

PROJECT SPECIAL PROVISIONS**ROADWAY****FINAL ACCEPTANCE AND FOURTEEN DAY OBSERVATION PERIOD:**

(7-1-95)

RR 13

Upon completion of construction as shown on each map, a 14 day observation period is required before acceptance. During the 14-day period, warrant the resurfaced area against failure.

No payment will be made for replacing failed pavement, as the cost of it will be considered incidental to the work initially paid for under the various items in the contract.

Completion and final acceptance of the project is contingent upon successful completion of the Observation Period. The observation period will be considered a part of the work required to be completed by the final completion date specified herein.

PRICE ADJUSTMENT - ASPHALT BINDER FOR PLANT MIX:

(11-21-00)

RR 19

Price adjustments for asphalt binder for plant mix will be made in accordance with Section 620 of the *Standard Specifications*.

The base price index for asphalt binder for plant mix is **\$307.86** ton.

This base price index represents an average of F.O.B. selling prices of asphalt binder at supplier's terminals on **May 1, 2007**.

FINAL SURFACE TESTING - ASPHALT PAVEMENTS (Rideability):

(5-18-04) (Rev.7-18-06)

RR 20

On portions of this project where the typical section requires two or more layers of new pavement, perform acceptance testing of the longitudinal profile of the finished pavement surface in accordance with these provisions using a North Carolina Hearne Straightedge (Model No. 1). Furnish and operate the straightedge to determine and record the longitudinal profile of the pavement on a continuous graph. Final surface testing is an integral part of the paving operation and is subject to observation and inspection by the Engineer as deemed necessary.

Push the straightedge manually over the pavement at a speed not exceeding 2 miles per hour. For all lanes, take profiles in the right wheel path approximately 3 ft from the right edge of pavement in the same direction as the paving operation, unless otherwise approved due to traffic control or safety considerations. Make one pass of the straightedge in each full width travel lane. The full lane width should be comparable in ride quality to the area evaluated with the Hearne Straightedge. If deviations exist at other locations across the lane width, utilize a 10 foot non-mobile straightedge or the Hearne Straightedge to evaluate which areas may require corrective action. Take profiles as soon as practical after the pavement has been rolled and compacted but in no event later than 24 hours following placement of the pavement, unless otherwise authorized

by the Engineer. Take profiles over the entire length of final surface travel lane pavement exclusive of -Y- line travel lanes less than or equal to 300 feet in length, turn lanes less than or equal to 300 feet in length, structures, approach slabs, paved shoulders, loops, and tapers or other irregular shaped areas of pavement, unless otherwise approved by the Engineer. Test in accordance with this provision all mainline travel lanes, full width acceleration or deceleration lanes, -Y- line travel lanes greater than 300 feet in length, ramps, full width turn lanes greater than 300 feet in length, and collector lanes.

At the beginning and end of each day's testing operations, and at such other times as determined necessary by the Engineer, operate the straightedge over a calibration strip so that the Engineer can verify correct operation of the straightedge. The calibration strip shall be a 100 ft section of pavement that is reasonably level and smooth. Submit each day's calibration graphs with that day's test section graphs to the Engineer. Calibrate the straightedge in accordance with the current NCDOT procedure titled *North Carolina Hearne Straightedge - Calibration and Determination of Cumulative Straightedge Index*. Copies of this procedure may be obtained from the Department's Pavement Construction Section.

Plot the straightedge graph at a horizontal scale of approximately 25 ft per inch with the vertical scale plotted at a true scale. Record station numbers and references (bridges, approach slabs, culverts, etc.) on the graphs, and distances between references/stations shall not exceed 100 ft. Have the operator record the Date, Project No., Lane Location, Wheel Path Location, Type Mix, and Operator's Name on the graph.

Upon completion of each day's testing, evaluate the graph, calculate the Cumulative Straightedge Index (CSI), and determine which lots, if any, require corrective action. Document the evaluation of each lot on a QA/QC-7 form. Submit the graphs along with the completed QA/QC-7 forms to the Engineer, within 24 hours after profiles are completed, for verification of the results. The Engineer will furnish results of their acceptance evaluation to the Contractor within 48 hours of receiving the graphs. In the event of discrepancies, the Engineer's evaluation of the graphs will prevail for acceptance purposes. The Engineer will retain all graphs and forms.

