHALT CONCRETE

1.0 GENERAL:

Asphalt concrete shall be a mixture of asphalt binder and mineral aggregates. Mineral admixture, mineral filler and anti-stripping agent shall be included in the mixture when required by the mix design or by the Engineer. All materials shall be proportioned by weight, volume or a combination in a central mix plant in the proportions required by the mix design to provide a homogeneous and workable mass. Asphalt concrete shall be produced in accordance with the MAG Specification Sections 321, 326 and 710 with the following modifications:

A. *Subsection 321.5 and 326.5* – Delete the 1st paragraph and substitute with the following, “If the contractor/supplier elects to change the source of material for a mix that is already on the EVAC approved list, the contractor/supplier shall furnish a new mix design that is in accordance with the EVAC criteria. Upon review and approval of the new mix design by EVAC, the new mix design will replace the originally approved mix design on the approved EVAC list or may be added as an additional approved mix to represent the change in source material. However, note that if only the asphalt binder source is changing in the existing approved mix design, EVAC will accept a 1-pt verification at the optimum binder content for the existing approved mix design with the original aggregate source. This will add an additional mix design to the approved list in addition to the original approved mix design.”

B. *Subsection 321.10.2 and 326.10.2* – Delete the reference to “fan drying per AASHTO T209 Section 15.”

C. *Subsection 321.10.6 and 326.10.6* - Shall be deleted in its entirety, Engineering Analysis (EA) are not permitted with the use of EVAC approved mix designs.

D. *Subsection 710.1* – Delete the 2nd sentence in the 1st paragraph and substitute with the following, “Mineral admixture, mineral filler and anti-stripping agent shall be included in the mixture when required by the mix design or by the Engineer. All materials shall be proportioned by weight, volume or a combination in a central mix plant in the proportions required by the mix design to provide a homogeneous and workable mass.”

E. *Subsection 710.2.2* – Delete the last paragraph and substitute with the following, “The natural sand shall not exceed 10 percent by weight of the total aggregate for a mix.”

F. *Subsection 710.2.4* – Add the following text to this subsection, “When liquid anti-stripping agents are used, the agent shall conform to the requirements of AASHTO designation R 15-89. The agent shall be added in accordance with the manufacturer’s recommended dosage rate. Other mineral filler, mineral admixture, or anti-stripping agents shall be approved by the Engineer prior to start of mix design.”

G. Additional Requirements:

The designation for asphalt concrete mixes shall be based on the nominal maximum aggregate size of the mix. The applicable mix designations are: ½-inch and ¾-inch all mixes shall have a dense gradation in accordance with MAG 710, table 710-3.

The EVAC committee will maintain two (2) lists located online at <https://www.mesaaz.gov/business/engineering/approve-products-equipment-natural-gas-line-contractors> . One list for Conventional Asphalt and the other for Modified Asphalt, as itemized below. PG70-10 and PG70-16TR/PM mix designs shall be as specified in Section 2.0. DG76-22 PM, PMTR and RAP mix designs shall be as specified in Section 3.0.

Suppliers shall submit one design for the following mix classifications only:

Conventional Asphalt: Projects totaling less than 25 tons in total require no asphalt mix testing, no in-place compaction testing requirements, visual verification of approved mix and rolling pattern by Engineer's representative. This does not apply to any new streets, overlays or trench restoration projects. Agencies may elect to utilize this for all types of projects, whereas if the total exceeds 25 tons, Quality Control and Quality Assurance as specified by the project’s provisions shall be required.

