613 - ULTRATHIN BONDED ASPHALT SURFACE (UBAS)

613.1 DESCRIPTION

Construct the Ultrathin Bonded Asphalt Surface (UBAS) as designated in the Contract Documents.

BID ITEM	UNITS
Ultrathin Bonded Asphalt Surface (UBAS), Thoroughfare	SY
Ultrathin Bonded Asphalt Surface (UBAS), Residential	SY

The **2015 Standard Specifications for State Road and Bridge Construction** shall govern the construction of UBAS overlays as described in Section 613 of the Standard Specifications except as otherwise modified herein. References made herein to Appendices, Divisions, Sections and Tables are to the Standard Specifications. All testing required by this specification including mix design and field verification of the mix shall be the responsibility of the Contractor. The mix designation and nominal thickness of the UBAS is specified to be Type B and 5/8 inches, respectively.

613.2 CONTRACTOR QUALITY CONTROL REQUIREMENTS

a. General. Provide qualified personnel and sufficient equipment complying with the requirements listed in Part V to conduct quality control testing that complies with Appendix A. The Contractor will conduct quality control tests on a per lot basis at the frequencies shown in Appendix A.

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

Calibrate and correlate the testing equipment with prescribed procedures, and conduct tests in compliance with specified testing procedures as listed in the KDOT Construction Manual.

Maintain quality control test results on an ongoing basis.

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

Provide the following test data to the City's Project Representative by electronic mail:

- Copies of all test results for the lot under production within 12 hours.
- Copies of all failing test results.

b. Testing Facilities. UBAS Design shall be the responsibility of the Contractor's Laboratory. The laboratory shall be a commercial testing laboratory or a Contractor-owned 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 UBAS or 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.

c. Testing Requirements for Production Lots.

(1) A lot is defined as 400 tons or the amount of material produced in one day if the daily volume of production is less than 400 tons.

(2) Take all samples for tests at the rate specified in Appendix A.

Provide the Engineer with the random locations before obtaining the sample. The Engineer reserves the right to generate the random locations. If the Engineer generates the random locations, the Contractor will be notified of which truck to sample after the aggregate has left the cold feeds, and before the truck is finished loading.

(3) Conduct the tests for mixture properties, aggregate gradation and binder content on representative portions of the HMA, quartered from the larger sample of HMA. Take a random sample weighing a minimum of 55 pounds using a method to retain heat to facilitate sample quartering procedures.

(4) Testing of Split Samples. At the City's discretion, split samples will taken for testing. The City will have their laboratory test their portion of the split sample. The City's laboratory will determine G_{mm}, perform ignition burnoff, evaluate the mix gradation and complete calculations. At a minimum, compare G_{mm}, binder content, and film thickness results. The acceptable difference for the G_{mm} results is 0.019. If the test results do not compare favorably, the City and the Contractor will investigate the differences in test results together and take appropriate action.

613.3 MATERIALS

a. Asphalt Binder. Provide Asphalt Binder that complies with **DIVISION 1200**. Post a legible copy of the latest bill of lading for the Asphalt Binder in the Contractor's Field Lab. Use the mixing and compaction temperatures shown on the bill of lading; however, the maximum mixing or compaction temperature is 340ºF, unless otherwise approved by the Engineer. Notify the Engineer if the mixing or compaction temperature changes. The asphalt binder shall be Performance Graded Asphalt Binder PG 70-28.

Provide Emulsion Bonding Liquid (EBL) that complies with **DIVISION 1200**.

b. Reclaimed Asphalt Pavement (RAP) and Reclaimed Asphalt Shingles (RAS). Do not use RAP or RAS in the UBAS.

c. Aggregates. Provide aggregates that comply with **SECTION 1103**.

The contractor shall submit a copy of current aggregate quality and consensus tests for aggregates used in the mix. The quality test must have been run within 12 months of the date of a mix design submission or a volumetric test report.

d. Combined Aggregates. Provide combined aggregates for the mixes required in the Contract Documents as shown in **TABLE 613-1**.

Mixes may use any combination (except as noted below) of aggregate and mineral filler supplements complying with the applicable requirements in **TABLES 1103-1** and **1103-2**. When coarse aggregates are blended from 1 or more sources, or if more than 1 type, each source or type shall meet the coarse aggregate properties (CAA, LA Abrasion, and micro-deval) in **TABLE 1103-3**.

The minimum Uncompacted Void Content of the Fine Aggregate "U" Value, of the combined aggregate is 45%.

