KANSAS DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION TO THE
STANDARD SPECIFICATIONS, EDITION OF 1990

NOTE: This special provision is generally written in the imperative mood. The subject, "the *Contractor*" is implied. Also implied in this language are "*shall*", "*shall be*", or similar words and phrases. The word "*will*" generally pertains to decisions or actions of the Kansas Department of Transportation.

Add a new section to Division 600:

DIVISION 600

PLANT MIX BITUMINOUS CONSTRUCTION
(Quality Control/Quality Assurance (QC/QA))

1.0 DESCRIPTION.

Furnish materials for, mix, and place one or more courses of plant mixed bituminous mixture on a prepared surface. Demonstrate quality control by providing the quality control testing.

BID ITEM	**UNIT**
Bituminous Base (*)(**)(***)	ton
Bituminous Surface (*)(**)(***)	ton
Quality Control Testing (Bituminous)	ton

*Mix Designation
**Grade of Asphalt Cement
***Shoulder

2.0 CONTRACTOR QUALITY CONTROL REQUIREMENTS.

a. General.

(1) Provide qualified personnel and sufficient equipment meeting the requirements listed in the Department's appropriate test procedures (KDOT Construction Manual, Part V) to conduct quality control testing. Perform the testing in conformance with the Sampling and Testing Frequency Chart for Bituminous Construction Items for Quality Control/Quality Assurance Projects (Appendix A).

Allow the Engineer access to the Contractor's laboratory so that he may observe any and all testing procedures, calculations, test documentation, and plotting of test results.

(2) Calibrate and correlate the testing equipment with prescribed procedures and conduct tests in conformance with specified testing procedures as listed in the Department's Superpave Mix

Design (SD) and Superpave Field Laboratory Technician (SF) Certification Training Manual (SD/SF Manual).

(3) Store and retain all quality control and verification samples for the Department for a period of seven days.

(4) Maintain control charts on an ongoing basis.

(5) File reports, records, and diaries developed during the progress of construction activities directed by the Engineer. Such documents will become the property of the Department.

(6) Provide the following test data to the KDOT Project Representative (the KDOT Project Representative will fax the results to the Construction Office and the District Materials Engineer):

(a) Copies of all test results and control charts on a weekly basis, representing the prior week's production.

(b) Copies of the quality control summary sheet on a daily basis. Include, as a minimum, mix gradation, binder content, theoretical maximum specific gravity, air voids at N_{ini}, N_{des}, N_{max}, voids in mineral aggregate, and voids filled with asphalt.

(c) Copies of all failing test results (based on a moving average of four tests, when appropriate). Include all applicable sieves, voids in mineral aggregate, voids filled with asphalt, density at N_{ini} and N_{max}, and dust/binder ratio.

b. Quality Control Plan.

(1) Submit to the Engineer for approval, at the preconstruction conference, a quality control plan as outlined in the Department's SD/SF Manual. Follow Appendix A of the Contractor's Quality Control Plan as a general guideline. The Contractor's laboratory and equipment will be inspected and approved as outlined in the Department's SD/SF Manual. Include a listing of the names and phone numbers of individuals and alternates responsible for quality control administration and inspection in the quality control plan. Show the specified lines of authority relating both to mix design and quality control operations during production on the Contractor's organizational chart. Post the organizational chart in the Contractor's test facility.

(2) The Contractor's quality control organization or private testing firms representing the Contractor must include individuals who have complied with the requirements for the Certification Qualifications for Bituminous Technicians. Certification requirements are on file with the Department. Only certified technicians may perform process control testing on the project.

c. Testing Facilities.

(1) Locate the Contractor's testing facility at the plant site or adjacent to the project site and get approval by the Engineer prior to the commencement of mixture production. Any other laboratory location must be approved by the District Materials Engineer. Provide suitable space and specified testing equipment for use by the Contractor's quality control personnel to perform tests as required.

(2) To facilitate communication between the Contractor and the Engineer regarding quality control, equip the Contractor's testing facility with the following:

(a) A telephone with a private line for the exclusive use of the testing facility's quality control personnel.

(b) A copying machine for use by the Contractor's personnel and the Engineer.

(3) Equip the KDOT field laboratory with the following:

(a) A facsimile machine for use by the Contractor's personnel and the Engineer.

(b) An air conditioner that can maintain a temperature below 25 °C in the main part of the Type A Field Office and Laboratory.

d. Testing Requirements.

(1) Take all samples for tests at random locations as designated in the approved quality control plan at the rates specified in the Sampling and Testing Frequency Chart for Bituminous Construction Items for Quality Control/Quality Assurance Projects (see Appendix A).

Provide the KDOT Project Representative with the random locations before going to the roadway to determine density or sample the bituminous mixture. The Engineer reserves the right to generate the random locations. If KDOT plans to generate the random locations, the Contractor will be notified before he goes to the roadway to sample the bituminous mixture or determine density.

(2) Conduct the tests for mixture properties, aggregate gradation and binder content on representative portions of the hot mix, quartered from a larger sample of hot mix taken at random behind the paver. At the paver, take a sample weighing at least 25 kilograms and transport it to the test facility using a method to retain heat to facilitate sample quartering procedures.

(3) On the first day of production the Engineer will observe the Contractor splitting the hot mix sample into three representative portions and testing the sample. Each sample consists of a minimum of two Superpave gyratory specimens. Compact one sample immediately while still hot (additional heating may be required to raise the temperature of the sample to compaction temperature). Allow the second sample to cool to ambient air temperature and then be heated to compaction temperature and compacted. Allow the third sample to cool to ambient air temperature and then be transported to the District laboratory where it will be heated to compaction temperature and be compacted. (If the project sample is collected, transported while hot to the District lab and compacted in less than two hours, then, at the District Materials Engineer's discretion, the requirement to cool the sample may be waived.) Determine bulk specific gravity differences for the various samples compacted as specified above. The District Materials Engineer will utilize the difference in bulk specific gravity when comparing assurance test results to field test results. The above procedure to develop assurance comparison values may be repeated at the discretion of the Contractor or the Department.