PG70-10 (½ inch and ¾ inch)

Modified Asphalt: The Following mixes are for all new streets, overlays, utility trench restoration and for projects above 25 tons where asphalt mix testing and in-place compaction testing will occur:

- PG70-16 TR (½ inch and ¾ inch)
- PG70-16 PM (½ inch and ¾ inch)
- PG76-22 PMTR (½ inch and ¾ inch)
- PG76-22 PM (PMA) (½ inch and ¾ inch)
- PG76-22 PMTR w/ Max 15% RAP (½ inch and ¾ inch)
- PG76-22 PM w/ 15% RAP (½ inch and ¾ inch)
- PG76-22 PM w/ 25% RAP (½ inch and ¾ inch for AC Base ONLY)

Each mix shall be designed using the Superpave Gyrotory Compactor (SGC) method only. Unless otherwise determined by the specifying agency, the following table (Table 1) displays the required minimum lift thickness for various asphalt concrete mix designations found within MAG Standard Specification Section 710. Note that these are based on each mix designation’s nominal maximum aggregate size. The compacted thickness of layers placed shall not exceed 150% of the Minimum Lift Thickness of Table 1 except as otherwise provided in the plans and specifications, or as approved in writing by the Engineer.

**TABLE 1
RECOMMENDED MINIMUM LIFT THICKNESSES for ASPHALT CONCRETE MIXES**

<u>Designation (inches)</u>	<u>Minimum Lift Thickness Gyrotory Mixes</u>
½-inch	1.5 inches
¾-inch	3.0 inches

2.0 MIX DESIGN REQUIREMENTS:

2.0.1 General: The mix design for asphalt concrete shall be prepared by a laboratory that is accredited through the AASHTO Accreditation Program (AAP) in Hot Mix Asphalt Aggregates and Hot Mix Asphalt. The laboratory shall be under the direct supervision of a Civil Engineer, registered by the State of Arizona. While laboratories, who are listed by ADOT as a “Qualified Asphaltic Concrete Mix Design Engineer” within ADOT’s latest list of approved laboratories are preferred, it is not required. The latest list of approved laboratories is available on ADOT’s web page www.azdot.gov. The date of the design shall not be older than one (1) year from the date of submittal, unless supportive documentation is provided and approved by the Engineer.

The mix design report shall include the elements as outlined in Section I G above and include the following:

- (1) The name and address of the testing organization and the person responsible for the mix design report.
- (2) The mix plant identification and/or location, as well as the supplier or producer name.
- (3) A description of all products that are incorporated in the asphalt concrete along with the sources of all products, including admixtures and asphalt binder, and their method of introduction.

(4) The supplier and grade of asphalt binder, the source and type of mineral aggregate, and the percentage of asphalt binder and mineral admixture used.

(5) The mix design report shall state in all cases Gyratory based mix designs shall be designated as high traffic mixes.

(6) The results of all testing, determinations, etc., such as: specific gravity and gradation of each component, water absorption, sand equivalent, loss on abrasion, fractured coarse aggregate particles, Tensile Strength Ratio (AASHTO T 283), asphalt absorption, percent air voids, voids in mineral aggregate, and bulk density.

Historical abrasion values may be supplied on existing sources. The submittal should include a plot of the gradation on the Federal Highway Administration 0.45 Power Gradation Chart along with specification limits, plots of the compaction curves and the results of moisture sensitivity testing.

(7) The laboratory mixing and compaction temperature ranges from the supplier and grade of asphalt binder used in the mix design.

(8) A specific recommendation for design asphalt binder content and any limiting conditions that may be associated with the use of the design, such as minimum percentages of crushed or washed fine aggregate.

(9) The supplier's product code, the laboratory Engineer's seal (signed and dated), and the date the design was performed. The mix design shall be submitted to the Agency or Engineer by the Contractor/Supplier for which it was developed as part of his project submittals. Once the mix design has been approved by the agency or Engineer, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer. Any changes in the plant operation, the producer's pit, the asphalt binder, including modifiers in the asphalt binder, or any other item that will cause an adjustment in the mix, shall be justification for a new mix design to be submitted.

Binder Grade	Temperatures	
	Lab Mixing Range, °F	Lab Compaction Range, °F
PG 70-10	317 – 328	297 – 307
PG 70-16TR/PM	317 – 328	297 – 307
PG 76-22PMTR	327 – 338	306 – 316
PG 76-22 PM	327 – 338	306 – 316

2.2.2 Mix Design Criteria: The mix design shall be performed by the SGC Mix Design method. The method shall be specified on the plans, special provisions, or by the Engineer. A minimum of 4 points will be used to establish the mix design results. The oven aging period for loose mixture prior to Gyratory compaction shall be 2 hours at the compaction temperature.