Use blanking bands of 0.2 inches, 0.3 inches, and 0.4 inches to evaluate the graph for acceptance. The 0.2 inch and 0.3 inch blanking bands are used to determine the Straightedge Index (SEI), which is a number that indicates the deviations that exceed each of the 0.2 inch and 0.3 inch bands within a 100 ft test section. The Cumulative Straightedge Index (CSI) is a number representing the total of the SEIs for one lot, which consist of not more than 25 consecutive test sections. In addition, the 0.4 inch blanking band is used to further evaluate deviations on an individual basis. The Cumulative Straightedge Index (CSI) will be determined by the Engineer in accordance with the current procedure titled "North Carolina Hearne Straightedge - Calibration and Determination of Cumulative Straightedge Index".

The pavement will be accepted for surface smoothness on a lot by lot basis. A test section represents pavement one travel lane wide not more than 100 ft in length. A lot will consist of 25 consecutive test sections, except that separate lots will be established for each travel lane, unless otherwise approved by the Engineer. In addition, full width acceleration or deceleration

lanes, ramps, turn lanes, and collector lanes, will be evaluated as separate lots. For any lot that is less than 2500 feet in length, the applicable pay adjustment incentive will be prorated on the basis of the actual lot length. For any lot which is less than 2500 feet in length, the applicable pay adjustment disincentive will be the full amount for a lot, regardless of the lot length.

If during the evaluation of the graphs, 5 lots (mainline travel lanes and full width -Y- line travel lanes greater than 300 feet in length only) require corrective action, then proceed on limited production for unsatisfactory laydown in accordance with Article 610-12. Proceeding on limited production is based upon the Contractor's initial evaluation of the straightedge test results and shall begin immediately upon obtaining those results. Additionally, the Engineer may direct the Contractor to proceed on limited production in accordance with Article 610-12 due to unsatisfactory laydown or workmanship.

Limited production for unsatisfactory laydown is defined as being restricted to the production, placement, compaction, and final surface testing of a sufficient quantity of mix necessary to construct only 2500 feet of pavement at the laydown width. Once this lot is complete, the final surface testing graphs will be evaluated jointly by the Contractor and the Engineer. Remain on limited production until such time as acceptable laydown results are obtained or until three consecutive 2500 foot sections have been attempted without achieving acceptable laydown results. The Engineer will determine if normal production may resume based upon the CSI for the limited production lot and any adjustments to the equipment, placement methods, and/or personnel performing the work. Once on limited production, the Engineer may require the Contractor to evaluate the smoothness of the previous asphalt layer and take appropriate action to reduce and/or eliminate corrective measures on the final surface course. Additionally, the Contractor may be required to demonstrate acceptable laydown techniques off the project limits prior to proceeding on the project.

If the Contractor fails to achieve satisfactory laydown results after three consecutive 2500 foot sections have been attempted, cease production of that mix type until such time as the cause of the unsatisfactory laydown results can be determined.

As an exception, the Engineer may grant approval to produce a different mix design of the same mix type if the cause is related to mix problem(s) rather than laydown procedures. If production of a new mix design is allowed, proceed under the limited production procedures detailed above.

After initially proceeding under limited production, the Contractor shall immediately notify the Engineer if any additional lot on the project requires corrective action. The Engineer will determine if limited production procedures are warranted for continued production.

If the Contractor does not operate by the limited production procedures as specified above, the 5 lots, which require corrective action, will be considered unacceptable and may be subject to removal and replacement. Mix placed under the limited production procedures for unsatisfactory laydown will be evaluated for acceptance in accordance with Article 105-3.

The pay adjustment schedule for the Cumulative Straightedge Index (CSI) test results per lot is as follows:

Pay Adjustment Schedule for Cumulative Straightedge Index (CSI) (Obtained by adding SE Index of up to 25 consecutive 100 ft. sections)				
*CSI	ACCEPTANCE CATEGORY	CORRECTIVE ACTION	PAY ADJUSTMENT	
			Before Corrective Action	After Corrective Action
0-0	Acceptable	None	\$300 incentive	None
1-0 or 2-0	Acceptable	None	\$100 incentive	None
3-0 or 4-0	Acceptable	None	No Adjustment	No Adjustment
1-1, 2-1, 5-0 or 6-0	Acceptable	Allowed	\$300 disincentive	\$300 disincentive
3-1, 4-1, 5-1 or 6-1	Acceptable	Allowed	\$600 disincentive	\$600 disincentive
Any other Number	Unacceptable	Required	Per CSI after Correction(s) (not to exceed 100% Pay)	

***Either Before or After Corrective Actions**

Correct any deviation that exceeds a 0.4 inch blanking band such that the deviation is reduced to 0.3 inches or less.