The minimum sand equivalency (SE) of the combined aggregates is 45%.

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

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

No natural sand will be used in the UBAS.

Traveled way mixes shall include:

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

e. **Patching Asphalt**. Provide asphalt that complies with Overland Park Superpave Asphaltic Concrete Intermediate Course.

f. Contractor Trial Mix Design. A minimum of 10 working days before the start of UBAS production, submit in writing to the City for review and approval, a proposed JMF for each combination of aggregates. For each JMF submitted, include test data to demonstrate that mixtures complying with each proposed JMF shall have properties specified in **TABLE 613-1** for the designated mix type at the Recommended Percent Asphalt (Pbr). Submit the proposed JMF on forms used by KDOT. KDOT forms will be supplies upon request. Submit the worksheets used in the design process to include at a minimum the individual coarse aggregate properties listed in **TABLE 1103-3**, the fine aggregate properties listed in

TABLE 1103-4, and the mix properties listed in **TABLE 613-2**. Contact the City to determine if additional material is needed for additional design checks.

For each aggregate used in the mix design, determine the specific gravity using KT-6.

TABLE 613-1: COMBINED AGGREGATE REQUIREMENTS FOR ULTRATHIN BONDED ASPAHLT SURFACE*

Mix Designation / Nom Thickness	Percent Retained - Square Mesh Sizes										Asphalt Content (%)
	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No.100	No. 200	
Type A - 5/8"		0	0-7	45-60	68-78	75-85	82-90	87-92	90-94	94.0-96.0	5.0-6.2
Type B - 5/8"	0	0-7	0-25	62-75	73-83	75-85	82-90	87-92	90-94	94.0-96.0	4.8-6.2
Type C - 5/8"	0	0-25	20-50	62-75	73-83	75-85	82-90	87-92	90-94	94.0-96.0	4.8-6.2

*For flat and elongated particles in the combined coarse aggregate, use the ratio of 3:1 in lieu of 5:1 shown in KT-59.Do not exceed 25% for the total sample.

TABLE 613-2: MIX PROPERTIES

Property	Test Method	Limits
Total Amine Value of Antistrip Agent (mg/g of KOH, min)[a]	ASTM D2074	500
Design Film Thickness (µm, min.)	KDOT Construction Manual	9.0[b]
Drain Down (% max.)	KT-63	0.10
Gyratory Compacted Revolutions, Nmax	KT-58	100[c]
Emulsion Bonding Liquid (EBL), (gal/sy)	Equation 1	(0.20±0.07)[d]

a – The asphalt binder used in the mix will contain a minimum of 0.25% of an amine based antistripping agent by weight of the asphalt binder.
b – Calculate using the film thickness equation in Section 5.10.4 of the "KDOT Construction Manual".
c – Compact gyratory specimen to 100 gyrations. Calculate the percent air voids using KT-15, Procedure IV.
d – Calculate the target EBL Shot Rate (Sebl (gal.sy)), using Equation 1; however, the value must be within the limits in this table.

Equation 1: $$S_{ebl} = 3.93 * P_s * \frac{(V_a + MF)}{100}$$

The particle size (Ps), and the mix factor (MF) are based on the mix designation as shown in the **TABLE 613-3**.

TABLE 613-3: VARIABLES IN EBL SHOT RATE EQUATION

Mix Designation	Particle Size (P_s)	Mix Factor (MF)
Type A	0.250	3.2
Type B	0.375	3.2
Type C	0.500	3.2

Consider adjusting the EBL spray rate based on the condition of the existing surface as listed in **TABLE 613-4** of the standard specifications. Consult the supplier of the EBL to obtain the recommended adjustment to the spray rate.

TABLE 613-4: EBL ADJUSTMENT CONSIDERATIONS

Existing Pavement Type	Condition	Adjustment Rate (gal/sy)
PCCP	Smooth	0.00
	Textured	+0.02 to +0.04
HMA	Flushed	-0.02 to -0.04
	New	0.00
	Matte and OGFC	+0.02
	Dry	+0.03
	Milled	+0.02 to +0.04

Surface Recycle & Cold Recycle	Flushed	-0.02 to -0.04
	Black	+0.02
	Dry	+0.03
Chip Seal	Flushed	-0.02 to -0.04
	Black	+0.02
	Dry	+0.03

613.4 CONSTRUCTION REQUIREMENTS

a. Plant Operation. Adjust all plant operations to operate continuously.