2.2.2.1 Superpave Gyratory Mix Design: SGC Mix Designs shall be performed in accordance with the requirements of latest edition of the Asphalt Institute’s MS-2 manual AI MS-2, Asphalt Mix Design Methods current edition. Mix design laboratory compacted specimens shall be prepared using a gyratory compactor in accordance with AASHTO T-312.

The mix design shall be formulated in a manner described for volumetric mix designs in the current edition of the AI MS-2 Asphalt Mix Design Methods current edition except the number of trial blend gradations necessary will be determined by the mix design laboratory. Duplicate gyratory samples shall be prepared at a minimum of four (4) binder contents to select the recommended binder content. The completed mix design shall meet all the mineral aggregate and mix design criteria specified herein. The binder content should fall within the range of 5.8% to 6.2% of the total weight of mix for grades PG70-10 and PG70-16. If not, this must be brought to the attention of EVAC or contracting local agency.

For purposes of design, the number of gyrations shall be 8 for N_{ini} and 100 for N_{des}

The mix shall comply with the criteria in Table 4.

**TABLE 4
SUPERPAVE GYRATORY MIX DESIGN CRITERIA**

<u>Criteria</u>	<u>Requirements</u>		<u>Designated Test Method</u>
	<u>1/2" Mix</u>	<u>3/4" Mix</u>	
1. Voids in Mineral Aggregate: %, Min.	14.0	13.0	AI MS-2
2. Effective Voids: %, Range*	3.5 ± 0.5	3.5 ± 0.5	AI MS-2
3. Absorbed Asphalt: %, Range **	0 - 1.0	0 - 1.0	AI MS-2
4. Dust to Eff. Asphalt Ratio, Range ***	0.6 – 1.4	0.6 – 1.4	AI MS-2
5. Tensile Strength Ratio: %, Min.	75	75	AASHTO T-283
6. Dry Tensile Strength at 77°F: psi, Min.	75	75	AASHTO T-283
7. Mineral Aggregate Grading Limits	Percent Passing with Admix shall be per MAG		AASHTO T-27 Table 710-3

* Recommended target only

** Unless otherwise approved by the Engineer.

*** The ratio of the mix design composite gradation target for the No. 200 sieve, including admixture, to the effective asphalt content shall be within the indicated range.

2.2.2.2 Moisture Sensitivity Testing: Moisture sensitivity testing will be performed in accordance with AASHTO Test Method T283 SGC mix designs. The minimum required Tensile Strength Ratio is indicated in Table 4.

3.0 POLYMER MODIFIED AND POLYMER MODIFIED TERMINAL BLEND RUBBERIZED MIXES (PG76-22PM & PG76-22PMTR)

The East Valley Asphalt Committee maintains a list of approved polymer-modified and polymer modified terminal blend rubberized mix designs (PM & PMTR mixes), as specified in this section. Use of the PM and PMTR mix designs by a specific agency will be determined by that agency, as will be specified in their supplements to MAG and/or as covered in the project-specific plans and specifications. Street widening, and trench patches shall match the existing asphalt surface type.

3.1 GENERAL:

The materials mix design and installation of the PMTR asphalt mixes shall comply with MAG Section 326 and 710 as modified herein.

The asphalt concrete mix should be an SGC Mix of either 1/2" inch or 3/4" inch nominal size aggregate. The mix design shall be in accordance with Section 710 and AI MS-2 current edition, except for the binder content range. The design binder content shall be a minimum of 6.5%. Production tolerances shall be -0.5% to +0.5% as shown in TABLE 326-4 in Section 4. The design pavement thickness is 2.0 inches unless otherwise noted. A 1-point verification shall be utilized to determine optimum binder point between 6.0% and 6.5% for 15% RAP mix only.

When using RAP in the mix design, the RAP aggregate shall not exceed 15% by weight of total aggregate for surface course and 25% for base course. The composite gradation shall meet Table 710-3 in MAG Section 710. Section 710.2.3 shall be edited as follows:

710.2.3 Reclaimed Asphalt Pavement (RAP): When allowed by the Engineer, Reclaimed Asphalt Pavement (RAP), as defined in Section 701.5, may be used in asphalt concrete provided all requirements of Section 710 are met. References to use of RAP in Section 710 apply only if RAP is used as part of the mixture.