(4) Record and document all test results and calculations on data sheets approved by the Department. Record specific test results on a daily summary sheet approved by the Department to facilitate the computation of moving test averages. Base moving averages on four consecutive test results. Include a description of quality control actions taken (adjustment of cold feed percentages, changes in Job Mix Formulas (JMFs), etc.) in the Daily Quality Control Summary Sheet. In addition, post and keep current quality control charts showing both individual test results and moving average values. As a minimum, plot the single test values and the four test moving average values, as applicable, on Department approved control charts for the mix characteristics shown in **TABLE 7** of this Special Provision along with the following properties:

(a) Maximum specific gravity (Rice Test) to third decimal point.

(b) Gradation and binder content for the RAP used in SR type mixtures. Include a determination of the mixture moisture correction factor in the testing.

(c) Percent of theoretical maximum density of the compacted pavement determined from cores or nuclear density tests.

(5) Plot individual test results in black for each test point. Connect those points with a solid black line. Plot the moving average for each test variable in red, starting with the fourth test. Connect those points with a dashed red line. Plot the Department's verification test results with green asterisks.

(6) Indicate job mix formula and specification working range limits as listed in Table 7 for single test results on the control charts using a green ink dotted line and the four point moving average results with a green ink solid line.

3.0 MATERIALS REQUIREMENTS.

a. Bituminous Material. Furnish bituminous materials that comply with the requirements of Section 1200 of the Standard Specifications.

b. Reclaimed Asphaltic Pavement (RAP). The Contractor may choose to use RAP in the plant mixed bituminous mixture only when such option is permitted by Contract Special Provisions. If the Contractor chooses to use RAP in the mixture, then the use of RAP will be subject to the limitations (i.e. source, percent in mix, etc.) contained in the appropriate Contract Special Provisions.

c. Aggregates. Aggregates will conform to the requirements of Subsection 1103 of the Standard Specifications, with the following exceptions and additions:

Page 741, Subsection 1103.02 (a)(1.2). Delete this subsection except the first paragraph and add the following:

(1.6) Use crushed steel slag produced by the mechanical crushing of electric furnace steel slag.

Page 743, Table 5. Add the following to this table:

CSSL	Crushed Steel Slag	Blend gradation with other aggregate in the mix

The quantity of crushed steel slag used in the mix shall not exceed 50% of the total aggregate mass.

Page 744, subsection 1103.02(b)(1). Add the following: Mix Designation SM-1B, SR-1B, SM-1T, SM-2A, SR-2A, SM-2AM, SR-2AM, SM-2C, and SR-2C.

Page 744, Subsection 1103.02 (b)(1.3). Delete this subsection and replace it with the following:

(1.3) Mix designation SM-1T may be composed of any combination of aggregate and mineral filler supplements meeting the applicable requirements in Table 5. However, the mix used on the traveled way must include a minimum of 40% primary aggregate based on total aggregate mass. When chat is used as the primary aggregate, a minimum of 50% and a maximum of 80% of the plus 4.75 mm mesh sieve material in the mixture shall be from the primary aggregate. When material other than chat is used as the primary aggregate, a minimum of 50% of the plus 4.75 mm mesh sieve material in the mixture shall be from the primary aggregate. Primary aggregate shall be chat, crushed sandstone, crushed gravel, crushed steel slag, and crushed porphyry (rhyolite, basalt, granite, and Iron Mountain Trap Rock are examples of crushed porphyry). Primary aggregate requirements do not apply to the mixture used on the shoulder.

Page 749, subsection 1103.02(c). Delete this subsection and replace it with the following:

(c) Contractor Trial Mix Design**.**

(1) At least five working days (seven working days for mixtures containing reclaimed asphaltic pavement (RAP) material) before the start of a bituminous mixture production, submit in writing a proposed JMF for each combination of aggregates to the District Materials Engineer for review and approval. For each JMF submitted, include test data to demonstrate that mixtures conforming to each proposed JMF will have properties as specified in Table 6 for the designated mix type. Submit the proposed JMF on forms approved by the Department. In addition, submit a cold 15 kilograms uncompacted sample (if the sample is transported while hot to the District lab and compacted in less than two hours, then, at the District Materials Engineer's discretion, the requirement to cool the sample may be waived) plus two Superpave Gyratory briquettes compacted at the optimum binder content using the specified maximum number of gyratory revolutions (N_{max}), for laboratory examination and evaluation. The optimum percentage of bituminous material is the percentage which yields the design intent air voids (4.0 percent) at N_{des} gyrations and meets the other requirements of the Specification.

(2) Submit the following test data for each blend and the proposed JMF for the Department's review and approval:

(2.1) The percentage (in units of one percent except the 75 µm sieve in units of one-tenth percent) of aggregate retained on each of the specified sieves for each aggregate to be incorporated into the mixture. Derive the gradation for the RAP from material after the residual binder has been removed.

(2.2) The proportion of each material (in percent of aggregate).

(2.3) The composite gradation based on (2.1) and (2.2) above.

(2.4) The composite gradation plotted on KDOT 0.45 power graph paper. (KDOT Form 712)

(2.5) For mixtures containing RAP:

(2.5.1) The binder content of the RAP from ignition oven analysis.

(2.5.2) The corrected binder content of the total recycled mixture from ignition oven analysis.

(2.6) The percentage (in units of one-tenth of one percent) of bituminous material to be added, based upon the total wet mass of the mixture.

(2.7) The percentage of flat and elongated particles in the coarse aggregate along with the coarse aggregate angularity and the uncompacted voids content of the fine aggregate.

(2.8) The tensile strength ratio of the mixture (Modified Lottman Test).

(2.9) The sand equivalent value for the combined virgin aggregates.

(2.10) A mix design with a minimum of four different binder contents (maximum of 0.5 percent between each point) with at least two points above, one at and one point below the optimum binder percentage that reports the following (see appropriate KT-Methods):

(2.10.1) A theoretical maximum specific gravity determination for each binder content.

(2.10.2) Individual and average bulk specific gravity test results for at least two specimens at each binder content.

(2.10.3) The percent of air voids in the mixture for each binder content when compacted to N_{ini}, N_{des} and N_{max} gyratory revolutions along with copies of the Gyratory graphs.