Corrective actions shall be performed at the Contractor's expense and shall be presented for evaluation and approval by the Engineer prior to proceeding. Any corrective action performed shall not reduce the integrity or durability of the pavement that is to remain in place. Corrective action for deviation repair may consist of overlaying, removing and replacing, indirect heating and rerolling. Scraping of the pavement with any blade type device will not be allowed as a corrective action. Provide overlays of the same type mix, full roadway width, and to the length and depth established by the Engineer. Tapering of the longitudinal edges of the overlay will not be allowed.

Corrective actions will not be allowed for lots having a CSI of 40 or better. If the CSI indicates *Allowed* corrective action, the Contractor may elect to take necessary measures to reduce the CSI in lieu of accepting the disincentive. Take corrective actions as specified if the CSI indicates *Required* corrective action. The CSI after corrective action should meet or exceed *Acceptable* requirements.

Where corrective action is allowed or required, the test section(s) requiring corrective action will be retested, unless the Engineer directs the retesting of the entire lot. No disincentive will apply after corrective action if the CSI is 40 or better. If the retested lot after corrective action has a CSI indicating a disincentive, the appropriate disincentive will be applied.

Test sections and/or lots that are initially tested by the Contractor that indicate excessive deviations such that either a disincentive or corrective action is necessary, may be re-rolled with asphalt rollers while the mix is still warm and in a workable condition, to possibly correct the

problem. In this instance, reevaluation of the test section(s) shall be completed within 24 hours of pavement placement and these test results will serve as the initial test results.

Incentive pay adjustments will be based only on the initially measured CSI, as determined by the Engineer, prior to any corrective work. Where corrective actions have been taken, payment will be based on the CSI determined after correction, not to exceed 100 percent payment.

Areas excluded from testing by the N.C. Hearne Straightedge will be tested by using a non-mobile 10-foot straightedge. Assure that the variation of the surface from the testing edge of the straightedge between any two contact points with the surface is not more than 1/8 inch. Correct deviations exceeding the allowable tolerance in accordance with the corrective actions specified above, unless the Engineer permits other corrective actions.

Furnish the North Carolina Hearne Straightedge(s) necessary to perform this work. Maintain responsibility for all costs relating to the procurement, handling, and maintenance of these devices. The Department has entered into a license agreement with a manufacturer to fabricate, sell, and distribute the N.C. Hearne Straightedge. The Department's Pavement Construction Section may be contacted for the name of the current manufacturer and the approximate price of the straightedge.

No direct payment will be made for the work covered by this section. Payment at the contract unit prices for the various items covered by those sections of the specifications directly applicable to the work constructed will be full compensation for all work covered by this section including, but not limited to, performing testing in accordance with this specification, any corrective work required as a result of this testing and any additional traffic control as may be necessary.

ASPHALT PAVEMENTS - HOT IN-PLACE RECYCLING:

3-20-07

SPI

Revise the *2006 Standard Specifications* as follows:

Page 6-84, Article 663-1 Description

Third paragraph, last sentence, delete the word *herein* and substitute the words *elsewhere in the contract*.

Page 6-84, Article 663-2(A) Hot Mix Asphalt Admixture

First paragraph, add the following two sentences after the third sentence in this paragraph:

Unless otherwise approved, the asphalt binder PG Grade in the admixture shall be PG 64-22, regardless of the grade required for the HIR Mix Type by Table 663-2. In addition, use at least 0.25% anti-strip additive in asphalt binder used in admixtures.

Page 6-88, Article 663-3Delete *Table 663-2* and substitute the following *Table 663-2*:**TABLE 663-2 HIR MIX DESIGN CRITERIA**

Mix Type	Design	Binder	Compaction Levels		Volumetric Properties (b)			
	ESALs millions	PG Target Grade	No. Gyration @		AASHTO R 35 Modified			
	(a)	(c)	N _{ini}	N _{des}	% Min.	%	Min. - Max.	@ N _{ini}
SF-9.5A	<0.3	64 -22	6	50	16.0	3.0 - 5.0	70 - 80	≤ 91.5
S-9.5A	<0.3	64 -22	6	50	16.0	3.0 - 5.0	70 - 80	≤ 91.5
S-9.5B	0.3 - 3	64 -22	7	75	15.0	3.0 - 5.0	65 - 80	≤ 90.5
S-9.5C	3 - 30	70 -22	8	100	15.0	3.0 - 5.0	65 - 76	≤ 90.0
S-12.5B	3 - 30	70 -22	7	75	14.0	3.0 - 5.0	65 - 78	≤ 90.0
S-12.5C	3 - 30	70 -22	8	100	14.0	3.0 - 5.0	65 - 75	≤ 90.0
I-19.0B	< 3	64 -22	7	75	13.0	3.0 - 5.0	65 - 78	≤ 90.5
I-19.0C	3 - 30	64 -22	8	100	13.0	3.0 - 5.0	65 - 75	≤ 90.0
	Design Parameter				Design Criteria			
All Mix Types	Penetration(AASHTO T 49) from Absom Recovery(AASHTO T 170)				40 -80			

Notes: (a) Based on 20 year design traffic.(b) Volumetric Properties based on specimens compacted to N_{des} as modified by the Department. Mix Design Criteria may be modified subject to the approval of the Engineer.