(1) Preparation of the Asphalt Binder. Heat the asphalt binder to within a range as specified in **SECTION 601**. When heating the asphalt binder to the specified temperature, avoid local overheating. At all times, provide a continuous supply of the asphalt binder to the mixer at a uniform temperature. Asphalt binder received from the refinery at temperatures less than 375°F may be used as received, if the requirements regarding the reheating of asphalt binder in **SECTION 601** are met.

(a) Commingling of Asphalt Binders. Do not add or commingle asphalt binders from 2 or more sources into a storage tank. If this occurs, the contents of the storage tank are considered contaminated. Do not use the contents of the storage tank on the project, except as follows: It is permissible, at the Contractor's option, to thoroughly mix the contents of the tank and request sampling of the mixture. Submit the sample to the City's representative for testing. Do not use the asphalt binder until approved, and when needed, a new mix design evaluation is completed.

(b) Asphalt Binder Sources. Before changing asphalt binder sources on a project, obtain approval from the City. A new JMF may be required.

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

(2) Preparation of Mineral Aggregate. When the mineral aggregate is composed of 2 or more ingredients, combine as shown in the approved JMF.

Temperature Requirements. Dry the aggregate for the mixture and heat to a temperature to obtain an asphalt-aggregate mixture temperature immediately after mixing within the 75 to 150 second Saybolt viscosity range of the asphalt binder used. Obtain the temperature for this viscosity range from the MRC or the Asphalt Binder Producer. No mixing or compaction temperatures are to exceed 340ºF without approval from the City. The minimum temperature may be revised by the City provided it is demonstrated that satisfactory results may be obtained at a lower temperature. In such event, deliver the HMA to the paver at a temperature sufficient to allow the material to be satisfactorily placed and compacted to the specified density and surface tolerance requirements.

(3) Preparation of HMA. Introduce asphalt binder into the prepared aggregate in the proportionate amount determined by the Pbr in the JMF.

(a) Basis of Rejection. HMA will be rejected if the aggregate, as it is discharged from the drum or the pugmill, contains sufficient moisture to cause foaming of the mixture, or if the temperature of the aggregate is such that the asphalt-aggregate mixture temperature is outside the range specified in **SECTION 601** of the Standard Specifications.

(b) Mixing Time. Operate drum mixers at a rate to provide uniform aggregate coating in a continuous operation. For batch and continuous type plants, the minimum wet mixing time is 40 seconds. In all cases, mix a sufficient time to produce a uniform mixture in which all the aggregate particles are thoroughly coated. On batch plants, begin the timing at the start of the asphalt binder introduction into the pugmill, and end upon the opening of the discharge gate. For continuous flow plants, mixing time in seconds shall equal:

[pugmill dead capacity in pounds] divided by [pugmill output in pounds per second].

(c) Manufacturer's Specifications. Operate all drying, pumping and mixing equipment within the limits specified by the manufacturer, unless it can be demonstrated to the satisfaction of the Engineer that such limits may be exceeded without detriment to the HMA.

(d) Batcher Operation. Coordinate HMA batchers (Gob Hoppers) with the plant production rate at all times so the hopper is more than ¾ full before the gates open, and the gates close before material can drop through the gob hopper directly into the surge bin, weigh hopper or truck.

(e) Wasted Material. Wasted material is not measured for pay. If after an interruption of production, the drum-mixer contains cold, uncoated or otherwise unsuitable material, waste material through a diversion chute. In a continuous or batch plant drier, waste unsuitable material through the pugmill.

At the end of a production run, waste any segregated material in the cone of the storage bin.

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

b. Road Surface Preparation.

(1) Preparation of an Existing Asphalt Pavement. Clean the surface to remove all foreign material.

Broom and blow surface to remove dust. The joint between the existing pavement and the curb and gutter shall be blown free of all debris immediately prior to placing UBAS. All existing asphalt material and all debris shall be removed from existing pavement, curb and gutter, sidewalk ramps, medians, and median noses immediately prior to paving. Excavate areas shown in the Contract Documents or as determined by the Engineer to be patched to a depth directed by the Engineer. Fill with HMA and compact. HMA mixture used for patching shall be preapproved by the Engineer. All patching shall be completed prior to the texturing operation. Patches will be a minimum of 2 inches in depth and shall be placed to be flush with the existing surface prior to texturing. Patches shall be a minimum of 2 feet in width. Patch quantities may be adjusted by the Engineer. All areas excavated for patching shall be patched during the same working day.