(2.10.4) The percent Voids in Mineral Aggregate (VMA) at each binder content. (Note: The Contractor is cautioned that plant produced material generally yields a mixture with less VMA than predicted by the design. In such case, the design VMA should be increased above the specified minimum accordingly.)

(2.10.5) The dust to effective binder content (D/B) ratio calculated to the nearest tenth of a percent at each binder content.

Pages 752 and 753, Table 6. Delete this table and replace it with the following:

TABLE 6
MIX DESIGN REQUIREMENT

Mix Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm	2.36 mm	1.18 mm	600 µm	300 µm	75 µm	Minimum VMA (%)
SM-1T			0	0-10	10 min.	53-68	68 min.	76 min.	81 min.	90-98	15.0
SM-1B		0	0-10	10 min.		61-72	74 min.	81 min.	84 min.	90-98	14.0
SR-1B		0	0-10	10 min.		61-72	74 min.	81 min.	84 min.	90-98	14.0
SM-2A		0	0-10	10 min.		42-61	68 max.	77 max.	84 max.	90-98	14.0
SR-2A		0	0-10	10 min.		42-61	68 max.	77 max.	84 max.	90-98	14.0
SM-2AM		0	0-10	10 min.		42-61	68 max.	80 max.	88 max.	90-98	13.0
SR-2AM		0	0-10	10 min.		42-61	68 max.	80 max.	88 max.	90-98	13.0
SM-2C	0	0-10	10 min.			65-77	78 min.	83 min.	86 min.	92-98	13.0
SR-2C	0	0-10	10 min.			65-77	78 min.	83 min.	86 min.	92-98	13.0

1. The requirements for coarse aggregate angularity; uncompacted voids content of fine aggregates; sand equivalent; Superpave gyratory compaction revolutions N_{ini}, N_{des}, N_{max}; and void filled with asphalt will be as shown in the contract special provisions for each mix designation.
2. The flat or elongated particles in the coarse aggregate shall not exceed 10 percent.
3. The maximum percent moisture in the final mixture shall not exceed 0.5 for any mix designation.
4. The dust to binder ratio (D/B) shall be within the range of 0.6 to 1.2 for any mix designation.
5. The target air voids for any mix designation shall be 4.0 % at N_{des} gyrations.
6. The minimum tensile strength ratio shall be 80 % for any mix designation.

7. The level of compaction of the mix when compacted to N_{ini} gyrations shall be less than 89 percent of the maximum specific gravity and when compacted to N_{max} gyrations shall be less than 98 percent of the maximum specific gravity.

4.0 CONSTRUCTION REQUIREMENTS.

Construction requirements will conform to the requirements of Section 603 of the Standard Specifications, with the following exceptions and additions:

Page 306, subsection 603.03(e)(1). Add the following paragraphs to the beginning of this subsection:

Except when placing bituminous mixture SM-1T, the material transferred from the hauling unit shall be remixed prior to placement. The Contractor shall use equipment such as mobile conveyor, material transfer device, shuttle buggy, material transfer vehicle, material transfer paver, or paver with remixer conveyor system. After starting the project with the equipment listed above, and after producing bituminous pavement density within the limits specified in subsection 603.03(e)(2), the Engineer will consider other types of equipment or modifications to pavers that will produce less segregation. The use of equipment as noted above will not relieve the Contractor of his responsibility to comply with subsection 603.03(e)(2) of the 1990 Standard Specifications. The Engineer will check the pavement for longitudinal streaks and other irregularities. The Contractor shall make every effort to prevent or correct any irregularities in the pavement, such as changing pavers or using different and additional equipment.

The wings of the paver receiving hopper shall not be raised (dumped) at any time during the paving operation. The Engineer may waive this requirement if he has determined that raising (dumping) the wings will not produce detrimental segregation. If segregation, or irregularities in the pavement surface or density are noted, the Contractor shall review the plant, hauling, and paving operations and take corrective action. The recommendations made in KDOT's "Segregation Check Points" should reduce the segregation and irregularities to an acceptable level. Copies of KDOT's "Segregation Check Points" may be obtained from the Bureau of Construction and Maintenance.

Page 306, subsection 603.03(e)(2). Add the following paragraphs to this subsection:

Segregation and uniformity of density will be checked by the Engineer using methods outlined in KDOT's "Segregation Check Using the Nuclear Density Gauge". Copies of KDOT's "Segregation Check Using the Nuclear Density Gauge" may be obtained from the Bureau of Construction and Maintenance. The acceptable criteria for density uniformity is as follows:

Course	Maximum Density Range (highest - lowest)	Maximum Density Drop (average - lowest)
Surface & Base	80 kg/m^3	40 kg/m^3

Whenever the results from two consecutive density profiles fail to meet both of the requirements listed above, plant production and paving will be suspended. The Contractor shall follow the procedures listed in the Profile Evaluation section of KDOT's "Segregation Check Using the Nuclear Density Gauge" until normal production may be resumed.

Page 307, subsection 603.03(e)(7) Compaction of Mixtures. Delete the fourth paragraph which reads: "The specified percentage of field molded density shall be the absolute minimum density permitted."

Page 308, subsection 603.03(e)(8), Density requirements. Delete this subsection and replace it with the following:

603.03 (e)(8) Density Requirement

(8.1) The lot density requirements and appropriate pay factor adjustments are shown in Table 8 as the percent of the maximum specific gravity value based on the average of the density tests, along with the lowest average of any sublot. The standard lot size is 10 density tests. Smaller lot sizes may result as outlined in Table 8. Normally, the maximum specific gravity value used to calculate the density is the average value of all tests conducted the same day the lot was placed and compacted. This value will be used for all density sublots placed that same day. If less than three maximum specific gravity values were obtained that day, then use the moving average value (last four tests prior to the end of the day).

The maximum density must be achieved before the temperature of the bituminous mixture falls below 80 °C. Excess crushing of the aggregate will not be allowed. Roller marks may be removed from the mat with a self-propelled static steel roller when the mat temperature falls below 80 °C.

Page 318, subsection 603.05. Delete this subsection and replace it with the following:
603.05 COMPACTION TESTING.

