

**KANSAS DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION TO THE
STANDARD SPECIFICATIONS, EDITION 2007**

SECTION 602

**HOT MIX ASPHALT (HMA) CONSTRUCTION
(Quality Control/Quality Assurance (QC/QA))**

Page 600-2, replace subsection 602.2a. with the following:

a. General. Provide qualified personnel and sufficient equipment complying with the requirements listed in Part V to conduct quality control testing that complies with Appendix B, Sampling and Testing Frequency Chart for Asphalt Construction Items for Quality Control/Quality Assurance Projects.

Allow the Engineer access to the Contractor's laboratory to observe testing procedures, calculations, test documentation and plotting of test results.

Calibrate and correlate the testing equipment with prescribed procedures, and conduct tests in compliance with specified testing procedures as listed in Section 5.17.10, Part V.

Store and retain the most recent 2 lots per mix designation of quality control samples for KDOT. KDOT will retain the most recent 2 lots per mix designation gyratory compacted air voids (Va) verification samples and the remaining material not previously used for testing (back half of sample). Do not retain more than the previous 3 lots per mix designation of quality control or verification samples. When the hot mix plant shuts down for the winter, discard the samples after 7 days.

Maintain control charts on an ongoing basis. Record all original documentation in a bound field book or other KDOT approved bound record and turn over to KDOT at the end of the project.

At the completion of the project, all documentation shall become the property of KDOT.

Provide the following test data to the KDOT Project Representative:

- Copies of all test results and control charts on a weekly basis, representing the prior week's production;
- Copies of the quality control summary sheet on a daily basis. Include, as a minimum, mix gradation, binder content, theoretical maximum specific gravity (Gmm), Va at Ndes, percent Gmm at Nini and Nmax, voids in mineral aggregate (VMA), voids filled with asphalt (VFA) and dust to effective binder content (D/B) ratio; and
- Copies of all failing test results (based on a moving average of 4 tests, when appropriate). Include all applicable sieves, VMA, VFA, density at Nini and Nmax, and D/B ratio.

Page 600-3, subsection 602.2d.(5). In the second paragraph change "subsection 602.2d.(1) and (4)" to "subsections 602.2d.(1) through (4)".

Page 600-4. Add the following to the end of subsection 602.3a.:

Exception: The mixing temperature may be increased no more than 10°F above the maximum mixing temperature shown on the bill of lading provided all the following are met:

1. The air temperature is below 70°F
2. The plant has not produced mix earlier in the day.
3. Do not exceed a mix temperature of 350°F.
4. No truck has returned for its second load of the day.

Once a previously loaded truck returns for its next load, reduce the temperature to not higher than the maximum mix temperature shown on the bill of lading, not to exceed 340°F.

Page 600-4, replace subsection 602.3d. with the following:

d. Combined Aggregates. Provide combined aggregates for the mixes required in the Contract Documents as shown in **TABLE 602-1**.

Mixes may use any combination of aggregate and mineral filler supplements complying with the applicable requirements in **TABLES 1103-1** and **1103-2**.

Provide materials with less than 0.5% moisture in the final mixture.

The maximum quantity of crushed steel slag used in the mix is 50% of the total aggregate weight.

For all mixes used on the traveled way, the maximum quantity of natural sand is 35%.

Natural sand shall be called SSG-1, SSG-2, etc. in the mix design.

Additional requirements for SM-9.5T and SR-9.5T:

- Traveled way mixes shall include a minimum of 40% primary aggregate based on total aggregate weight;
- A minimum of 50% of the plus No. 4 mesh sieve material in the mixture shall be from the primary aggregate;
- A minimum of 45% of the plus No. 8 mesh sieve material in the mixture shall be from the primary aggregate; and
- Primary aggregates are designated as CS-1 (excluding limestone), CS-2 (excluding limestone), CG, CH-1 and CSSL as described in **subsection 1103.2a.(1)**. Primary aggregate requirements do not apply to the mixture used on the shoulder.

Page 600-5, replace subsection 602.3e. with the following:

e. Contractor Trial Mix Design. A minimum of 10 working days before the start of HMA production, submit in writing to the DME for review and approval, a proposed JMF for each combination of aggregates. For each JMF submitted, include test data to demonstrate that mixtures complying with each proposed JMF shall have properties specified in **TABLE 602-1** for the designated mix type at the Recommended Percent Asphalt (P_{br}). Submit the proposed JMF on forms provided by KDOT. Submit the worksheets used in the design process to include at a minimum the mix properties listed in **TABLE 602-2**. Contact the DME to determine if additional information should be submitted. Provide sufficient material as identified in **TABLE 602-3**. Contact the DME to determine if additional material is needed for additional design checks such as the modified Lottman test (KT-56).