(2) Preparation of an Existing Concrete or Brick Pavement. Clean all foreign material and broom to remove dust. Clean and fill cracks and joints, and construct surface leveling as shown in the Contract Documents.

(3) A sweeper shall be kept for immediate use as needed with each patching, texturing and UBAS operation and as required by the engineer for general cleanup.

c. Weighing Operations. See **subsection 109.1** of the Standard Specifications for details regarding weighing operations.

d. Hauling Operations. Schedule operations to minimize hauling over a surface course. Deliver HMA to the paver at a temperature sufficient to allow the material to be placed and compacted to the specified density and surface tolerance.

e. Paving Operations.

(1) Technical Support: Provide personnel familiar with the process to provide technical support for production and placement of the UBAS.

(2) Equipment Use a transfer device between the haul units and the paver to assist in maintaining continuous placement on thoroughfares. Use equipment such as a shuttle buggy, material transfer vehicle or mobile conveyor (The material will not be deposited on the roadway and a pick-up device used to transfer the material to the paver). The use of a transfer device is not permitted for work on residential streets. Use a self-priming paver, designed and built for applying the UBAS and approved by the Engineer.

Use a paver with the following requirements:

- with a receiving hopper, feed conveyor, asphalt emulsion storage tank, a system for measuring the EBL volume applied, a spray bar, and a heated, variable width, vibratory screed;

- capable of spraying the EBL, applying the hot mix surface course and leveling the surface of the mat in one pass;
- capable of placing the hot mix surface course within 5 seconds after the application of the EBL;
- capable of paving at a controlled speed from 30-100 feet/minute;
- equipped so no wheel or other part of the paving machine is in contact with the EBL before the hot mix surface course is applied; and
- equip the screed with the ability to crown the pavement at the center and have vertically adjusted extensions to accommodate the desired pavement profile.

The Engineer will check the pavement for longitudinal streaks and other irregularities. Make every effort to prevent or correct any irregularities in the pavement, such as changing pavers or using different and additional equipment.

Do not raise (dump) the wings of the paver receiving hopper at any time during the paving operation.

(3) Application: Spray the EBL by a metered mechanical pressure spray bar at the temperature specified in **TABLE 601-1** of the Standard Specifications, or as recommended by the EBL supplier. Use a sprayer that accurately and continuously monitors the rate of spray and provides a uniform application across the entire width to be overlaid. The Engineer may make adjustments to the spray rate based upon the existing pavement surface conditions and the recommendations of the EBL supplier.

Apply the UBAS at a temperature of 290-330ºF and spread over the EBL immediately after the application of the EBL. Place the UBAS over the full width of the EBL with a heated vibratory screed. Adjust the screed and its extensions to eliminate variances in surface texture caused by density segregation. Operate the paver as continuous as possible to reduce the possibility of screed indentations in the finished mat.

The target application rate of the UBAS will be stated in the Contract Documents. Use a field application rate as necessary to minimize fracturing of the top size aggregate by the screed. The Engineer will determine the acceptable extent of fracturing at the edge of the paving for tapering purposes.

The finished asphalt surface shall be free of oversized material. The Engineer will determine the extent of the oversized material in the UBAS. Take immediate corrective action to eliminate the source. If the source of the oversized material is determined to be a stockpile or a process of plant operations, cease production until corrective actions are complete.

Spread the UBAS without tearing the surface. Strike a finish that is smooth, free of segregation, true to cross section, uniform in density and texture and free from surface irregularities. If the pavement does not comply with all of these requirements, plant production and paving will be suspended until the deficiency is corrected.

(4) Compaction: Roll the UBAS with a minimum of 1 pass and a maximum of 3 passes with 2-axle tandem steel rollers having a minimum weight of 10 tons, before the material temperature has fallen below 195ºF. The Engineer will determine the number of passes necessary based on appearance of the rolled material. Do not allow the roller or rollers to remain stationary on the freshly placed UBAS. Perform rolling immediately following the placement of the UBAS with approved asphalt rollers. Supply adequate roller units so the rolling will be accomplished promptly following the placement of the material. A release agent (added to the water system) may be required to prevent adhesion of the fresh mix to the roller drum and wheels. Normally, perform rolling in the static mode. Do not excessively roll the driving lanes, to the extent of aggregate degradation. The Engineer will determine the acceptable extent of fracturing at the edge of the pavement from the rolling operation. Do not open the new pavement to traffic or allow any roller to sit idle on the pavement until the rolling operation is complete and the material has cooled below 160°F.