(a) For normal daily production rates (1000 tons or greater), make the density determination of the compacted mixture using test results on samples selected by the Contractor or Engineer (see subsection **2.0 d.** (1) of this Special Provision) from each lift placed.

For shoulders less than or equal to 1.8 m wide and containing rumble strips, the density pay factors will not apply for the top lift. Density will be controlled using an approved rolling procedure.

A lot consists of a day's production for each lift placed and contains five approximately equal sublots. Take samples at randomly selected sites within a sublot. Lot acceptance will be based on two test results from each of the five sublots. Select sites in accordance with the approved quality control plan. Take the nuclear density tests or core samples before placement of the next lift and before opening to construction or public traffic, and no later than the next working day following the date of placement. If one day's production from any lift is less than 500 tons, combine it with the next day's production of that lift to form a lot. If the lift is completed that day or if it will be longer than one week before additional material is placed on that lift, the Engineer and Contractor may mutually agree to end the lot and determine the pay factors based on subsection **603.05(b)** for low production rates. (Air voids lots and density lots are normally of different sizes.)

If the lane being placed will be opened to traffic that day, the Engineer and the Contractor may predetermine the sublot size based on anticipated production. If actual production does not meet anticipated production, the sublot size will be adjusted. A total of ten density tests, five sublots, must be obtained each day unless less than 1,000 tons are produced that day (see (b) below).

(b) For low daily production rates (less than 1,000 tons), make the density determination of the compacted mixture using test results on samples selected by the Contractor or the Engineer (see subsection **2.0 d.** (1) of this Special Provision) from each lift placed.

For shoulders less than or equal to 1.8 m wide and containing rumble strips, the density pay factors will not apply for the top lift. Density will be controlled using an approved rolling procedure.

The minimum number of density tests are as listed in the following table. The Contractor has the option to take additional tests to provide ten test results to determine payment. The pay factors for specified density are listed in **TABLE 8** of this Special Provision.

Daily Production (tons)	No. of Cores or Nuclear Density Tests	No. of Verification Cores or Nuclear Density Tests
0-599	4	2
600-999	6	3
1000 or more	10	5

(c) Nuclear Density Tests

Take two nuclear density tests at random within each sublot. One random nuclear density verification test per sublot will be taken by the Engineer. Perform nuclear density testing to be used in the determination of pay adjustment factors. Do not take nuclear meter readings within 0.3 meters of a longitudinal joint or edge, nor within six meters of a transverse joint. Mark the outline of the nuclear meter on the pavement at each location tested with a method of marking that will last a minimum of 24 hours. If the Contractor doubts the accuracy of any of the nuclear test results he may choose to core the pavement at the nuclear meter test locations. If the Contractor chooses to core the pavement to determine the density for pay adjustment purposes then all nuclear density test results representing the lot will be voided and cores will be taken as prescribed in subsection **603.05(d)** below.

Verification nuclear density tests will be taken at random locations selected by the Engineer. Payment factors will be based on the Contractor's nuclear density test results provided the Contractor's test results are verified by the Department's nuclear density tests.

Note: KDOT will determine a calibration factor for the Contractor's nuclear density device at the same time as a calibration factor is determined for the Department's device.

(d) Cores

Take two cores at random within each sublot. The Contractor may be required to chill the compacted mixture before coring samples so that the samples may be removed intact without distortion. Cut the samples using a 100 millimeter coring device. Mark all samples with the lot number, sublot number, and core number. Transport the cores to the laboratory as soon as possible to prevent damage due to improper handling or exposure to heat. The Contractor is required to cut all cores including the Engineer's verification cores. The Contractor will be paid only for cores cut to calibrate the nuclear meter when requested by the Engineer. Use Kansas Test Method KT-15 Procedure III to determine core density.

Do not take cores within 0.3 meters of a longitudinal joint or edge nor within six meters of a transverse joint.

Take one verification core per sublot at locations selected by the Engineer for testing at the Department's laboratory. Payment factors are based on the Contractor's core results provided the Contractor's test results are verified by the verification cores sent to the Department's laboratory.

Dry the core holes, tack the sides and bottom, fill them with the same type of material, and properly compact it by the next working day.

Page 312, subsection 603.04. Delete this subsection and replace it with the following:
603.O4 PROCESS CONTROL.

(a) Requirements for All Mix Designations.

(1) General.

Establish gradation limits and proportions for each individual aggregate, mineral filler and RAP when applicable. Specify the limits and proportions such that the material produced will meet the applicable requirements of the designated mix type as specified in this special provision. The Contractor is responsible for all process control operations including testing. At no time will the Department's representative issue instructions to the Contractor or producer as to setting of dials, gauges, scales and meters. The Department will collect and test verification samples and assurance samples and inspect the Contractors quality control operations.

(2) JMF Adjustments.

Produce a mixture of uniform composition closely conforming to the approved Design JMF to assure that the mixture, when compacted, will achieve the specified properties. If, during production, the Contractor determines from results of quality control tests that adjustments are necessary to the mix design to achieve the specified properties, adjustments to the design JMF single point gradation and binder content values may be made. The JMF adjustments must produce a mix that complies with the requirements of **Table 6** of this Special Provision for the specified mix designation. It is intended that such adjustments be made on a sublot basis when needed. Report the new JMF to the Department's field representative and the District Materials Engineer before making such changes.

(3) Specification Working Ranges.

Establish acceptable limits for field test results by applying the tolerances shown in **Table 7** of this Special Provision to the JMF or adjusted JMF for binder content. Establish acceptable limits for the other listed mix characteristics by applying the tolerances shown in **TABLE 7** of this Special Provision to the specification requirements of **TABLE 6** of this Special Provision.

