

EXHIBIT C

1 - OVERLAND PARK SUPERPAVE ASPHALTIC CONCRETE SURFACE AND INTERMEDIATE COURSE

Revision Date:
12/21/15

1.1 DESCRIPTION

The **2007 Standard Specifications for State Road and Bridge Construction**, Sections 109, 601, 611 (Class A), 1201, 1202, and 1203 shall govern the asphaltic concrete work except as otherwise modified herein. All testing required by this specification including mix design and field verification of the mix shall be the responsibility of the Contractor. The mix design shall be modified or redesigned whenever a material source changes or a quarry starts producing from a different geological unit or a major change is made to the asphalt plant. This work shall be subsidiary to other bid items.

1.2 MATERIALS

a. Asphalt Cement

Asphalt cement shall conform to the requirements of AASHTO-MP 1a-04^{1,2} Performance Graded Asphalt Binder PG 64-22. The grade of the asphaltic binder shall not be changed without a laboratory remix design. It shall also comply with Sections 1201 and 1202. **Each shipment of asphalt to the asphalt plant shall have a bill of lading stating the asphalt cement meets the specifications referenced above. Copies of the bill of lading shall be submitted to the City Engineer.** Asphalt cement shall not be paid for directly but shall be considered a subsidiary bid item.

b. Anti-Stripping Agent

All bituminous mixtures shall contain an anti-stripping agent. AD-here[®] LOF 65-00 LS as - manufactured by ARR-MAZ Products, L.P. shall be added to the asphalt cement at the rate of 0.75% by weight of the total added asphalt cement. Other asphalt anti-stripping additives and their application rate may be used when proven equal after testing as specified in Paragraph “Resistance of Compacted Bituminous Mixture to Moisture Induced Damage AASHTO T 283-03” and approved by the City Engineer. Copies of the bill of lading shall be submitted to the City Engineer.

c. Aggregates General

The total aggregate (coarse aggregate, fine aggregate, and the material passing the No. 200 sieve) shall contain not less than 85 percent crushed material for intermediate course and surface course. Coarse aggregate shall be tested in accordance with KT-31. If the Sand Ratio for all aggregates is above 60.0% calculate the percentage of fine aggregate contributed to the total aggregate blend (Percentage Sand Fraction) by the fine fraction of the FRAP stockpiles. Note that individual FRAP sources may have Sand Ratios above 60.0%. Sand Ratio and Percentage Sand Fraction are defined as:

$$\text{SandRatio} = \frac{B - D}{C - D} \times 100$$

Where:

- B = % of Gradation passing the No. 30 Sieve
- C = % of Gradation passing the No. 8 Sieve
- D = % of Gradation passing the No. 200 Sieve

$$\text{Percentage SandFracti on} = (\%P8 - \%P100) \times \frac{\%FRAP}{100}$$

Where:

- %P8=Percent of gradation passing the No. 8 Sieve
- %P100 = Percent of gradation passing the No. 100 Sieve
- %FRAP = Percent of combined FRAP within the total aggregate blend

If the Percentage Sand Fraction plus the percentage of natural sand within the total aggregate blend is more than 25.0 percent, the Fine Aggregate Angularity (FAA) shall be determined in accordance

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with KT-50. The minimum FAA uncompacted void content shall be 45% for the fine aggregate fraction of the entire aggregate blend. This testing shall be conducted as a part of FRAP stockpile prequalification and original submission of the JMF. It will not be required with each lot of asphalt produced provided that the FRAP evaluation remains in specification as described below.

The job mix formula (JMF) shall be within the control points shown below. It shall be noted that when the gradation of extracted plant produced mix varies appreciably from JMF, the test properties of the mix will be out of specifications.

The contractor may use Fractionated Reclaimed Asphalt Pavement (FRAP) as an aggregate source. FRAP is defined as having two or more stockpiles, where Reclaimed Asphalt Pavement (RAP) is processed into coarse and fine fractions. The fine FRAP stockpile will contain only material passing the 1/4 inch screen. The coarse FRAP stockpile will contain milled material retained on the 1/4 inch screen and passing the 3/4 inch screen. The maximum combined FRAP is 35% of the total mix by weight. FRAP may be comprised of coarse or fine FRAP or a combination thereof. Utilize a separate cold feed bin for each stockpile of FRAP used. Do not blend coarse and fine FRAP either in the stockpile or in a cold feed bin. Add FRAP to the mix through the RAP collar. Sources and types FRAP must be recorded and submitted to the City Engineer upon request. Recycled Asphalt Shingles (RAS) or RAP that contains RAS is not allowed.

The FRAP used in production shall be similar in composition (extracted gradation and asphalt content) to the source used for design.

The contractor shall submit a complete mix design report annually to the City Engineer, prior to asphalt placement during that calendar year. This report shall contain the calculations as described in the following sections and shall contain material certifications for all materials used in the asphaltic concrete. All aggregate quality tests must have been run within 12 months of the submission date of a mix design or a volumetric test report.