When more than 25% of the virgin aggregates in a mix are comprised of siliceous materials, the minimum amount of anti-strip required in the mix is 0.01% for every percent of natural sand in the mix. Thus, if 35% natural sand is in a mix, then 0.35% anti-strip by weight of total asphalt binder is required in the mix. The total asphalt binder is determined from the ignition oven analysis (KT-57).

When RAP containing siliceous material is included in a mix, the minimum amount of anti-strip required in the mix is 0.01% for every percent of RAP in the mix. Thus, if 25% RAP is in the mix, then 0.25% anti-strip is required. The District Materials Engineer will determine the composition of the RAP aggregates. These minimum values of anti-strip are additive.

If during production, the TSR values (both KDOT and Contractor) exceed 85%, then the Contractor and the District Materials Engineer, working together, may decide on a lower amount of anti-strip.

Submit for the Engineer's review and approval, the test data listed in **TABLE 602-4** for each blend and the proposed JMF. In addition, for mixes containing RAP, submit for the Engineer's review and approval, the test data listed in **TABLE 602-5** for each blend and the proposed JMF. For mixes containing Warm Mix Asphalt (WMA) additives, submit for the Engineer's review and approval, the additive or process used, the recommended rate of application, and the temperature ranges for mixing and compaction. Submit a mix design for each blend and the proposed JMF as outlined in **TABLE 602-6**.

For each aggregate used in the mix design, determine the specific gravity using KT-6. This may be accomplished while the project is being constructed or anytime during the 12 months preceding the start of construction on a project. If construction has not yet begun, notify the DME 5 working days prior to obtaining the material for the specific gravity test so that companion samples may be obtained at the same time. If construction has already begun on the project, then the specific gravity values of the individual aggregates shall be determined before 10,000 tons of HMA is produced. Provide the test results to the DME within 14 days of sampling the material. If the producer of the aggregate has been required to submit material to KDOT for a new Official Quality test, since the time the Contractor ran the specific gravity tests, then perform KT-6 on the aggregate currently produced. The specific gravity values obtained from these tests shall not be used in the mix design calculations for current projects unless mutually agreeable to both parties. The information shall be used, as soon as it becomes

available, as part of the process to verify and update the “Monthly Hot Mix Aggregate Specific Gravity Values” posted on KDOT’s Internet site.

Page 600-5, add subsection 602.3f:

f. Additives. Provide Warm Mix Asphalt (WMA) additives or processes that comply with **special provision 07-12002, latest revision**. The Contractor is permitted to use WMA unless otherwise shown on the plans.

For mixes containing Warm Mix Asphalt (WMA) additives, submit for the Engineer’s review and approval, the additive or process used, the recommended rate of application, and the temperature ranges for mixing and compaction.

Mixing temperature range is provided by the Asphalt Binder Supplier. When using WMA, the mixing temperature may be reduced no more than 30°F for WMA water foaming processes, and no more than 70°F for WMA chemical and organic additives. The minimum mixing temperature for WMA is 220°F.

Page 600-6, replace TABLE 602-1 and its notes with the following:

TABLE 602-1: COMBINED AGGREGATE REQUIREMENTS											
Nom. Max. Size Mix Designation	Percent Retained – Square Mesh Sieves									Min. VMA (%)	D/B Ratio
	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 200		
SM-4.75A				0	0-5	0-10		40-70	88-94	16.0	0.9 – 2.0
SR-4.75A			0	0-2	0-5	0-10		40-70	88-94	16.0	0.9 – 2.0
SM-9.5A				0	0-10	10 min.	33-53		90-98	15.0	0.6 – 1.2
SR-9.5A			0	0-2	0-10	10 min.	33-53		90-98	15.0	0.6 – 1.2
SM-9.5B				0	0-10	10 min.	53-68		90-98	15.0	0.8 – 1.6
SR-9.5B			0	0-2	0-10	10 min.	53-68		90-98	15.0	0.8 – 1.6
SM-9.5T				0	0-10	10 min.	53-68		90-98	15.0	0.8 – 1.6
SR-9.5T			0	0-2	0-10	10 min.	53-68		90-98	15.0	0.8 – 1.6
SM-12.5A			0	0-10	10 min.		42-61		90-98	14.0	0.6 – 1.2
SR-12.5A		0	0-2	0-10	10 min.		42-61		90-98	14.0	0.6 – 1.2
SM-12.5B			0	0-10	10 min.		61-72		90-98	14.0	0.8 – 1.6
SR-12.5B		0	0-2	0-10	10 min.		61-72		90-98	14.0	0.8 – 1.6
SM-19A		0	0-10	10 min.			51-65		92-98	13.0	0.6 – 1.2
SR-19A	0	0-2	0-10	10 min.			51-65		92-98	13.0	0.6 – 1.2
SM-19B		0	0-10	10 min.			65-77		92-98	13.0	0.8 – 1.6
SR-19B	0	0-2	0-10	10 min.			65-77		92-98	13.0	0.8 – 1.6