TABLE 7
SPECIFICATION WORKING RANGES (QC/QA)

Mix Characteristic	**Tolerance from JMF**	
	Single Test Value	**4 Point Moving Average Value**
Binder Content:	±0.6%	±0.3%
	Tolerance from Specification Limits	
	Single Test Value	**4 Point Moving Average Value**
Gradation (all applicable sieves shown in **TABLE 6**):	NA	zero tolerance
Air Voids @ N_{des} gyrations:	±2.0%	NA
Voids in Mineral Aggregate:	1.0% below min.	zero tolerance
Voids Filled with Asphalt:	NA	zero tolerance
Course Aggregate Angularity:	zero tolerance	NA
Sand Equivalent:	zero tolerance	NA
Fine Aggregate Uncompacted Voids:	zero tolerance	NA
Tensile Strength Ratio:	zero tolerance	NA
Density at N_{ini} and $N_{max:}$	NA	zero tolerance
Dust/Binder Ratio:	NA	zero tolerance

5.0 MIXTURE ACCEPTANCE.

a. General. Test each mix designation at each plant for compliance with all requirements listed in **TABLE 6** of this Special Provision. Acceptance will be made on a lot to lot basis contingent upon satisfactory test results. Obtain test samples of the mix designation from the roadway behind the paving operation before compaction. The sampling device and procedures used to obtain the samples must be approved by the Engineer. Use Kansas Test Method KT-25 for obtaining bituminous mixture from the roadway. The Contractors quality control tests will be used for acceptance in accordance with this special provision. However, any load or loads of mixture which, in the opinion of the Engineer, are unacceptable for reasons such as being segregated, aggregate being improperly coated, foaming aggregate, or being in excess of the maximum mixing temperature may be rejected. (Verification samples will be taken by the Engineer at randomly selected locations from behind the paver.)

The air voids test values will also be used to determine pay adjustments to the Contract bid price in accordance with subsection **6.0 c.** of this Special Provision.

b. Lot Definition for Mix Production Sampling and Testing. A lot is defined as an isolated quantity of a specified material produced from a single source or operation. Each lot will normally be represented by four contiguous test results. A lot may be represented by test results on samples taken from one or more days production.

c. Lot Investigation. The Engineer may examine materials represented by individual test results which lie beyond the Contractor's normal quality control testing variation. The investigation may be based on either Contractor's test results or the Department's test results. The information

from additional testing (including testing of in place bituminous mix) may be used to define unacceptable work in accordance with subsection 106.08 of the Standard Specifications and apply appropriate price reductions or initiate corrective action as determined by the Engineer.

For any test, if a dispute exists between the Engineer and the Contractor about the validity of the others test results, the KDOT Materials and Research Center (MRC) will perform referee testing, except for nuclear density dispute resolution. If the disputed Department test result was generated at the MRC, then an independent laboratory agreeable to both parties will be selected. The Laboratory must be accredited by the AASHTO Accreditation Program in the appropriate testing category. If referee testing indicates that the Department's test results are correct then the Contractor pays for the additional testing, including referee testing performed at the MRC. If the referee testing indicates that the Contractor's test results are correct then the Department pays for the additional testing.

For nuclear density dispute resolution (the statistical comparison fails and the Contractor questions the Department's results), the following procedure will be followed:

- Pay factors previously established with the nuclear meter will be discarded and the core results will be used to establish the pay factors.
- The Contractor, with the Engineer present, will take one core from each of the locations previously tested with the Contractor's nuclear meter and the Department's nuclear meter (normally 15 cores).
- The cores will be taken to the field laboratory and dried to a constant mass before testing. The Contractor and the Engineer, working together, will determine the core densities (Kansas Test Method KT-15, Procedure III).
- A statistical comparison will be made between the Contractor's core results and the Department's core results. If the "t" test passes, the Department will pay for all cores. The Contractor's test results will be used to calculate the pay factors. If the "t" test fails, the Department will not pay for the cores. The Department's test results will be used to calculate the pay factors.

When a deficiency within a lot is determined to exist, the Engineer shall decide on the disposition of each lot as to the acceptance, the rejection, or the acceptance at an adjusted payment. The Engineer's decision will be final. (It is not intended that this clause be applied to materials accepted at reduced payment for air voids and in-place density under the terms of this special provision.)

d. Resampling of Lots. It is the intent of these specifications that lots of materials, products, items of construction, or completed construction will meet the specification requirements at the time of sampling. No samples for re-test will be taken for pay adjustment purposes except as noted in subsection **5.0 c.** of this Special Provision.

e. Multiple Projects. If multiple projects are supplied from one or more plants, the lots at each hot mix plant will carry over from project to project.

f. Lot Size. A standard size mix production lot (density test lots are defined previously in this special provision) consists of four equal sublots of 750 tons each of bituminous mix (lot size 3,000 tons).

It is anticipated that lot size will be as specified. However, the Contractor may, with concurrence of the Engineer, re-define lot size for reasons such as, but not limited to, change in Contract quantities or interruption of the work. Take one sample during production of each sublot and utilize it to determine disposition of the lot in which it occurs.

g. Increased Lot Size. After eight consecutive sublots have been produced within the tolerances shown for all mix characteristics listed in **TABLE 7** of this Special Provision and without an air voids penalty, the sublot size may be increased by the Contractor to 1,000 tons (lot size 4,000 tons), provided the normal production rate of the plant is greater than 250 tons per hour. Immediate notification of lot size changes must be provided to the Engineer.

If subsequent test results fall outside the tolerances shown for any mix characteristics listed in **TABLE 7** of this Special Provision or an air voids penalty is incurred the sublot size will be decreased to 750 tons. When the Increased lot Size criteria is again met, the sublot size may be increased to 1,000 tons (4,000 ton lot).

h. Pre-Production Sample. A pre-production sample from each plant will be tested by the Contractor before delivery of bituminous mixture from that plant to the project or projects, both at initial start-up and after suspension of production resulting from failing test results. Pre-production sample test results will not be used in determining adjusted payment for a lot. Pre-production sample test results must be in compliance with the gradation, dust to binder ratio, binder content, level of compaction for N_{ini}, N_{des}, N_{max} and laboratory air voids requirements before delivery of hot mix to a project will be permitted. Except for initial start-up, normal delivery of material to the project before completion of certain test results on pre-production samples may be authorized by the District Materials Engineer.