(c) This is the binder grade target of the combined asphalt binder to be incorporated into the HIR mix, including asphalt binder in the existing pavement, binder in admixture, if required, and rejuvenating agent, if required. All admixtures will be produced using PG 64-22 unless otherwise approved.

Page 6-88, Article 663-3(C) Job Mix FormulaSecond Paragraph, second sentence, delete the words *Superpave Version*.**Page 6-91, Article 663-5 Construction Requirements**

Delete the first paragraph on this page and substitute the following:

The HIR layer thickness specified in the plans or contract shall be the compacted in-place thickness of the rejuvenated mixture layer, including any admixture, if required. The average thickness of the compacted HIR layer shall be within +/- 1/4 inch of the thickness shown on the typical section. The average thickness shall be determined in accordance with the provision Quality Management System for Asphalt Pavements (Hot In-Place Recycled Asphalt Concrete) included herein.

Page 6-91, Article 663-6 Measurement and Payment

Second paragraph, delete the word *Emulsified*.

Delete the fourth paragraph and substitute the following:

Asphalt Binder for Admixture, Grade PG 64-22 will be paid for as the theoretical number of tons of asphalt binder required by the applicable job mix formula based on the actual number of tons of admixture used and accepted on the job.

Page 6-92, Article 663-6 Measurement and Payment

Add the following Pay Item and Pay Unit.

Pay Item	Pay Unit
Asphalt Binder for Plant Mix, Grade PG 64-22	Ton

QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS

(Hot In-Place Recycled Asphalt Concrete)

3-20-07

SPI

A) Description

Produce and construct Hot In-Place Recycled (HIR) asphalt concrete pavements. Work and materials shall conform to Division 6 of the *Standard Specifications*. Perform all quality control activities in accordance with the Department’s *Hot Mix Asphalt Quality Management System (HMA/QMS) Manual*.

(B) Description of Responsibilities

(1) Quality Control

The Contractor shall provide and conduct a quality control program. A quality control program is defined as all activities, including mix design, process control inspection, sampling and testing, and necessary adjustments in the process that are related to production of a pavement which meets all requirements of the specifications.

(2) Quality Assurance

The Department will conduct a quality assurance program. A quality assurance program is defined as all activities, including inspection, sampling, and testing related to determining that the quality of the completed pavement conforms to specification requirements.

(C) Mix Design/Job Mix Formula Requirements

All mix design and job mix formula requirements of Article 663-3 of the *Standard Specifications* and the contract documents shall apply. In addition, submit Superpave gyratory compactor printouts for all specimens required to be compacted during the mix design process.

(D) Field Verification of Mixture and Job Mix Formula Adjustments

The Contractor shall conduct field verification of the hot in-place recycled mix at the beginning of production of each new mix design. Beginning production shall be limited to a maximum of 2500 linear feet of laydown width for the purpose of performing the field verification tests. In addition to the required sampling and testing, all preliminary checks and equipment calibrations shall be performed. Retain records of these calibrations and mix verification tests, including Superpave Gyrotory Compactor (SGC) printouts at the QC laboratory. In addition, furnish copies of all calibrations and mix verification tests to the Engineer for review and approval before beginning normal production of the HIR mix.

Field verification testing shall consist of a minimum of 1 set of samples tested according to "Required Sampling and Testing" specified elsewhere in this provision. The field verification mix sample shall be obtained from the completed hot in-place recycled mix prior to laydown and compaction and split in accordance with current procedures in the *HMA/QMS Manual*. Normal production shall not begin until all field verification test results have been completed and approved by the Engineer. Verification is considered satisfactory when all volumetric properties except $\%G_{mm}@N_{ini}$ are within the applicable mix design criteria and the gradation, binder content, and $\%G_{mm}@N_{ini}$ are within the individual limits for the mix type being produced, unless otherwise approved by the Engineer.

If the Contractor and/or the Engineer determine from results of quality control tests conducted during mix verification that adjustments to the JMF are necessary to achieve specified mix properties, adjustments to the JMF may be made within tolerances permitted by specifications for the mix type being produced. All JMF adjustments will be approved by the Engineer and documented in writing.