The Contractor shall maintain Control Charts for the percent passing the median sieve, percent passing the No. 200 sieve, and asphalt binder content for each FRAP stockpile contained within the approved JMF. The Control Charts will use the average value of each of the three properties determined from the prequalification of the FRAP stockpile(s) as the target values.

The following table presents Action Limits and Suspension Limits for use with the Control Charts.

Action and Suspension Limits for FRAP Stockpiles		
Property	Action Limits	Suspension Limits
FRAP Asphalt Content	±1.0%	±1.4%
% Passing Median Sieve	±10.0%	±14.0%
% Passing No. 200 Sieve	±3.0%	±4.5%

Evaluation of the Control Charts shall occur with each mix test. Each FRAP stockpile within the JMF will be deemed out of specification, construction stopped and corrective action taken if:

1. One point falls outside the Suspension Limits for an individual measurement; or,
2. Two points in a row fall outside the Action Limits for individual measurements.

Corrective action may include, but is not limited to, remixing of the FRAP stockpile, utilizing a different FRAP stockpile, development of a new JMF, etc. Anytime that construction is stopped and corrective actions taken, FRAP stockpile(s) shall go through the prequalification program prior to further construction. New Control Charts shall be developed and evaluated as described above with the target values being the average from the prequalification process.

d. Aggregate for Asphaltic Concrete Surface Course

The exact gradation shall be determined by the contractor's laboratory.

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Sieve Size	Percent Passing 12.5 mm Nominal Size Control Points	
	19mm (3/4 inch)	_____
12.5 mm (1/2 inch)	90	100%
9.5 mm (3/8 inch)	80	95%
4.75 mm (No. 4)	_____	_____
2.36 mm (No. 8)	36	48%
1.18 mm (No. 16)	_____	_____
600 µm (No. 30)	_____	_____
300 µm (No. 50)	_____	_____
150 µm (No. 100)	_____	_____
75 µm (No. 200)	2	8%

Surface mixtures for streets designated thoroughfares by the city shall contain the following:

Fifteen percent of the minus No. 4 sieve material and 15 percent of the total aggregate shall be chat, crushed sandstone, crushed gravel, crushed steel slag, or crushed porphyry (rhyolite, basalt, granite, and Iron Mountain Trap Rock are examples of crushed porphyry).

e. Aggregate for Asphalt Concrete Intermediate or Leveling Course

The exact gradation shall be determined by the contractor’s laboratory.

Sieve Size	Percent Passing 12.5 mm Nominal Size Control Points	
	19 mm (3/4 inch)	_____
12.5 mm (1/2 inch)	85	100%
9.5 mm (3/8 inch)	75	90%
4.75 mm (No. 4)	_____	_____
2.36 mm (No. 8)	34	44%
1.18 mm (No. 16)	_____	_____
600 µm (No. 30)	_____	_____
300 µm (No. 50)	_____	_____
150 µm (No. 100)	_____	_____
75 µm (No. 200)	2	8%

1.3 CONSTRUCTION REQUIREMENTS

a. Superpave Asphaltic Concrete Mix Design Method

The finished mixture shall meet the requirements described below when prepared in accordance with AASHTO T 312-04 (using 6 inch nominal size molds) and the volumetric properties of compacted paving mixtures as calculated using Chapter 4 of Superpave Mix Design, Superpave Series No. 2 (SP-2), Third Edition 2001 Printing, Published by the Asphalt Institute referred hereafter as “SP-2”, unless otherwise specified. The procedure shall be as specified in Chapter 5 and 6 of the SP-2. The Theoretical Specific Gravity (Gmm) shall be determined following AASHTO T 209-99 (2004) and the Bulk Specific Gravity of the Compacted Asphalt Mixture (Gmb) shall be determined following AASHTO T166-00. The material for the theoretical specific gravity (Gmm) and the material for the Gyrotory Compactor specimens (pucks) shall be cured at 140+/-3° C (285+/-5° F) for four hours in a closed oven after the mix is produced in the laboratory. Also, the plant-produced mixture shall be tested when the mix is four hours old. The mixture shall be transported to the laboratory in an insulated container and then stored in a laboratory oven at 140 +/-3° C (285 +/-5° F) minimum temperature for the remainder of the curing period. The curing oven shall be the forced air type and may be operated at a temperature not to exceed

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the maximum temperature at which the mixture may be discharged from the plant as specified in paragraph “Mixing Plants”. This procedure shall be used when the water-absorption as determined by ASTM C 127-04 and ASTM C 128-04a of any individual aggregate stockpile in the aggregate blend exceeds 1.25 percent. The mixture shall be compacted at 140 +/-3° C (285 +/-5° F). The theoretical specific gravity (G_{mm}) shall be performed using the Type E-A 4500ml metal vacuum pycnometer with a clear polymethyl methacrylate PMMA lid. The vacuum shall be applied for 15 minutes to gradually reduce the residual pressure in the vacuum vessel to 28 mm Hg. The bulk specific gravity of the Fine Sand Chat shall be determined using the standard Cone Test for Surface Moisture as stated in ASTM C-128-04a unless otherwise directed by the City Engineer. The G_{se} of the FRAP material shall be used as aggregate G_{sb} in volumetric calculations provided that the asphaltic cement content of the FRAP fraction is determined through the use of AASHTO T-164 Standard Method of Test for Quantitative Extraction of Asphalt Binder from Hot-Mix Asphalt (HMA) (ASTM Designation: D 2172/D 2172M-11). **The AASHTO Specification shall be used when this specification references the AASHTO number.** The contractor shall furnish four uncompacted HMA samples, sized to the design weight for 1 gyratory plug, four 1200 gram samples of uncompacted HMA, and 2 gyratory plugs compacted to N_{design} when submitting the mix design for approval.