The material produced for a pre-production sample may be placed on side roads, entrances and shoulders prior to completion of appropriate test result if specifically approved by the District Materials Engineer. Placement of material for a pre-production sample on the mainline may be permitted by the District Materials Engineer but will be limited to a maximum of 200 tons before completion of the appropriate tests.

i. Suspension of Mix Production. Suspend production of the mix until appropriate corrections have been made, if two consecutive test results for any single mix characteristic fails to fall within the limits established by the tolerances shown in the single test value column of **TABLE 7** of this Special Provision. Additionally, suspend production of the mix until appropriate corrections have been made, if any four point moving average value for any single mix characteristic fails to fall within the limits established by the tolerances shown in the four point moving average value column of **TABLE 7** of this Special Provision. Production remains suspended pending the satisfactory results of a pre-production sample, unless waived by the District Materials Engineer.

The Engineer may cause production of bituminous mix to cease at any time the mix or process is determined to be unsatisfactory. The Contractor must make the necessary corrections

before production will be allowed to resume. Failure to cease operations for the conditions cited above will subject all subsequent material to rejection by the Engineer or acceptance at a reduced price as determined by the Engineer.

j. Non-Conforming Materials. Establish and maintain an effective and positive system for controlling non-conforming material, including procedures for its identification, isolation and disposition. Reclaim or rework non-conforming materials in accordance with procedures acceptable to the Engineer.

Positively identify all non-conforming materials and products to prevent use, shipment, and intermingling with conforming materials and products. Provide holding areas, mutually agreeable to the Engineer and the Contractor.

6.0 BASIS OF ACCEPTANCE.

a. General. Acceptance of the mixture will be on the basis of Contractor quality control test results on consecutive random samples. If the Department's verification test results do not show favorable comparison with the Contractors quality control test results then the Department's test results will be used for material acceptance, material rejection and/or the determination of any pay adjustment on the air voids and roadway density. Disputed test results will be handled in accordance with subsection **5.0 c.** of this Special Provision.

KDOT will use a spreadsheet program to calculate pay density and air voids, and to compare the Contractor's QC and KDOT's QA test results. KDOT will provide a copy of this program to the Contractor if he requests one. MICROSOFT EXCEL software is required to run this program; it is the Contractor's responsibility to obtain the correct software.

b. Compaction Payment. Payment adjustment for compaction of the completed pavement will be by lot based on the percentage of maximum specific gravity obtained. Pay adjustment (incentive or disincentive) will be computed by multiplying the density pay adjustment factor (P_D) times the number of tons included in the lot times the bid price per ton. (Air voids lots and density lots are normally of different sizes.)

Payment factors will be determined from **TABLE 8** of this Special Provision (for **TABLE 8**, average the percent of maximum specific gravity values to 0.1% and calculate pay factors A and B to 0.001).

TABLE 8
PAY FACTORS FOR SPECIFIED DENSITY

% of Maximum Specific Gravity Average of 10 Density Tests[a]	**Pay Factor A[b]**		
	Mixes SM-2A, SR-2A, SM-2AM, SR-2AM SM-2C, & SR-2C	**Mix SM-1T**	**Mixes SM-1B & SR-1B**
94.0% or greater			1.020
93.0% or greater	1.020	1.020	
93.0% to 93.9%			A4
92.0% to 92.9%	A1	A1	1.000
91.0% to 91.9%	1.000	1.000	
90.0% to 90.9%		1.000	
88.0% to 91.9%			A5
87.0% to 90.9%	A2		
86.0% to 89.9%		A3	
less than 88.0%			[c]
less than 87.0%	[c]		
less than 86.0%		[c]	
Lowest Average of Any Sublot Within the Lot	**Pay Factor B[b]**		
	Mixes SM-2A, SR-2A, SM-2AM, SR-2AM SM-2C, & SR-2C	**Mix SM-1T**	**Mixes SM-1B & SR-1B**
92.0% or greater			1.020
91.0% or greater	1.020	1.020	
91.0% to 91.9%			B4
90.0% to 90.9%	B1	B1	1.000
89.0% to 89.9%	1.000	1.000	
88.0% to 88.9%		1.000	
86.0% to 89.9%			B5
85.0% to 88.9%	B2		
84.0% to 87.9%		B3	
less than 86.0%			[c]
less than 85.0%	[c]		
less than 84.0%		[c]	

[a] For low daily production rates less than 1000 tons or when the Engineer's verification tests are to be used for density pay determination, the lot sample size is as determined under subsection 603.05(b) for compaction testing.

[b] For shoulders less than 1.8 m wide and containing rumble strips, the density pay factors will not apply for the top lift. Density will be controlled by using an approved rolling procedure.

[c] The Engineer will determine whether the material may remain in place. The pay factor for such material remaining in place is 0.700 for Pay Factor A and 0.800 for Pay Factor B.

Calculations for Pay Factors A1, A2, A3, A4, A5, B1, B2, B3, B4, and B5:

A1 = [100 + 2 (% of lot maximum specific gravity - 92.0)] ÷ 100

A2 = [90 + 2.5 (% of lot maximum specific gravity - 87.0)] ÷ 100

A3 = [90 + 2.5 (% of lot maximum specific gravity - 86.0)] ÷ 100

A4 = [100 + 2 (% of lot maximum specific gravity-93.0)] ÷ 100

A5 = [90 + 2.5 (% of lot maximum specific gravity-88.0)] ÷ 100

B1 = [100 + 2 (% of sublot maximum specific gravity - 90.0)] ÷ 100

B2 = [90 + 2.5 (% of sublot maximum specific gravity - 85.0)] ÷ 100

B3 = [90 + 2.5 (% of sublot maximum specific gravity - 84.0)] ÷ 100

B4 = [100 + 2 (% of sublot maximum specific gravity - 91.0)] ÷ 100

B5 = [90 + 2.5 (% of sublot maximum specific gravity - 86.0)] ÷ 100

Pay Factor Calculation:

Density Pay Adjustment Factor (P_D)* = [(Pay Factor A) (Pay Factor B)] - 1.000

*(P_D will be rounded to the nearest 0.001)

c. Air Void Payment. Payment adjustment for air voids will be computed by multiplying the air voids pay adjustment factor (P_V) times the number of tons included in the lot times the bid price per ton. Calculate P_v to 0.001.