Failure by the Contractor to fully comply with the above mix verification requirements shall result in immediate production stoppage by the Engineer. Normal production shall not resume until all mix verification sampling and testing, and calibrations have been performed and approved by the Engineer. Any mix produced that is not verified may be assessed a price reduction at the Engineer's discretion in addition to any reduction in pay due to mix and/or density deficiencies.

(E) Contractor's Quality Control System**(1) Personnel Requirements**

The Contractor shall provide a certified Hot-In-Place Recycling Asphalt Plant Technician Level I to perform quality control operations and activities at all times during production of hot in-place recycled mix on the project. The Contractor shall also have a certified Asphalt Plant Technician Level II readily available to supervise, coordinate, and make any necessary process adjustments in the HIR asphalt mixture.

In addition, a certified Plant Technician Level I shall be provided at the asphalt plant during production of the hot mix asphalt admixture, if required. A plant operator who is a certified Asphalt Plant Technician Level I may be used to meet

this requirement when daily production for the admixture is less than 100 tons, provided the randomly scheduled increment sample as defined elsewhere in this provision, is not due. When performing in this capacity, the plant operator will be responsible for all quality control activities that are necessary and required. The Contractor producing the admixture shall also have a certified Asphalt Plant Technician Level II readily available to supervise, coordinate, and make any necessary process adjustments in the hot mix asphalt admixture.

Any absence of either Level I Technician, other than those for normal breaks and emergencies, shall be pre-approved by the appropriate QA Supervisor or his designated representative. Any extended absence of the Technician that has not been approved will result in immediate suspension of production by the Engineer. A plant technician may serve in more than one of the above capacities; however, all specification requirements shall still apply.

The Contractor shall provide a certified QMS Roadway Technician with each hot in-place recycling operation at all times during production and placement of asphalt. This person is responsible for monitoring all roadway paving operations and all quality control processes and activities, to include stopping production or implementing corrective measures when warranted.

The Contractor shall provide a certified nuclear gauge operator when nuclear density control is being used.

All certifications shall be in accordance with the Department's current asphalt technician certification program.

(2) Field Laboratory Requirements

The Contractor shall furnish and maintain a Department certified laboratory for quality control testing of the hot in-place recycled mix. The laboratory shall be located either at or near the project site. In either case, all other requirements of these specifications shall apply. The laboratory may be either stationary or portable and shall include all necessary equipment and supplies for performing required Contractor quality control testing. The Contractor shall also furnish a certified laboratory for the quality control testing of the hot mix asphalt admixture, if required. This laboratory may be located at the plant site or may be the laboratory provided at the project site for testing of the hot in-place recycled mix. Convenient telephone and fax machine access for QMS personnel shall be provided by the Contractor at the plant laboratory site producing the admixture and the laboratory site testing the completed mix from the roadway.

(3) Field Laboratory Equipment

The laboratory testing equipment shall meet the requirements of the test methods identified as Required Sampling and Testing shown elsewhere in this provision.

Laboratory equipment furnished by the Contractor or his representative shall be properly calibrated and maintained. The Engineer shall be allowed to inspect measuring and testing devices to confirm both calibration and condition. If at any time the Engineer determines that the equipment is not operating properly or is

not within the limits of dimensions or calibration described in the applicable test method, the Engineer may stop production until corrective action is taken. The Contractor shall maintain a record of calibration results at the laboratory.

(4) Required Sampling and Testing (Mixtures)

All mix sampling, testing, data analysis and data posting shall be performed or directly supervised by a certified HIR QMS Asphalt Plant Technician.

The Contractor's quality control process shall include, at a minimum but not limited to, the sampling and testing of all parameters outlined in these provisions using test methods and frequencies as specified herein. The Contractor shall obtain randomly selected samples of hot in-place recycled mix prior to the laydown and compaction processes. A minimum of one random mix sample of 200 pounds shall be taken from each 5000 linear foot section of roadway being remixed. The Contractor shall also obtain a minimum of one randomly selected 90 pound sample of the hot mix asphalt admixture, when required, from each 200 ton increment of admixture production. The admixture samples shall be taken from the truck at either the plant site or project site. The random samples shall be obtained in accordance with AASHTO T 168 Modified and at location(s) determined in accordance with procedures specified in ASTM D3665 Modified. All samples shall be split and retained in accordance with the procedures in the most current edition of the Department's "*HMA/QMS Manual*" and shall be logged on forms provided by the Engineer.

The untested split portions of the hot in-place recycled mix sample and hot mix asphalt admixture sample shall be retained for 5 calendar days at the appropriate laboratory site by the Contractor commencing the day the samples are tested. The QC Superpave Gyratory Compactor (SGC) specimens shall be retained for 5 calendar days commencing the day the specimens are prepared. Disposal permission may be given by Quality Assurance personnel prior to these maximum storage periods. The split portion of the Contractor's mix verification sample shall be retained until disposal permission is given by QA personnel. All retained samples shall be stored in a dry and protected location.