Superpave Design and Testing Properties
 Required Density (% of Theoretical
 Maximum Specific Gravity (G_{mm})
 Number of Gyration (Average of 2-6 inch specimens)

N _{initial} 6		85 - 91%
N _{design} 60	(Mix Design Only)	96%
Percent Air Voids, in compacted mixture 0% FRAP	Mix Design Only Field	4.0% 3.0-5.0%
Percent Air Voids, in compacted mixture 5-25% FRAP	Mix Design Only Field	3.7% 2.8-4.5%
Percent Air Voids, in compacted mixture 26-35% FRAP	Mix Design Only Field	3.4% 2.6-4.1%
VEA% ¹	(0% FRAP) (5-25% FRAP) (26-35% FRAP)	10.0% 10.3% 10.6%
The ratio of minus 75µm (No. 200) material to % effective asphalt control (P _{be}) based on the weight of the aggregate from the extraction test	Mix Design Field (0-25% FRAP) Field (26-35% FRAP)	0.6-1.2 0.6-1.6 0.5-1.5

¹VEA% = Volume of Effective Asphalt (%) which is the numerical difference between VMA and Air Voids.

When the aggregate absorption is high, the produced mixture will be tender until the asphalt is absorbed into the aggregate. Therefore, it may be beneficial to silo the mixture at the plant for a time before delivering to the project site. This is more important when the truck haul is short.

b. Resistance of Compacted Bituminous Mixture to Moisture Induced Damage

AASHTO T 283-03

The index of retained strength must be greater than 80 percent as determined by AASHTO T 283-03 (using a 4 inch nominal size mold). Specimens shall be conditioned by freezing and thawing. When

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the index of retained strength is less than 80 the amount of anti strip may have to be adjusted. No additional payment will be made to the Contractor for addition of anti-stripping agent required. The mix shall contain the anti-stripping agent specified in paragraph "Anti-Stripping Agent" and tested by AASHTO T 283.

(1) Method of determining the retained strength of plant-produced mixtures. Sample the plant produced mixture at the plant site in accordance with ASTM D 979 or behind the paver using the procedure specified herein. Transport the mixture to the laboratory and determine the theoretical specific gravity as specified in paragraph "Asphaltic Concrete Mix Design Method". Prepare the specimens for the AASHTO T 283 test using the same four-hour cured material and compact to 7 ± 0.5 percent air voids. Allow the samples to cool and cure overnight at room temperature and proceed with testing by determining the thickness and bulk specific gravity, then separating the specimens into subsets and preconditioning as specified herein. Then proceed with the testing as specified in AASHTO T 283.

(2) Test for AASHTO T 283

One set of tests for each mix design from each plant shall be made as the final verification of the plant produced mix design by the contractor's laboratory.

(a) One set of tests for each mix produced for Public Works Department Contracts shall be taken during the initial production each year and one set of tests for each 10,000 tons produced that year. Sampling frequency shall be adjusted when the Contractor has multiple contracts with the Public Works Department so that tests are taken every 10,000 tons of production. The City Engineer may take an additional test at his expense. Any test that fails will require the contractor to adjust the JMF and take additional test at the contractor's expense.

(b) One set of tests shall be made and approved by the City Engineer at contractor's expense when any of the material sources change or when requested by the City Engineer.

c. Asphalt Content Correction Constant

With each test for AASHTO T 283, the contractor shall also obtain 4 samples from each fraction to validate the Asphalt Content Correction Constant. Two samples will be tested using Ignition (ASTM ASTM D-6307-05), the remaining two samples will be tested using Extraction (AASHTO T-164). The difference between the average ignition content and extracted content will be compared to the prequalification constant. If the difference exceeds 0.4% that FRAP fraction must be requalified and a new constant determined. If the difference is less than 0.4% the correction constant derived during prequalification will continue to be used for volumetric calculations.

d. Contractor's Laboratory

Asphaltic Concrete Mix Design shall be the responsibility of the Contractor's Laboratory. The laboratory shall be a commercial testing laboratory meeting the requirements of ASTM D 3666-05a. The manager of the laboratory shall submit a signed certificate stating that the laboratory has a current certificate stating that the laboratory meets the ASTM D 3666-05a requirements. The laboratory shall have past experience in testing materials and making Superpave Asphaltic Concrete mix designs. The laboratory shall be approved by the City Engineer. The laboratory shall establish the mix design using the criteria specified herein. Certified test results of the mix design and materials shall be submitted 30 days prior to commencing construction for review by the City Engineer. The test results shall include all detailed raw calculations for the composition of the mix design and shall include all specific gravity calculations. The calculations must be legible but not necessarily typed.