Damaged Areas: Replace any defective areas, as determined by the Engineer, at no additional cost to the City.

(5) Construction Joints.

- Transverse Construction Joints. Use a method of making transverse construction joints which provide a thorough and continuous bond and provide an acceptable surface texture. Do not

vary the surface elevation more than 3/16 inch in 10 feet, when tested longitudinally across the joint. When required, repair the joints or paving operations will be suspended.

- Longitudinal Joints. Construct well bonded and sealed longitudinal joints to obtain maximum compaction at the joint.

(6) Adjustment of Manholes. When required, this work will be performed and paid in accordance with "Adjustment of Manhole and Valves".

f. Treatment of Adjacent Areas. Pave side roads, entrances and turnouts for mailboxes as shown in the Contract Documents. Overlay all widening areas designated in the Contract Documents or ordered by the Engineer.

g. Pavement Smoothness. UBAS is excluded from profilograph testing.

613.5 PROCESS CONTROL

a. General. Establish gradation limits and proportions for each individual aggregate and mineral filler, when applicable. Specify the limits and proportions such that the material produced complies with the applicable requirements of the designated mix type. The Contractor is responsible for all process control operations including testing. At no time will the Engineer issue instructions to the Contractor or producer as to setting of dials, gauges, scales and meters. The City will collect and test verification samples and assurance samples and inspect the Contractor's quality control operations.

b. JMF Adjustments. Produce a mixture of uniform composition closely complying with approved design JMF to obtain the specified properties when compacted. If, during production, results from quality control tests demonstrate a need to make adjustments to the mix design, then make adjustments to the design JMF single point gradation and binder content to achieve the specified properties. The JMF adjustments shall produce a mix that complies with **TABLE 613-1** for the specified mix designation. When necessary, adjust on a lot basis. Report the new JMF to the Engineer.

TABLE 613-5: SPECIFICATION WORKING RANGES (QC/QA)	
Mix Characteristic	**Tolerance from JMF and Specification Limits**
	Single Test Value
Binder Content (Maximum deviation from JMF)	±0.3%
Film Thickness	n/a
Gradation**	n/a
Course Aggregate Angularity (CAA)	zero tolerance
Fine Aggregate Uncompacted Voids (FAA)	zero tolerance
Sand Equivalent	zero tolerance
The maximum deviation for UBAS from the JMF for the sieves with a ± tolerance shall be as listed in **TABLE 613-5. Only the No. 16, 30, 50 and 100 sieves may exceed the limits listed in **TABLE 613-1** provided the minimum retained percentage shown in **TABLE 613-5** is met.	

Table 613-6: Specification Limits

Mix Designation / Nom Thickness	Percent Retained - Square Mesh Sizes									
	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No.100	No. 200
Type A				±5	68-78	75 min	82 min	87 min	90 min	94.0-96.0
Type B			±5	±4	73-83	77 min	82 min	87 min	90 min	94.0-96.0
Type C		±5	±5	±4	73-83	77 min	82 min	87 min	90 min	94.0-96.0

c. EBL shot rate Specification. Periodically determine the application rate of the EBL. The Engineer will verify the application rate. Acceptable tolerance of the application rate is the target rate ±0.02 gal/sq yd. Check for proper coverage at least twice per day by applying the EBL to the road surface for a minimum distance of 20 feet. When the Engineer verifies the coverage meets specification, back up the paver and shoot not more than 1/4 of the EBL shot rate over the previously tacked segment.

613.6 WEATHER LIMITATIONS

Do not place UBAS on any wet or frozen surface or when weather conditions otherwise prevent the proper handling and finishing of the mixture. Only place UBAS when either the minimum ambient air temperature is 50°F or the minimum road surface temperature is 55°F.

613.7 MIXTURE ACCEPTANCE

a. General. Test the UBAS at each plant for compliance with **TABLE 613-1**. Acceptance will be made on a lot by lot basis contingent upon satisfactory test results. Obtain quality control and verification samples of the UBAS using KT-25 sampling procedure C.1 Plant Discharge or C.2 Truck Bed.

A 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 outside the mixing temperature range may be rejected.

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 shall normally be represented by 1 test result.

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 or the City's test results. The information from additional testing (including testing of in-place HMA) may be used to define unacceptable work according to **subsection 105.5** in the **2007 Standard Specifications for State Road and Bridge Construction**. The Engineer may initiate corrective action.