A lot will normally be comprised of the results of four contiguous individual air void tests performed on Superpave gyratory compacted samples of a given mix design. Lot size is defined in subsections **5.0 f.** and **5.0 g.** of this Special Provision. (Air voids lots and density lots are normally of different sizes.)

The absolute value of the deviation from target at N_{des} for each individual air voids test in a lot will be computed as shown:

$$\text{Deviation from target} = \left| 4.0 - \text{test value} \right|$$

The average deviation (D) from target will be computed as follows:

D = Sum of deviations from target ÷ number of tests in lot

The average air voids deviation (D) will be used to select the air voids pay factor from the appropriate table (**TABLE 9a,b,c or d**). Calculate D to 0.01.

TABLE 9a
PAY FACTOR TABLE FOR AIR VOIDS (LOT SIZE OF FOUR TESTS)

Air Voids Average Deviation	Pay Factor
$0.00 \leq D_4 \leq 0.35$	1.030
$0.36 \leq D_4 \leq 0.55$	1.000 + 0.15 (0.55 - D)
$0.56 \leq D_4 \leq 1.05$	1.000
$1.06 \leq D_4 \leq 1.40$	1.000 - 0.44 (D - 1.05)
$1.41 \leq D_4$	**(a)**

When the testing rate does not provide a complete four test lot (e.g. at the end of a production run) the following applies: Combine the three tests into a lot and use the following table for D_3. When there are one or two tests remaining, combine them with the previous four tests to create a five or six test lot respectively. Pay factors for D_5 and D_6 are also shown below.

TABLE 9b
PAY FACTOR TABLE FOR AIR VOIDS (LOT SIZE OF THREE TESTS)

Air Voids Average Deviation	Pay Factor
$0.00 \leq D_3 \leq 0.37$	1.030
$0.38 \leq D_3 \leq 0.58$	1.000 + 0.14 (0.58 - D)
$0.59 \leq D_3 \leq 1.11$	1.000
$1.12 \leq D_3 \leq 1.48$	1.000 - 0.35 (D - 1.11)
$1.49 \leq D_3$	**(a)**

TABLE 9c
PAY FACTOR TABLE FOR AIR VOIDS (LOT SIZE OF FIVE TESTS)

Air Voids Average Deviation	Pay Factor
$0.00 \leq D_5 \leq 0.29$	1.030
$0.30 \leq D_5 \leq 0.53$	1.000 + 0.125 (0.53 - D)
$0.54 \leq D_5 \leq 1.01$	1.000
$1.02 \leq D_5 \leq 1.35$	1.000 - 0.41 (D - 1.01)
$1.36 \leq D_5$	**(a)**

TABLE 9d
PAY FACTOR TABLE FOR AIR VOIDS (LOT SIZE OF SIX TESTS)

Air Voids Average Deviation	Pay Factor
$0.00 \leq D_6 \leq 0.28$	1.030
$0.29 \leq D_6 \leq 0.51$	1.000 + 0.13 (0.51 - D)
$0.52 \leq D_6 \leq 0.98$	1.000
$0.99 \leq D_6 \leq 1.31$	1.000 - 0.39 (D - 0.98)
$1.32 \leq D_6$	**(a)**

Note: **(a)** The Engineer will determine whether the material may remain in place. The pay factor for such material remaining in place is 0.800.

Pay Factor Calculation:

Air Voids Pay Adjustment Factor (P_V) = Pay Factor - 1.000

7.0 MEASUREMENT AND PAYMENT.

Measurement and Payment will conform to the requirements of Section 603 of the Standard Specifications, with the following exceptions and additions:

Page 319, subsection 603.08(a). Delete the first sentence and replace it with the following:

(a) Bituminous Surface and Bituminous Base shall be measured by the ton of material at the time of delivery to the road and no deduction will be made for the weight of bituminous material in the mixture.

PAGE 320, 603.08(b)(c)(d). Delete these subsection and replace with the following:

(b) When the Contractor is required to remove any base course, subgrade or existing surface course and provisions are not made in the Plans or Contract, the material used for repair and

patching will be measured separately, by the ton at the time of delivery to the road. No deduction will be made for the asphalt cement in the mixture, and the material will be paid as provided in subsection 603.09(b).

(c) Bituminous materials will be measured by the ton as provided in Division 100. For mixes containing Reclaimed Asphaltic Pavement (RAP), compute the bituminous material contained in the RAP using the binder content determined from ignition oven testing. Maintain this information for materials tracking purposes. No separate payment for bituminous material in RAP will be made.

(d) Each set of cores required by the Engineer to calibrate the nuclear density meters will be measured per each set for payment. Three cores constitutes a set. No payment will be made for cores deemed unsuitable for calibrating the nuclear density meters. No payment will be made for cores taken at the Contractor's option to determine density.

Each core taken for nuclear density dispute resolution (see subsection **5.0 c.** of this Special Provision) will be measured as one-half of a set for payment if the Contractor's test results are used for payment. No payment will be made for nuclear density dispute resolution cores if the Department's test results are used for payment.

PAGE 320, 603.08. Add the following as a new paragraph to this subsection.

(g) Quality control testing (Bituminous) performed by the Contractor will be measured on a per ton basis of Bituminous Surface and Bituminous Base placed on the project.

PAGE 320, 603.09 (a)(b)(f). Delete paragraphs and add the following:

(a) The amount of completed work measured as provided above will be paid for at the Contract unit price per cubic meter for "Water". The various types and grades of bituminous material used for tack coats will be paid for at the Contract unit price per ton. The bituminous material added to the mixture will not be paid for separately but shall be included in the bid price for "Bituminous Base" and "Bituminous Surface". "Bituminous Base" and "Bituminous Surface" will be paid for at the Contract unit price per ton. The pay adjustments if any, resulting from both the air voids pay factor and the density pay factor will both be applied and payment adjusted accordingly. The adjusted payment will be full compensation for furnishing all materials, for all labor, equipment, tools, supplies and incidentals necessary to complete the work.