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e. Verification of the Plant Produced Mix Design by the Contractor's Laboratory

(1) All test properties of the mix shall be verified by sampling and testing the uncompacted mix placed behind the paver. The test shall be performed in accordance with paragraph "Superpave Asphaltic Concrete Mix Design Method" and shall indicate the test properties of the mix shown in paragraph "Superpave Design and Testing Properties". Also, an extraction and gradation test shall be made using the ignition oven. The contractor's laboratory shall adjust the mix design entering the plant to obtain the test properties behind the paver.

(2) The properties of the plant produced mix shall be determined using uncompacted mix sampled behind the paver. The properties shall be determined at N_{design} from the average of two 6 inch nominal size samples.

(3) Material for the sample shall be from the following locations

One from each side of the placed bituminous mat and one from the center of the mat. A square, pointed shovel shall be used for taking the sample and for evenly laying material back into the disturbed mat. Care shall be taken not to get foreign material or tack oil into the sample.

(4) A test shall be taken at least daily, or as directed by the engineer when the plant has produced a minimum of 200 tons.

(a) The test shall also consist of one gradation test ASTM C-136-96a of hot bin material for conventional plants, or total aggregate material from the final feed belt for dryer-drum plants.

NOTE: The result of the gradation test is very important in determining how to adjust the mix. After the gradation or the bitumen content has been adjusted to obtain the properties of the mix, this verified mix design becomes the Job Mix Formula (JMF). The plant settings may have to be adjusted again whenever the gradation of the materials change. When a change is made it shall be reported on the Superpave Asphaltic Concrete Test Report form.

(b) Gradation and asphalt content of the mix shall be performed using ASTM D-6307-05 Standard Test Methods for Asphalt Content of Hot Mix Asphalt by the Ignition Method and ASTM D 5444-05. The initial temperature setting of the Ignition Oven shall not exceed 525° C (975° F). If FRAP is used, control tests as described above and an additional gradation and asphalt content test shall be performed for the combined FRAP sampled from the RAP cold feed into the plant.

(c) Laboratory test results shall be shown on the test report form "Superpave Asphaltic Concrete Test" shown at the end of this specification section. Test results shall be received by the contractor and the City Engineer field representatives within approximately 7 hours after the samples are taken. The laboratory shall determine the Percent Voids, VMA and VEA as soon as possible and evaluate in accordance with paragraph below: **"Corrective action to be taken when Asphaltic Concrete Test indicates the mix is out of specification." Whenever the Percent Voids or VEA is out of specification the laboratory shall contact the Contractor and the City Engineer immediately.** The Contractor's testing laboratory shall send the test results directly to the Contractor and the City immediately upon completion of the test. Signed checked copies may be sent later. The Contractor's laboratory shall furnish the City's laboratory other items such as the JMF mix gradation, plant setting, the bulk specific gravity of the aggregate G_{sb} and the specific gravity of the asphalt G_b . Laboratories shall compare final test results when the mix is out of specification. The test results shall indicate whether the plant needs adjusting and recommendations shall be provided on correcting the problem.

(d) The most recent Asphalt Concrete Test that indicates the mixture meets the specifications is the current mix design, except that a complete mix design shall be submitted at the beginning of each paving season or if the FRAP stockpile becomes out of specification.

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(5) Corrective action to be taken when Asphaltic Concrete Test indicates the mix is out of specification.

(a) Asphaltic Concrete Surface and Asphaltic Concrete Intermediate or Leveling Course

The mix should be adjusted when consecutive lot tests show the percent voids in the compacted mix are getting close to being the minimum or the maximum field values.

Paving shall stop and the mixture shall be redesigned whenever any of the following occurs: three consecutive sets of lot tests show the percent voids in the compacted mix are less than the minimum field value or more than the maximum field value; or two consecutive sets of lot tests show the percent voids in the compacted mix are less than 0.5 percent below the minimum field value or 0.5 percent greater than the maximum field value.

(b) Also paving shall stop and the mix shall be redesigned whenever three consecutive sets of lot tests show the VEA is more than 1.0% greater or 1.0% less than the VEA specified in paragraph **S-1.5**.

(c) Asphaltic Concrete mixtures with a test indicating the VEA is 2.0% above the value specified in paragraph **S-1.5** shall be removed unless directed otherwise by the City Engineer.

(6) Pre-Construction test strips

Test strips shall be constructed by the Contractor off city property at the contractor's expense. However, the City shall observe the sampling and testing. The contractor may negotiate the construction of a test strip on the project with the engineer. In that event, asphalt not meeting specification shall be removed at contractor's expense. Asphalt meeting specifications will be paid for at unit prices.