When a deficiency within a lot is determined to exist, the Engineer will decide on the disposition of each lot as to the acceptance, rejection or acceptance at an adjusted payment. The Engineer's decision is final.

d. Multiple Projects. If multiple projects are supplied from 1 or more plants using the same mix, carry over the lots at each hot mix plant from project to project.

e. Lot Size. A standard size mix production lot consists of 400 tons.

It is anticipated that lot size shall be as specified. However, with the Engineer's approval, the Contractor may re-define lot size for reasons such as, but not limited to, change in contract quantities or interruption of the work. Take 1 sample during production of each lot and utilize it to determine disposition.

f. Pre-Production Mix. Test and evaluate a pre-production mix, limited to a maximum of 85 tons. The pre-production test material will be placed at a location off of city property at the Contractor's expense. Evaluate the pre-production mix at initial start-up and after suspension of production resulting from failing test results. Limit pre-production quantities to 100 tons following a suspension of production. Provide a pre-production mix that complies with the "Single Test Value" in **TABLES 613-5** and **613-6**. Except for initial start-up, normal delivery of material to the project before completion of certain test results on preproduction mixes may be authorized by the City.

g. Suspension of Mix Production. Suspend production of the mix and the mixture shall be redesigned whenever any of the following occurs:

(a) Three consecutive sets of tests show the binder content in the compacted mix exceeds the tolerance shown for the single test value column of Table 613-5.
(b) Three consecutive sets of tests show the minimum design film thickness is less than 9.0 μm.
(c) Three consecutive sets of tests show the gradation to be outside of the specification limits shown in TABLE 613-6.

The JMF may only be adjusted, when requested by the Contractor, and when approved by the Engineer. For significant changes in the JMF, as determined by the Engineer, a new mix design may be required by the Engineer before the JMF is approved.

The Engineer may stop production of HMA at any time the mix or process is determined to be unsatisfactory. Make the necessary corrections before production will be allowed to resume. Failure to

stop production of HMA shall subject all subsequent material to rejection by the Engineer or acceptance at a reduced price, as determined by the Engineer.

h. Non-Complying Materials. Establish and maintain an effective and positive system for controlling noncomplying material, including procedures for its identification, isolation and disposition. Reclaim or rework noncomplying materials according to procedures acceptable to the Engineer. This could include removal and replacement of in-place pavement.

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

613.8 MEASUREMENT AND PAYMENT

a. UBAS. The Engineer will measure UBAS by the square yard. Payment for "Ultrathin Bonded Asphalt Surface (UBAS), Thoroughfare", and "Ultrathin Bonded Asphalt Surface (UBAS), Residential" at the contract unit price is full compensation for the specified work, including quality control testing.

b. Patching. The Engineer will measure patching by the ton. Payment for "Asphalt Patching" at the contract unit price is full compensation for the specified work including removal of existing asphalt.

APPENDIX A: SAMPLING AND TESTING FREQUENCY CHART FOR UBAS	
TESTS REQUIRED (record to)	**FREQUENCY**
Binder Sampling (KT-26)	1 per project
Binder Content (by ignition) (0.1 g or 0.01% of mass) (KT-57)	1 per lot
Mix Gradation (after ignition) (0.1 g or 0.01% of mass)	1 per lot
Theoretical Max. Sp. Gr. (Rice) (Gmm=0.001) (KT-39)	1 per lot (if more than 1 test is performed, use average)
Sand Equivalent (1%)(KT-55)	1 per project
Coarse Aggregate Angularity (0.1% of mass) (KT-55)	1 per week or per 10,000 tons
Uncompacted Voids Content of Fine Aggregates (0.1%)(KT-50)	1 per project
Gradation of individual aggregate (1%, 0.1% for No. 200, of mass)(KT-2)	1 per project per individual aggregate
% Moisture in Mixture (0.1 g or 0.01% of mass)(KT-11)	1 per project
%Moisture in Combined Virgin Aggregate (0.1g or 0.01% of mass)(KT-11)	1 per project
PI of Mineral Filler (0.01g or 0.01% of mass)(KT-10)	1 per project
Gradation of Mineral Filler (1%, 0.1% for No. 200, of mass)(KT-2)	1 per project

General Note: All sampling and testing frequencies are minimums. Additional quality control, verification and assurance tests will be performed, when necessary, to provide effective control of the work. When any quality control, verification or independent assurance test fails to comply with

the specification requirements then the next lot of production after obtaining the failing test results will be sampled and tested, regardless of any lesser frequency specified in Appendix A.