1. The requirements for Coarse Aggregate Angularity (CAA); Fine Aggregate Angularity (FAA); Sand Equivalent (SE); Gyrotory compaction revolutions N_{ini} , N_{des} , N_{max} , N_{ini} level of compaction and VFA shall be as shown in the Contract Special Provisions for each mix designation.
2. The flat and elongated particles in the combined coarse aggregate shall not exceed 10% for the total sample.
3. The maximum percent moisture in the final mixture shall not exceed 0.5 for any mix designation.
4. The target air voids (V_a) for any mix designation shall be 4.0% at N_{des} gyrations.
5. The minimum tensile strength ratio (%TSR) shall be 80% for any mix designation.
6. The level of compaction of the mix when compacted to N_{ini} gyrations shall be less than the percent of the G_{mm} shown in the Contract Special Provision, and when compacted to N_{max} gyrations shall be a maximum of 98.0% of the G_{mm} .

Page 600-7, replace TABLE 602-5 with the following:

TABLE 602-5: RAP TEST DATA SUBMITTALS	
Submittal	Information
RAP	Source and location where RAP will be obtained.
RAP Aggregate	Bulk Specific Gravity (G_{sb}). Mixes \leq 15% RAP, the Effective Specific Gravity (G_{se}) shall be calculated as shown in subsection 5.17.04c.(3), Part V and used as the G_{sb} . Mixes $>$ 15% RAP, the G_{sb} will be provided on the Contract Special Provision.
Asphalt Binder Content of RAP	Determined from ignition oven analysis using KT-57.
RAP G_{mm}	Determined by KT-39.
Asphalt Binder Specific Gravity	Specific Gravity of the asphalt binder in the RAP (G_b) shall be set equal to 1.035.
Corrected Asphalt Binder Content of the total recycled mixture	Determined from ignition oven analysis using KT-57.

Page 600-8, replace subsection 602.4a.(1)(c) with the following:

(c) Anti-Strip Additives. If liquid anti-strip additives are added at the Contractor's plant, install a "totalizer" to monitor the quantity of anti-strip additive being added. The Engineer may approve alternative methods for including anti-strip additives in a batch plant. If added at the plant, the anti-strip will be added in line with the asphalt binder as it is being transferred from the transit unit to the asphalt binder storage tank. Provide a method for the Engineer to monitor the percent of additive being added.

If hydrated lime is added, mix it in an approved pug mill to coat the combined aggregates. Moisten the combined virgin aggregate to a minimum of 3% above the saturated surface dry condition prior to, or during the addition of the hydrated lime.

Page 600-8, add subsection 602.4a.(1)(d).

(d) WMA Additives. If WMA additives are added at the Contractor's plant, install a "totalizer" to monitor the quantity of WMA additive being added. Provide a method for the Engineer to monitor the percent of additive being added.

Page 600-9, add subsection 602.4a.(4).

(4) End of Day Quantities. At the end of each day of production provide the Engineer with a document signed by the Plant Foreman or the Project Manager listing the dry weight of each aggregate, mineral filler, RAP, and WMA chemical or organic additive; the tons of asphalt binder, the tons of anti-strip agent used for the project during the day, and the tons of water used in the WMA foaming process. The dry weight is the tons of the material less the water content.