(a) The Contractor's laboratory shall test the final belt gradation if the plant is a dryer-drum plant or the hot bin material if the plant is a conventional plant, and adjust the feeds to insure the plant is producing the gradation of the mix design, before hot mix production begins for the tested strip.

(b) Test strips shall contain at least 85 tons of asphaltic concrete. A test sample shall be taken behind the paver at 80 tons. The paver shall be set 12 feet wide and at plan depth when the sample is taken. Care shall be taken not to get foreign material or tack oil into the sample.

(c) If the laboratory test results indicate the mix can be adjusted to meet the properties stated in paragraph "Superpave Design and Testing Properties", project paving may begin. However, this has to be agreed upon by the Contractor's laboratory, the Contractor, and the City Engineer. Otherwise, another test strip shall be constructed. Test strips will not be required on other projects which use this mix design. However, all materials have to be from the same sources and geological units. Also, the mix has to be produced by the same plant.

f. Verification testing of the plant produced asphaltic concrete by the city.

The City Engineer will take verification tests at random times, at the City's expense.

g. Mixing Plants

Mixing plants shall meet the requirements of KDOT's latest specification in effect when this project's bids are received by the City, except the mixture discharged from the plant shall not exceed 157.2°C (315°F).

h. RAP Stockpiles

RAP stockpiles shall be prequalified in accordance to the paragraph entitled "Aggregates General" and procedures described in "Recycled Asphalt Pavement Stockpile Use in Overland Park, Kansas, December 18, 2015", available from the office of the City Engineer. The report from this process shall be included in the mix design submittal. The City Engineer may verify the uniformity of the RAP stockpile at any time at the City's expense.

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i. Asphalt mixtures having temperatures less than 113°C (235°F), when dumped into the mechanical spreader will be rejected.

- (1) All bituminous mixtures shall be delivered to the paver at a temperature sufficient to allow the material to be placed and compacted to the specified density and surface tolerance.
- (2) All delivery trucks shall be totally covered with a water proof tarpaulin at the asphalt plant and shall not be uncovered until they are next in line to unload.

j. Placing

Asphaltic concrete intermediate and surface courses shall not be placed in compacted lifts greater than 3 inches deep except when otherwise indicated on maintenance project plans. Asphaltic concrete surface course shall not be placed thinner than 2 inches deep. Asphaltic concrete intermediate course used as surface shall not be placed thinner than 2 inches. Interim layers of intermediate course shall not be left uncovered by the subsequent course for more than 5 days, weather permitting. Material trucks hauling materials other than asphaltic concrete or tack coat shall not travel on previously constructed layers of asphaltic intermediate course until the final course of the intermediate is constructed.

- (1) The Contractor shall schedule and route his hauling operation to minimize hauling over a final course as much as feasible.

(2) Bituminous-Materials Spreaders

Bituminous-materials spreaders shall be the self-propelled type equipped with hoppers, tamping, or vibrating devices, distributing screws (augers), adjustable screeds operated either manually or automatically, equipment for heating the screeds and equalizing devices. The spreader shall be capable of spreading hot bituminous mixtures without leaving indented areas, tearing, shoving, or gouging and capable of confining edge of strips to true lines without use of stationary side forms and capable of placing the course to the required thickness. It shall also be capable of producing a finished surface conforming to the smoothness requirements specified. Spreaders shall be designed to operate forward at variable speeds and in reverse at traveling speeds of not less than 100 feet per minute. If an automatic grade control device is used on the spreader for two-lane paving operations, it shall consist of sensing device for control of one end of the screed and a slope-control mechanism for control of the other end of the screed, or a sensing device on each side of the paving machine. Where the paver is used on multiple paving lanes (more than two paving lanes), sensing devices shall be used on each side of the spreader for control of the screed. The slope-control mechanism shall not be used for grade control in multiple paving lane operations.

- (a) When the contractor chooses to pave lanes through the project wider than 12 ft. the spreader (paver) shall be equipped with auger extensions.

- (b) Through lanes shall be paved before left turn lanes and side street intersections. Through lane pavers shall not stop for other areas to be paved.

(3) Special Procedures to Prevent Segregation

The wings of the spreader hopper shall not be emptied (flipped) between truck loads. The depth of the material in the screed auger chamfer shall be kept approximately three-fourths (3/4) full - all the way out to the end gate. The augers should be running automatically and the vibrating screed turned on. The hopper conveyor shall always have approximately 6 inches of material covering it and not be allowed to run out of material. Whenever the paver is run empty (conveyor exposed) the area behind the paver should be checked for a segregated spot. If a spot exists the paver should be stopped and the segregated spot repaired before it is rolled.