When RAP is used in asphalt concrete, it shall be of a consistent gradation, asphalt binder content, and properties. When RAP is fed into the plant, the maximum RAP particle size shall not exceed the nominal maximum size of the mix design specified. **The percentage of asphalt binder in the RAP shall be determined in the mix design. The percentage of RAP asphalt binder in the total asphalt binder content of the mix shall be determined in the mix design. Performance Grading of the recovered asphalt binder shall be performed for all RAP stockpiles and recorded to represent that stockpile of RAP material as well as the gradation of the RAP aggregate. This will permit the use of known materials and allow for variation from the mix design in the job mix formula to be adjusted to meet the mix design criteria.

In addition to the requirements of Section 710.3.1, the job mix formula shall indicate the percent and performance grade of the RAP asphalt binder and the percent and performance grade of the virgin (added) asphalt binder. The true performance grade of the blend of the RAP asphalt binder and the virgin asphalt binder shall be stated in the mix design. The laboratory prepared blend of the two binders (RAP and virgin) shall meet the requirements for PG 76-22PMTR listed in EVAC Section 3.2 below. In case the performance grade of the blend asphalt binder (virgin binder plus RAP binder) does not meet the requirements for PG 76-22PMTR or PG76-22PM listed in EVAC Section 3.2, the percent of RAP must be adjusted in order for this requirement to be met while keeping the RAP aggregate below 15% by weight of total aggregate.

When batching aggregate samples for gradation analysis, the extracted RAP aggregate shall be used at the specified RAP percent. For example, if 15% RAP is specified, the extracted RAP aggregate shall be incorporated as 15% of the total aggregate blend sample.

The bulk specific gravity (G_{sb}) of the extracted RAP aggregate shall be measured and used in the determination of the bulk specific gravity of the aggregate blend used in the mix design.

When batching mix samples for compaction in the SGC, the amount of RAP materials added into the mix must be adjusted to account for the presence of the asphalt binder. The adjustment is based on the RAP asphalt binder content. For example, if 15% RAP is used in the mix and the RAP binder content is 5.75%, the amount of RAP material included into the mix sample is: $15(1 + \text{RAP binder content in decimal})$: $15(1 + 0.0575) = 15.86\%$ of the total sample weight. In the case of a 6000g SGC sample, the amount of RAP materials will be: $0.1586 \times 6000 = 951.6\text{g}$.

3.2 ASPHALT BINDER:

The asphalt binder shall be polymer modified terminal blend rubber Performance Graded PG 76-22 PMTR or polymer modified Performance Graded PG76-22PM in accordance with the requirements of AASHTO M320, Table 1. except as modified in Tables 5 and 6 below:

The use of Poly Phosphoric Acid (PPA) is not permitted. Air blown asphalt, recycled oil and/or other modifiers will not be permitted.

Crosslinking agents used to stabilize polymer in asphalt binder shall be allowed and that they be considered part of the polymer.

TABLE 3.1

PERFORMANCE GRADED PG 76-22 PMTR SPECIFICATIONS (HOT CLIMATE)		
Property	Test Method	Requirement
Original Physical Properties		
Whole Scrap Ground Tire Rubber (percentage of weight of total asphalt cement)	Certificate of Compliance	10 percent (min.)
SBS Polymer	Certificate of Compliance	3 percent (min.)
COC Flash Point, °F	ASTM D-92	450 (min.)
Elastic Recovery @ 10° C, percent	ASTM D-6084	75 (min.)
Solubility, percent	ASTM D-2042	98 (min.)
Specific Gravity @ 60° F	-----	Report
Weight per Gallon @ 60° F	-----	Report
Original		
$G^*/\text{Sin } \delta$ @ 76° C @ 10 rad/sec, kPa	AASHTO T315	1.00 (min.)
δ , Phase angle, Degrees	AASHTO T315	75 (max.)
RTFO Aging		
MSCR $J_{nr3.2}$ at 70°C	AASHTO T350	1.00 kPa ⁻¹ (max.)
Max Loss, %	AASHTO T240	1.00 (max)
PAV Aging AASHTO R28 (110 °C)		
$G^*\text{Sin } \delta$ @ 31° C @ 10 rad/sec, kPa	AASHTO T315	5,000 (max.)
Creep Stiffness, S @ -12° C @ 60 sec, MPA	AASHTO T313	300 (max.)
m-Value @ -12° C @ 60 sec		0.300 (min.)