Page 600-12, subsection 602.4e.(7)(a), delete the first paragraph and replace with the following:

(a) For mixes with a specified thickness greater than or equal to 1 1/2 inches:

For lots 1 and 2, control density as shown in subsection 602.4e.(7)(b). Before beginning production, the Contractor has the option to accept the pay adjustment for density on both Lots 1 and 2, or only Lot 2. If the Contractor chooses to accept the pay adjustments for density on both Lots 1 and 2, or only Lot 2, control the density as shown in subsections 602.4e.(7)(a)(i-ii). If the Contractor chooses to accept pay adjustment for density on Lot 1, the pay adjustment can not be rejected on Lot 2.

Page 600-12, replace subsection 602.4e.(7)(c) with the following:

(c) For all lots, achieve the maximum density before the temperature of the HMA falls below 175°F. When using WMA, achieve the maximum density before the temperature of the WMA falls below 165°F. Do not crush the aggregate. When the mat temperature falls below 175°F or 165°F for WMA, roller marks may be removed from the mat with a self-propelled static steel roller.

Page 600-14, replace TABLE 602-12 and its notes with the following:

TABLE 602-12: SPECIFICATION WORKING RANGES (QC/QA)				
Mix Characteristic	Tolerance from JMF			
	Single Test Value	Plot	4 Point Moving Average Value	Plot
Binder Content	±0.6%	*	±0.3%	*
Tolerance for Specification Limits				
Mix Characteristic	Single Test Value	Plot	4 Point Moving Average Value	Plot
Gradation (applicable sieves in TABLE 602-1)	N/A	*	zero tolerance	*
Air Voids @ N _{des} gyrations	±2.0%	*	N/A	
Voids in Mineral Aggregate (VMA)	1.0% below min.	*	zero tolerance	*
Voids Filled with Asphalt (VFA)	N/A		zero tolerance	*
Course Aggregate Angularity (CAA)	zero tolerance		N/A	
Sand Equivalent (SE)	zero tolerance		N/A	
Fine Aggregate Uncompacted Voids (FAA)	zero tolerance		N/A	
%Tensile Strength Ratio (%TSR)	zero tolerance	*	N/A	
Density @ N _{ini} and N _{max}	N/A		zero tolerance	
Dust to Effective Binder (D/B) Ratio	zero tolerance	*	zero tolerance	*

* Plot data according to **subsection 106.4d.(2)**.

For gradations, as a minimum, plot the No. 4, 8, 30 and 200 sieves.

Plot G_{mm} to third decimal point.

Indicate Job Mix Formula (JMF) and specification working range limits for single test results on the control charts using a green ink dotted line.

Indicate the specification working range limits for the 4-point moving average results with a green ink solid line.

Page 600-15, replace Equation B with the following:

Equation B: $Deduct = BP * Q * (\%RAP_4 - \%RAP_{max})$

Page 600-18, replace subsection 602.8c.(2) with the following:

(2) For V_a dispute resolution (the statistical comparison fails and the Contractor questions KDOT results), the following procedure applies for the lots in question:

- Determine which lots to dispute. Only dispute the lot produced immediately prior to the lot currently under production and being tested. Notify the Engineer, prior to the completion of all Contractor V_a testing for this lot. (When production is completed for any mix, the last lot may be challenged the day production is completed). When the hot mix plant shuts down for the winter, the Contractor has a maximum of 7 calendar days to dispute the last lot produced prior to winter shut down.
- Discard V_a and V_a pay adjustment factors previously determined within the lots being questioned.
- All saved gyratory compacted V_a quality control and verification samples and back half of samples within the lots in question will be taken by KDOT to the District Materials Laboratory. All back half of samples shall be a minimum of 35 pounds. Failing to obtain enough material removes the right to dispute resolution. Copies of all paperwork, including work sheets, associated with previous V_a calculations for the disputed lots will also be taken to the District Materials Laboratory.

The following retesting will be completed by KDOT:

- Check the samples to be sure they are dry before retesting. Reweigh the original gyratory compacted V_a quality control and verification samples. Determine the G_{mb} at N_{des} revolutions for all saved gyratory plugs. Compare retest results with original test results. Use this information to isolate potential testing errors, but continue with the remainder of the retesting steps.
- Determine the G_{mm} using the back half of all samples within each lot being questioned. Normally, there will be 5 back halves (4 Contractor's and 1 KDOT) to test within each lot.
- Compact the back halves to N_{max} revolutions and determine the G_{mb} at N_{des} revolutions.
- Use G_{mm} determined above and the G_{mb} determined from the recompacted samples to calculate V_a at N_{des} revolutions for the lots in question.
- Using the retest V_a results, a statistical comparison will be made. If the t-test passes, the Contractor's retest results will be used to calculate the pay factor and KDOT will pay for all retesting. Use the procedures shown in **subsection 602.9d**. If the t-test fails, KDOT's retest results will be used to calculate the pay factor, and the Contractor will pay for all retesting.