(4) Joints General

Joints between old and new pavements or between successive day's work shall be cut back vertical with a saw. Other joints shall be sawed vertical as directed by the City Engineer. All joints shall be tacked and shall be made carefully to insure continuous bond between old and new sections of the course. All joints shall have the same texture, density, and smoothness as other sections of the course. The tack shall be overlapped onto the previous pavement 1 inch to 2 inches. Contact surfaces of previously constructed pavements, curbs, gutters, manholes, etc., shall be tacked. Surfaces that have become coated with dust, sand, or other objectionable material shall be cleaned by brushing or cut back with an approved power saw, as directed. The surface against which new material is to be placed shall be sprayed with a thin, uniform coat of bituminous material conforming to the requirements of paragraph

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TACK COAT stated hereinafter. The material shall be applied far enough in advance of placement of the fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

(a) Edges of previously placed pavement that have cooled and are irregular, honeycombed, poorly compacted, damaged, or otherwise defective unsatisfactory sections shall be cut back to expose a clean, sound surface for the full thickness of the course as directed by the City Engineer.

(b) Transverse Joints

The roller shall pass over the unprotected end of freshly placed mixture only when placing of the course is discontinued or when delivery of mixture is interrupted to the extent that unrolled material may become cold. In all cases, the edge of the previously placed course shall be cut back to expose an even, vertical surface the full thickness of the course. In continuing placement of the strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling which conforms to the required density and smoothness specified herein.

A string line shall be used to set pavement elevations twenty-five feet after a beginning at a transverse joint or twenty-five feet before an ending at a transverse joint.

(c) Offsetting Joints in Intermediate and Surface Courses

The surface course shall be placed so that longitudinal joints of the surface course will not coincide with joints in the intermediate course by approximately 9 inches. Care shall be taken when possible to offset longitudinal joints in a manner that the final surface course joint is in the center of the pavement or at the location shown on the plans. Transverse joints in the surface course shall be offset by at least two feet from transverse joints in the intermediate course.

(d) Special Requirements for Placing Paving Lanes Succeeding Initial Lanes

In placing each succeeding lane after the initial lane has been placed and compacted as specified hereafter, the screed endgate of the mechanical paver shall overlap the previously placed lane slightly and shall be approximately 1.25 times thicker than the existing compacted lane to allow for compaction roll down and produce a smooth compacted joint with the specified density. Mixture placed on the edge of the previously placed lane by the mechanical paver shall be pushed back (tucked) to the edge of the lane being placed by use of a lute (rake). The pushed back material shall form a ridge on the uncompacted lane along the edge of the previously placed lane. The height of the ridge above the uncompacted lane should be approximately equal to the thickness being allowed for roll down during compaction. These procedures shall be used to facilitate getting a smooth joint with density. Excess mixture shall be removed and wasted. Excess material shall not be spread over the uncompacted mat.

(5) Steel-Drum Rollers

Steel-drum rollers shall be self-propelled, tandem (two-axle) with both drums the same size, powered by both drums, vibratory types, weighing not less than 20,000 pounds static weight and not less than 150 lb/in of drum. Drums shall be equipped with adjustable scrapers, water tanks, and sprinkling apparatus for keeping the drums wet, thereby preventing the bituminous mixture from sticking to the wheels. Rollers shall be capable of reversing without backlash and free from worn parts. Roller drums with flat and pitted areas or projections that leave marks in the pavement will not be permitted.

(6) Heavy Pneumatic-Tired Rollers

Heavy pneumatic-tired rollers shall be self-propelled and shall consist of two axles on which are mounted an odd number of pneumatic-tired wheels. The roller shall have at least nine pneumatic-tired wheels in such manner that the rear group of wheels will not follow in the tracks of the forward group, but spaced to give essentially uniform coverage with each pass. Axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. Tires shall be smooth, inflated to 90 p.s.i.. Construction of the roller shall be such that each wheel can be loaded to a minimum of 2,300 pounds.

(7) Blowers and Brooms

Blowers and brooms shall be power type and suitable for cleaning the surface to be paved. Open faced brooms may only be used when approved by the City Engineer.

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k. Compaction of Mixture

The contractor is responsible for the development of a compaction procedure that will obtain the required density. The following paragraphs describe a procedure that generally obtains density. **The contractor shall determine the exact amount of rolling (coverages needed) to obtain a density meeting paragraph: "Density and Density Test". The ideal density is an average density between 92% and 94%.**

(1) General

The surface of the placed material shall be corrected if necessary before compaction begins. Compaction of the mixture shall be accomplished using a minimum of two steel-drum rollers and a pneumatic-tired roller as specified above. Breakdown rolling shall be as close behind the paver as possible. The break down roller shall be a steel-drum and operated in the vibratory mode on the first forward pass and may be operated in vibratory mode on subsequent passes either forward or back. Delays in rolling freshly spread mixture will not be permitted. The pneumatic-tired roller shall be used as an intermediate roller; however, it shall also roll closely behind the break down roller. The pneumatic-tired roller shall always be kept moving in order to keep its tires warm. The second steel-drum roller shall be used as a final finish roller. Rollers shall not travel faster than 3 mph. Steel-drum rollers shall not be used in the vibratory mode except for initial breakdown rolling. When steel-drum rollers are used in the vibratory mode they shall be operated at maximum frequency and minimum amplitude. Rolling shall be continued until density is obtained in all portions of each course.