The Contractor shall maintain minimum test frequencies as established above. All tests shall be completed within 24 hours of the time the sample was taken, unless specified otherwise in these provisions. Should the specified tests not be completed within the required time frame, production will cease at that point until such time the tests are completed.

The Contractor may use innovative equipment or techniques not addressed by these specifications to produce and/or monitor the production of the mix, subject to approval by the Engineer.

Should the Contractor's testing frequency for hot in-place recycled mix fail to meet the minimum frequency requirement, all mix without the specified test representation shall be considered unsatisfactory. If the Engineer allows the mix to remain in place, payment will be made at 50 percent of the contract unit bid price for the hot in-place recycling.

Should the Contractor's testing frequency for the hot mix asphalt admixture fail to meet the minimum requirements, all admixture without test representation shall be considered unsatisfactory and will be paid for at 50 percent of the contract unit bid price for the admixture.

(5) Quality Control Sampling and Testing Schedule (Mixtures)

Perform the following test series on all regularly scheduled random samples.

- (a) Hot In-Place Recycled Mix: Sampled from the paver at the roadway (AASHTO T 168 Modified) (split sample required)
- (i) Blended aggregate recovered from hot in-place recycled mix sample (AASHTO T-30) shall be graded on all sieves specified on the job mix formula.)
 - (ii) Binder Content, % (Contractor may select any option below)
 - (a) Extraction (AASHTO T-164)
 - (b) Ignition Furnace (AASHTO T 308 Modified)
 - (c) OTHER: Contractor may request to use other means of checking Binder Content subject to approval by the Engineer.
 - (iii) Maximum Specific Gravity (AASHTO T 209 or ASTM 2041), optional (ASTM 6857)
 - (iv) Bulk Specific Gravity of Compacted Specimens (AASHTO T 312), (AASHTO T 166), (optional ASTM 6752)
 - (v) Air Voids (VTM) (AASHTO T 269) Average of 3 specimens at N_{des} gyrations
 - (vi) Voids in Mineral Aggregate (VMA) (calculation)
 - (vii) Voids Filled with Asphalt (VFA) (calculation)
 - (viii) $P_{0.075}/P_{be}$ Ratio (calculation)
 - (ix) % Maximum Specific Gravity at N_{ini} (calculation)
- (b) **Hot Mix Asphalt Admixture (if required)**
- 1. Binder Content, % (Contractor may select any option below)
 - a. Extraction (AASHTO T-164)
 - b. Ignition Furnace (AASHTO T 308 Modified)
 - c. OTHER: Contractor may request to use other means of checking AC Content subject to approval by the Engineer
 - 2. Blended aggregate recovered from admixture sample (AASHTO T-30) (Shall be graded on all sieves specified on the job mix formula.)
- (c) In addition to the above sampling and testing program, the following test shall be conducted as indicated:
- 1. Penetration Test (AASHTO T 49) from Abson Recovery (AASHTO T 170).

Test performed on hot in-place mix sampled from roadway during field verification and at a minimum of weekly thereafter; however, penetration results are not required for approval of the field verification. Recovery and Penetration Test may be performed at an off-site laboratory. Results shall be furnished to the Engineer within 3 working days of obtaining the sample. Penetration test results should be within the range specified in Table 663-2.

2. Rut Test specimens in accordance with Article 610-3.

(6) Documentation (Records)

The Contractor shall document all activities, records of inspection, samples taken, adjustments to the mix, and test results on a daily basis. The results of observations and records of inspection shall be noted as they occur in a permanent field record. Adjustments to mix production and test results shall be recorded on forms provided.

Identify any additional quality control samples taken and tested at times other than the regularly scheduled random samples or directed samples which take the place of regularly scheduled as process control (PC) samples on the appropriate forms. Process Control test results should not be plotted on control charts nor reported to Quality Assurance Laboratory. Process control sample test results are for the Contractor's purposes only.

Make all such records available to the Engineer, upon request, at any time during project construction. Complete all QC records and forms and distribute in accordance with the most current edition of the Department's "*HMA/QMS Manual*". Maintain all QC records, forms and equipment calibrations for a minimum of 3 years from their completion date.

Failure to maintain QC records and forms as required, or to provide these records and forms to the Engineer upon request, may result in production and/or placement stoppage until the problem is resolved.