Page 600-19, replace subsection 602.8g. with the following:

g. Increased Lot Size. After 8 consecutive sublots have been produced within the tolerance shown for all mix characteristics listed in **TABLE 602-12** and without a V_a penalty, the subplot size may be increased to 1,000 tons (lot size of 4,000 tons), provided the normal production rate of the plant is greater than 250 tons per hour. Provide immediate notification of lot size changes to the Engineer any time a change is made.

After 8 additional consecutive sublots have been produced at the 1,000 ton subplot size, the subplot size may again be increased to 1,250 tons per subplot (lot size of 5,000 tons), provided all 8 consecutive 1,000 ton sublots have been produced within the tolerances shown for all mix characteristics listed in **TABLE 602-12**, without a V_a penalty, production rates for the previous 2 days have been greater than 3,750 tons per day, and a minimum of 2 of the last 3 segregation profile checks comply with **TABLE 602-14**.

TABLE 602-14: SEGREGATION PROFILE CHECKS FOR INCREASED SUBLOT SIZE		
Mix Designation	Maximum Density Range (highest minus lowest)	Maximum Density Drop (average minus lowest)
All	3.1 lbs./cu. ft.	1.9 lbs./cu. ft.

If subsequent test results fall outside the tolerances shown for any mix characteristic listed in **TABLE 602-12** or a V_a penalty is incurred, the subplot size shall be decreased to 750 tons. If the production rates fall below 3,750 tons per day for 2 consecutive days or a minimum of 2 of the last 3 segregation profile checks fail the above requirements, then the 1,250 ton sublots size shall be reduced to 1,000 ton per subplot provided the **TABLE 602-12** criteria is met and no V_a penalty is incurred.

When the increased lot size criteria are again met for 4 consecutive sublots, the subplot may be increased as the limits given above.

Page 600-22, subsection 602.9c. After Equation 1, in "S", delete "Section 5.17.0", and replace with "Section 5.17.09".

Page 600-23, subsection 602.10b. Delete the fifth paragraph and replace with the following:

The Engineer will determine the total core thickness for pay by taking 3 caliper measurements at approximately 120° apart and record each to the nearest 0.1 inch. The average of the 3 caliper measurements rounded to the nearest 0.1 inch shall represent the average measured thickness. The Engineer will use the total pavement thickness measurements to determine thickness pay adjustment factors.

Page 600-24, subsection 602.10b. In the third full paragraph (For Percent Within Limits...), change all "1 inch" to "1.0 inch".

Page 600-24, subsection 602.10c. In the first paragraph, replace "1 inch" with "1.0 inch". In the second and third paragraphs, replace all "½ inch" with "0.5 inch".

Page 600-24, subsection 602.10d. In the first paragraph, replace "1 ½ inches" with "1.5 inches". In the second and fourth paragraphs, replace all "¾ inches" with "0.8 inches".

Page 600-26, subsection 602.10e. In the definition for \bar{X} following Equation 8, change "1/8 inch" to "0.1 inch". In the definition for LSL, change "½ inch" to "0.5 inch" and change "¾ inch" to "0.8 inch".

Page 600-27, subsection 602.10e. Replace Equation 14 with the following:

Equation 14: Minimum Quantity (Tons) = $\frac{0.93 (A) (T) (G_{mm})}{42.7}$

Page 600-27, subsection 602.11b. In the second and fourth paragraphs, replace all "¼ inch" with "0.01 feet". In the third paragraph, replace the both "3.0 inches" with "0.25 feet".

Page 600-28, subsection 602.11e. Delete the second paragraph and replace with the following:

Payment for "Material for HMA Patching (Set Price)" at the contract set unit price includes all excavation, compaction of subgrade or subbase if required, disposal of waste material and all material (including emulsified asphalt for tack), all labor, equipment, tools, supplies, incidentals and mobilization necessary to complete the work.

Page 600-28, subsection 602.11f. Add the following paragraph:

The Engineer will not measure for payment Quality Control Testing (HMA) for the bid item Material for HMA Patching (Set Price).

Part V Sec. 5.9.50 KT-50 delete 7.1 and replace with the following:

7.1. Record to the nearest 0.1% uncompacted voids. Report the results to the nearest 1% uncompacted voids.