The speed of rollers shall be slow enough at all times to avoid displacement of the hot mixture. Displacement of the mixture resulting from reversing the direction of the roller or from any other cause shall be corrected at once by raking or removing and replacing fresh mixture when necessary. Alternate passes of the roller shall be varied slightly in length. During rolling, the wheels of steel-drum rollers and plates of vibro plate compactors shall be moistened to prevent adhesion of the mixture to the drums or plates, but excess water will not be permitted. Tires of heavy pneumatic roller shall be moistened with soapy water when required to prevent mixture from sticking to tires during rolling. Rollers shall not be permitted to stand on finished courses until the courses have thoroughly cooled. The contractor shall supply ample rollers to obtain the specified density. Places inaccessible to rollers shall be thoroughly compacted with hot hand-tampers or vibro plate compactors.

(2) Break Down Rolling

Rollers shall be operated as specified above. The unconfined edge or low side edge of the paving lane shall be broken down first. The other edge shall be broken down second and the middle broken down last. This is considered one coverage. Steel-drum break down rollers shall not hang over the free edge of the mat or stay back from it even though they are going to back up for the adjoining lane. The entire lane shall be broken down at the same temperature.

(a) Intermediate Rolling

The rubber tired roller shall be close behind the break down roller after the mat has cooled a few degrees. The rubber tired roller shall roll the same pattern making the same coverage as the breakdown. The rubber tired roller should stay the thickness of the lift from the free edge.

(b) The number of coverages shall be determined by the contractor. This will change with temperature, humidity and thickness of the lift.

(c) Longitudinal Joint Break Down Rolling of Paving Lanes Succeeding Initial Lanes

The break down roller in the vibratory mode shall lap over the tucked joint approximately six inches (6") on to the previously placed compacted lane.

As part of the break-down rolling and immediately after the break-down roller completes its first passes, the longitudinal joint shall be pinched to ensure compaction with the pneumatic-tired roller. The rubber tired roller shall make at least one complete pass (forward and backward) operated on the hot lane with the outside tire pinching the joint.

After the rubber tired roller rolls the joint, it shall make at least one pass over the rest of the mat and then drop back to its intermediate rolling. The steel drum roller in static mode shall immediately smooth out the rubber tired marks.

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(d) Finish Rolling

Finish rolling should start when the mat has cooled down 20°F to 40°F below the intermediate rolling (This could be approximately 225°F). The steel wheeled roller in static mode shall immediately smooth out the rubber tired marks using the same pattern making the same type coverages as the breakdown roller. Do not roll until cracks appear, let it cool. Finish rolling can continue until the temperature reaches 175°F to 150°F.

The finish rolling shall continue until the pavement is smooth and has the density specified above.

l. Sampling Pavements for Density

Samples of finished pavement shall be obtained by the contractor or the contractor's laboratory. A minimum of one test (three cores) shall be taken for each tonnage lot represented by a Superpave Asphaltic Concrete test. Lots larger than 1200 tons shall have one set of (three cores) for each 1000 tons placed or as directed by the Engineer. The cores samples shall be taken at locations throughout the tonnage lot. The locations shall not be previously marked. The core locations shall be marked by the City Engineer after each tonnage lot placement is completed. Cores shall be at least 4 inches in diameter. Sample holes shall be backfilled by the contractor using Quikrete, Rapid Road Repair manufactured by The Quikrete Companies, Atlanta Georgia, 30329, Crystex manufactured by L&M Construction Chemicals Inc., Omaha Nebraska, 68152 or approved equal. The top of the patch shall be sprayed black with paint. The samples shall be tested by the contractor's laboratory to determine conformance to density and thickness. The City Engineer may require the contractor to take more samples at the contractor's expense if the density is marginal.

m. Density and Density Test

Density of the compacted mixture of the surface or intermediate course shall be determined by tests made on specimens taken from the compacted course in accordance with the requirements of the previous paragraph: SAMPLING PAVEMENTS FOR DENSITY. The density shall be the average of the three cores 92% to 96% of max theoretical specific gravity of the Superpave Asphaltic Concrete test for the lot. No core shall be less than 90%.

n. Weather Limitations

Weather limitations in Section 611.3(b) of the Standard Specifications shall apply except that the following table shall be used.