Falsification of test results, documentation of observations, records of inspection, adjustments to the process, discarding of samples and/or test results, or any other deliberate misrepresentation of the facts will result in the revocation of the applicable person's QMS certification. The Engineer will determine acceptability of the mix and/or pavement represented by the falsified results or documentation. If the mix and/or pavement in question is determined to be acceptable, the Engineer may allow the mix to remain in place at no pay for mix processing, admixture, asphalt binder, rejuvenating agent and/or other mix components. If the mix and/or pavement represented by the falsified results are determined not to be acceptable, reprocess or remove and replace with mix that complies with the Specifications as approved by the Engineer. Payment will be made for the actual quantities of materials required to reprocess or replace the falsified quantities, not to exceed the original amounts.

(7) Documentation (Control Charts)

Standardized control charts furnished by the Department shall be maintained by the Contractor at the appropriate field laboratory. For mix incorporated into the project, record full test series data from all regularly scheduled random samples, or directed samples which replace regularly scheduled random samples, on control charts the same day the tests are obtained. Process Control (PC) test results should not be plotted on control charts nor reported to Quality Assurance Laboratory.

Results of quality assurance tests performed by the Engineer will be posted on the Contractor's control charts as data becomes available.

The following data shall be recorded on standardized control charts:

(8) Hot In-Place Recycled Mix

(a) Aggregate Gradation Test Results:

1. For each mix type: one sieve size smaller than the mix nominal maximum size.
2. For all mix types: 2.36 mm and 0.075 mm sieves

(b) Binder Content, %, P_b

(c) Bulk Specific Gravity of Compacted Specimens at N_{des} (measured)

(d) Maximum Specific Gravity Determined by AASHTO T 209

(e) Percent Voids in Total Mix at N_{des} Gyration

(f) Percent Voids in Mineral Aggregate at N_{des} Gyration

(9) Hot Mix Asphalt Admixture, if required

(a) Binder Content, %, P_b

(b) 0.075 mm sieve

(c) 2.36 mm sieve

Both the individual test value and the moving average of the last 4 data points will be plotted on each chart. The Contractor's test data will be shown in black and the moving average in red. The Engineer's assurance data will be plotted in blue. The warning control limits shall be drawn with a dash green line and individual test limits with a dash red line.

Maintain a continuous moving average with the following exceptions. Re-establish a new moving average only when:

- (a) A change in the binder percentage or aggregate blend is made in the JMF, or,
- (b) When the Contractor elects to stop or is required to stop production after one or two moving average values, respectively, fall outside the warning limits as shown elsewhere in this provision, or
- (c) If failure to stop production after two consecutive moving averages exceed the warning limits occurs, but production does stop at a subsequent time, re-establish a new moving average beginning at the actual production stop point.

In addition, re-establish the moving averages for all mix properties. Moving averages will not be re-established when production stoppage occurs due to an individual test result exceeding the individual test limits and/or Specifications.

All individual test results for regularly scheduled random samples or directed samples which replace regularly scheduled samples are part of the plant quality control record and shall be included in moving average calculations with the following exception. When the Contractor's testing data has been proven incorrect, use the correct data as determined by the Engineer in lieu of the Contractor's data to determine the appropriate pay factor in accordance with Article 105-3. In this case, replace the data in question and any related data proven incorrect.

(10) Control Limits

The following shall be considered control limits for mix production. For each criterion, the warning limits are based on a moving average of the last 4 data points. All control limits will be applied to target data as specified on the below tables.

HIR Asphalt Mixture Control Limits

Control Criteria	Target Source	Warning Limits	Individual Test Limits
2.36 mm Sieve	JMF	± 4.0	± 8.0
0.075 mm Sieve	JMF	± 1.5	± 2.5
Binder Content, %	JMF	± 0.3	± 0.7
VTM, % @ N _{des}	JMF	± 1.0	± 2.0
VMA, % @ N _{des}	Min. Spec. Limit	- 0.5	- 1.0
%Gmm @ N _{ini}	Max Spec. Limit	N/A	+2.0%

HMA Admixture Control Limits (If Required)

Control Criteria	Target Source	Warning Limits	Individual Test Limits
Binder Content, %	JMF	± 0.3	± 0.7
0.075 mm Sieve	JMF	± 1.5	± 2.5
2.36 mm Sieve (If Applicable)	JMF	± 4.0	± 8.0

(g) Corrective Action

Immediately notify the Engineer when moving averages exceed the warning limits. All required corrective actions are based upon initial test results and shall be taken immediately upon obtaining those results. In the event situations occur which warrant more than one corrective action and/or adjustment, give precedence to the more severe of these actions. Stopping production when required takes precedence over all other corrective actions. Document all corrective actions.