TABLE 3.2

PERFORMANCE GRADED PG 76-22 PM SPECIFICATIONS (HOT CLIMATE)		
Property	Test Method	Requirement
Original Physical Properties		
SBS Polymer	Certificate of Compliance	3 percent (min.)
COC Flash Point, °F	ASTM D-92	450 (min.)
Elastic Recovery @ 10° C, percent	ASTM D-6084	75 (min.)
Solubility, percent	ASTM D-2042	97.5 (min.)
Specific Gravity @ 60° F	-----	Report
Weight per Gallon @ 60° F	-----	Report
Original		
G*/Sin δ @ 76° C @ 10 rad/sec, kPa	AASHTO T315	1.00 (min.)
δ, Phase angle, Degrees	AASHTO T315	75 (max.)
RTFO Aging		
MSCR J _{nr3.2} at 70°C	AASHTO T350	1.00 kPa ⁻¹ (max.)
Max Loss, %	AASHTO T240	1.00 (max)
PAV Aging AASHTO R28 (110 °C)		
G*Sin δ @ 31° C @ 10 rad/sec, kPa	AASHTO T315	5,000 (max.)
Creep Stiffness, S @ -12° C @ 60 sec, MPA	AASHTO T313	300 (max.)
m-Value @ -12° C @ 60 sec		0.300 in.)

4.0 - Production Tolerances and Specifications

The following tables are adapted from MAG and edited in accordance with EVAC mix design criteria and Performance Analysis Report (8/10/20) as referenced. A copy of the Performance Analysis Report is available at the City of Mesa’s Engineering website.

For non-modified, Conventional Asphalt mixes, use the appropriate MAG Tolerances tables for the applicable production test results.

For Modified Asphalt mixes, the following acceptance and penalties shall be used:

TABLE 326-4		
ASPHALT BINDER CONTENT ACCEPTANCE AND PENALTIES		
Deviation from that permitted	When the contracting agency is the owner: Corrective Action	When the contracting agency is not the owner (i.e. permits): Corrective Action
Over 0.5% <u>above</u> optimum binder content	Removal*	Removal*
Within permitted range of optimum binder content	Full Payment	No Corrective Action
Over 0.5% <u>below</u> optimum binder content	Removal*	Removal*

* The contractor shall remove and replace the entire subplot that is deficient. In addition, it is at the discretion of the Engineer to determine if removal or a penalty option maybe levied as the Engineer dictates for non-permit work.

EVAC has elected to waive penalties associated with Laboratory Voids in production provided the mix design has met EVAC design criteria. Delete the table (321-5) and associated paragraphs related to the table. Penalties for Laboratory Voids shall still apply for unmodified conventional Asphalt Mixes, as specified in MAG, or as directed by the Engineer.

TABLE 326-8		
PAVEMENT DENSITY PENALTIES –		
Limits of In-place Air Voids for design lift thicknesses 1.5 inches and greater	When the contracting agency is the owner Payment or Corrective Action	When the contracting agency is not the owner i.e. permits Corrective Action
Below 3.0%	Removal*	Removal*
3.0% to 8.0%	Full Payment	No Corrective Action
Greater than 8.0%	Removal*	Removal*

* The contractor shall remove and replace the entire subplot that is deficient. In addition, it is at the discretion of the Engineer to determine if removal, penalty or other option maybe levied as the Engineer dictates for non-permit work.

PARTICIPATING AGENCIES

City of Chandler

Town of Gilbert

City of Mesa

City of Scottsdale

City of Tempe

Town of Queen Creek

PUBLISHING AGENCY

City of Mesa