Asphalt Placement Temperature Limitations			
Paving Course	Compacted Thickness (inches)	Air Temperature (°F)	Road Surface Temp. (°F)
Surface	All	55	60
Subsurface	< 1.5	50	55
Subsurface	≥ 1.5 and < 3	40	45
Subsurface	≥ 3	30	35

o. Road Surface Preparation

When the bituminous mixture is placed on an existing bituminous surface, the surface shall be cleaned of all foreign material and broomed as necessary to remove dust. Areas shown on the plans or designated by the City Engineer to be patched shall be excavated to a depth directed by the City Engineer, filled with bituminous mixture and compacted. When the contract does not provide for a patching item, an amount two and one-half times the unit price for the bituminous mixture shall be used. The excavation required will not be paid for directly but will be considered subsidiary. In addition to brooming, a high pressure type water truck, capable of washing all fines, dirt, and debris from the surface, may be required prior to overlaying as directed by the City Engineer. Equipment compliance with this specification shall be visual observation by the City Engineer at the commencement of washing operations. Unless specified, no direct payment shall be made for this item, as it shall be considered subsidiary to other bid items.

p. Tack Coat

Emulsified Asphalt CSS-1h meeting the requirements of Section 1203 of the Standard Specifications shall be used for tack coat. All existing and new asphaltic concrete surfaces shall receive a

EXHIBIT C

tack coat not more than six hours prior to placing an asphaltic concrete paving course. Surfaces previously tack coated and not covered with new asphaltic concrete for more than six hours shall be retacked. The rate of application shall be 0.05 gal./sy to 0.12 gal./sy, or as otherwise directed by the City Engineer. At locations where asphalt is being placed on top of existing concrete pavement, or for night work where temperatures warrant, the emulsified asphalt shall be diluted 10 percent with water versus the normal 50 percent dilution with water. Tack coat shall not be paid for directly but shall be considered subsidiary to other bid items.

q. Surface Smoothness

The surface course, upon completion of final rolling, shall be smooth and true to grade and cross-section. When a 12-foot straightedge is laid on the surface parallel with the centerline, the surface shall not vary more than 1/8 inch from the straightedge. When the 12-foot straightedge is laid on the surface transverse to the centerline between the crown and edge of pavement, the surface shall not vary more than 1/4 inch from the straightedge. Low or defective areas shall be immediately corrected by cutting out the faulty areas and replacing with fresh hot mixture and compacting the area to conform to the remainder of the pavement. Testing for plan grade conformance and surface smoothness shall be performed by the Contractor in the presence of a representative of the City Engineer. Tests shall be made at intervals as directed by the City Engineer. The City Engineer may direct the contractor to diamond grind areas that are out of tolerance in lieu of above replacement.

1.4 MEASUREMENT

Measurement shall be in accordance with Section 109.01 of the Standard Specifications and as modified herein after. The asphalt mixture shall be weighed on approved, certified scales at the contractor's expense. Scales shall be inspected and sealed at least annually by an approved calibration laboratory. The City Engineer will verify the weights at random times, at the City's expense.

1.5 PAYMENT

Payment will be made at the contract unit price bid per ton for "Asphaltic Concrete Intermediate Course" and "Asphaltic Concrete Surface Course". This shall be considered payment for all items of work specified in this section. No separate payment will be made for tack coat and asphalt cement.

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SUPERPAVE ASPHALTIC CONCRETE TEST (Verified Mix Design)					
Description:					
LAB I.D.:		TIME			TONS
Sample Date:		Belt _____			
Sample I.D.:		Hot Mix _____			
Supplier:					
GRAIN SIZE DATA – ASTM D5444, C136, C117					
Sieve Size	Belt Sample	RAP/FRAP Sample*	Hot-Mix Sample*	Master Grade Limits	Cal. Single Point
19mm (3/4")					
12.5mm (1/2")					
9.5mm (3/8")					
4.75mm (No. 4)					
2.36mm (No. 8)					
1.18mm (No. 16)					
600µm (No 30)					
300µm (No 50)					
15 µm (No 100)					
75µm (No 200)					
EXTRACTION DATA-ASTM D6307					
* from uncompacted mat					
%AC, total mix basis	FRAP	Sample	Plant Setting	Recycled AC %	
Aggregate Type	%**	Aggregate Type	%**		
**total aggregate basis					
VOLUMETRIC DATA 6" NOMINAL SIZE Gyratory Specimens					
Gyrations (average of 2 specimens) @ 280-290 deg F – AASHTO T312 - 01					
Ndes = 60 Nini = 6					
	Sample*	Specifications			
Mix bulk specific gravity @ Ndes, Gmb		--			
%Voids @ Ndes		3.0-5.0/2.8-4.5/2.6-4.1		AASHTO T T-169 0%/5-25%/26-40% RAP	
%VMA @ Ndes, Gsb basis					
%VEA @ Ndes		9.0-11 9.3-11.3 9.6-11.6		=%VMA-%Voids (0-5% 5-25% 26-40% RAP)	
%Gmm @ Nini		85-91		AASHTO T 166-00	
Ratio (-) 75µm (No. 200) to % Eff Binder		0.6-1.6/0.5-1.5		0-25%/26-40% RAP	
Tensile Strength Ratio, %		80 minimum		AASHTO T 283-03	
Max Theoretical Specific Gravity Gmm		--		AASHTO T 209-99(04)	
Max Theo. Density, pcf		--			
Effective specific gravity Agg. Gse		--			
Bulk Specific Gravity of Total Agg., Gsb		--		ASTM C128, C127	
Specific Gravity of Asphalt, Gb		--			
Shale or shale-like (virgin aggregates only)		1.0% maximum		KT-8	
COMMENTS:					