(b) "Material for Bituminous Patching" used in repair and patching of the base and/or subgrade, including the existing surface course is the "Plant Mix Bituminous Mixture - Commercial Grade" as provided in subsection 605.02 of the Standard Specifications; except, the Contractor has the option to use the "Bituminous Base" if such items are included in the Contract. Otherwise, the Contractor has the option to use "Bituminous Surface". The amount of completed and accepted work measured as provided in subsection 603.08(b) will be paid for at the Contract unit price set for "Material for Bituminous Patching", which price will be full compensation for all excavation, compaction of subgrade or subbase if required, disposal of waste material and for furnishing all material (including asphalt cement and asphalt for tack), for all labor, equipment, tools, supplies and incidentals necessary to complete the work. No payment will be made for the amount of material used in the repair of damage due to the Contractor's negligence.

(f) Sideroads, entrances and mailbox turnouts that are not shown on the Plans or listed in the Contract that are to be surfaced shall be paid for at 1½ times the unit price for "Bituminous Surface" or "Bituminous Base".

(g) Contractor “Quality Control Testing (Bituminous)” will be paid for at the bid price per ton. No adjustment in the bid price will be made for overruns or underruns in the Contract quantity. The bid price will constitute payment for all necessary mix design testing, field process control testing, the testing laboratory and all necessary test equipment.

APPENDIX A
SAMPLING AND TESTING FREQUENCY CHART FOR BITUMINOUS CONSTRUCTION ITEMS FOR QUALITY CONTROL/QUALITY ASSURANCE PROJECTS

TEST	QUALITY CONTROL BY CONTRACTOR	VERIFICATION BY KDOT	INDEPENDENT ASSURANCE BY KDOT
Binder Sampling (KT-26)	One sample per 3 loads (note a)	One per project	
Binder Content (by ignition) (KT-57)	One per sublot	One per 3 lots (note g)	Witness and test split sample - one per year per certified technician.
Mix Gradation (after ignition) (KT-34)	One per sublot	One per 3 lots	Witness and test split sample - one per year per certified technician.
Theoretical Max. Sp. Gr. (KT-39) (note h)	One per sublot	One per lot	Witness and test split sample - one per year per certified technician.
Air Voids (SD/SF Manual)	One per sublot	One per lot (note g)	Witness and test split sample - one per year per certified technician. Compact split sample on KDOT gyratory; one per week or 15 000 tons
Binder Content in RAP (by ignition) (KT-57)	One per 1 000 tons	One per 20 000 tons (note g)	
RAP Gradation (after ignition) (KT-34)	One per 1 000 tons	One per project	
Moisture Damage to Mix (Modified Lottman) (KT-56)	One on first lot, then one per week or 10 000 tons	One per project	Witness - one per year per certified technician.
Sand Equivalent (KT-55)	One per lot (note b)	One per project	Witness and test split sample - one per year per certified technician.
Coarse Aggregate Angularity (KT-31)	One per 1 000 tons of individual aggregate (note c)	One per week or per 10 000 tons	Witness and test split sample - one per year per certified technician.

TEST	QUALITY CONTROL BY CONTRACTOR	VERIFICATION BY KDOT	INDEPENDENT ASSURANCE BY KDOT
Uncompacted Voids Content of Fine Aggregates (KT-50)	One on the first lot, then one per 10 000 tons of combined aggregates	One per project	Witness and test split sample - one per year per certified technician
Gradation of individual aggregate (KT-2)	One per 1 000 tons of each individual aggregate (note d)	One per project per individual aggregate	Witness and test split sample - one per year per certified technician
% Moisture in Mixture (KT-11)	One per lot	One per project (note e)	
% Moisture in Combined Virgin Aggregate (KT-11)	One per lot	One per project (note e)	
% Moisture in RAP (KT-11)	One per lot	One per project (note e)	
P I and Gradation of Mineral Filler (KT-10 & KT-2)	One per 250 tons	One per project	Witness and test split sample - one per year per certified technician.
Roadway Density Determination (KT-15 Procedure III) or (KT-32)	10 tests per lot (note f)	5 companion tests per lot (note f)	Witness and replicate test - one per year per certified technician.
Flat or Elongated Particles (KT-59)	One on first lot	One per project	Witness and test split sample - one per year per certified technician.

General note: All sampling and testing frequencies are minimum. Additional quality control, verification and assurance tests will be performed, when necessary, to provide effective control of the work. When any quality control test result fails to comply with the specification requirements then the next sublot of production after obtaining the failing test results will be sampled and tested, regardless of any lesser frequency specified in this table.

Note a: The Engineer will notify the Contractor when the sampling frequency may be reduced. Generally, the sampling frequency will be reduced to one sample per 6 loads and then per 12 loads if test results determined by the Department show satisfactory compliance of the material with the specifications. Specification compliance will be determined on a producer basis not on a project basis.

Note b: Determine the Sand Equivalent (SE) value on the combined virgin aggregates on the first lot of production and the frequency may be reduced to one test per week provided the SE value exceeds the minimum specified value by five percentage points. The frequency may be reduced to one test per two weeks provided the SE value exceeds the minimum specified value by twenty-five percentage points. When any test (including verification and assurance) shows the SE value

to be less that five percentage points above the specified minimum value then the testing frequency will revert to one per lot until two consecutive tests exceed the minimum specified value by five percentage points.

Note c: All aggregate types except siliceous gravels will be considered to have at least two crushed faces on 100 percent of the aggregate particles.

Note d: The aggregate producers tests may be used for quality control purposes if the tests were performed by an appropriately certified technician. In such cases, the Contractor shall perform testing as necessary to determine the degrading effects of hauling and stockpiling on the individual aggregates. If during the determination of individual aggregate gradation, soft or friable particles, shale or shale like materials or sticks are found then perform KT-9, KT-8 and KT-35 respectively at such frequencies as jointly deemed necessary by the Contractor and the District Materials Engineer.

Note e: Witness one KT-11 and KT-16 test procedure per certified technician per year, regardless of the type of material being tested.

Note f: For small lots (lots with less than 1,000 t), the number of tests may be reduced (see this special provision).

Note g: Provide access to Contractor owned forced air ignition furnace, oven, and Superpave Gyratory compactor for the State inspector to perform verification tests.

Note h: If more than one test is performed on the sample, use the average value.

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