Immediately cease production and immediately notify the Engineer when either of the following occurs:

1. When an individual test result for a mix control criteria exceeds both the individual test control limits and the applicable specification design criteria, or
2. When two consecutive binder content test results exceed the individual limits.
3. When two consecutive penetration test results exceed the range specified in Table 663-2.

Do not resume normal HIR asphalt production and/or HMA Admixture production until approval has been granted by the appropriate QA Supervisor.

Acceptance of all mix failing to meet the individual test control limits as described above will be determined in accordance with Article 105-3. In addition, any mix that is deemed unacceptable will be rejected for use in the work. All unacceptable HIR asphalt mixture shall be remilled and reprocessed to comply with the Specifications, provided the quality of the HIR mixture is such that it can be reprocessed to meet specification requirements. Should the applicable HIR mixture not be of adequate quality such that it can be reprocessed to meet the specification requirements, remove and replace the unacceptable material with the appropriate thickness and type of HMA in accordance with Section 610 of the *Standard Specifications*. In either case payment will be made only for the applicable original HIR quantities. There shall be no direct pay for any required corrective action(s) performed by the Contractor.

Failure to stop production and make adjustments when required due to an individual test not meeting the specified requirements shall subject all mix from the stop point tonnage to the point when the next individual test is back on or within the warning limits, or to the tonnage point when production is actually stopped, whichever occurs first, to be considered unacceptable.

If two consecutive moving average values for any one of the mix control criteria fall outside the warning limits, the Contractor shall cease production of that mix and make adjustments. The Contractor may elect to stop production after only one moving average value falls outside the warning limits. In either case, a new moving average shall not be determined until the fourth test after the elective or mandatory stop in production.

Do not resume normal HIR asphalt production and/or HMA Admixture production until approval has been granted by the appropriate QA Supervisor.

If the process adjustment improves the property in question such that the moving average after four additional tests is on or within the warning limits, the Contractor may continue production with no reduction in payment.

If the adjustment does not improve the property in question such that the moving average after four additional tests is not on or within the warning limits, the applicable mix shall be accepted in accordance with Article 105-3. The quantity of mix in question will be determined by the Engineer. Any mix that is deemed unacceptable will be rejected for use in the work.

Failure to stop production and make adjustments as described above due to two consecutive moving average values falling outside the warning limits shall subject all mix produced from the stop point tonnage to the tonnage point when the moving average is back on or within the warning limits, or to the tonnage point when production is actually stopped, whichever occurs first, to be considered unacceptable.

(11) Allowable Retesting for Mix Deficiencies

The Contractor may elect to resample and retest for hot in-place recycled mix deficiencies when individual QC test(s) exceed one or more of the mix property target(s) by more than the tolerances indicated below. Perform retesting within 10 days after the initial test results are determined. Retesting shall be approved by the Engineer prior to being performed and in accordance with the Department's "Guidelines For Retests Of Plant Mix Deficiencies" as outlined in the HMA/QMS Manual, except sub-lots will be based on equivalent linear feet in lieu of tonnage. The Contractor will perform these tests under the supervision of the Department's QA personnel. Retests for any mix deficiency other than as listed below will not be allowed unless otherwise permitted by the Engineer. Acceptance of the mix in question will be based on the retest data in accordance with Article 105-3. The Department reserves the right to direct the Contractor to resample and retest at any time or location as directed by the Engineer.

Air Voids (VTM)	by more than +/- 2.5%
Binder Content	by more than +/- 1.0%
VMA	by more than - 2.0%
0.075 mm sieve	by more than +/- 3.0%
2.36 mm sieve	exceeds Specification Mix Design Limits and one or more of the above tolerances are also exceeded

(E) Quality Assurance of Mix

The Department shall furnish certified plant technicians responsible for its' quality assurance of the HIR mix. Quality assurance will be accomplished in the following ways:

- (1) By conducting assurance testing of split samples obtained by the Contractor at a frequency equal to or greater than 5% of the frequency required of the Contractor;

- (2) By periodically observing sampling and testing procedures performed by the Contractor;
- (3) By monitoring required control charts exhibiting test results of control parameters;
- (4) By directing the Contractor to take additional samples at any time and any location during production (in lieu of the next scheduled random sample for that increment) and;
- (5) By conducting verification sampling and testing on samples taken independently of the Contractor's quality control samples at a frequency equal to or greater than 10% of the required QC sample frequency; and
- (6) By any combination of the above

In all cases, the Engineer's quality assurance and verification testing will be independent of the Contractor's tests. The Department's quality assurance program will be conducted by a certified QMS technician(s).

The Engineer will conduct assurance tests on split samples taken by the Contractor for quality control testing. These samples may be the regular quality control samples or a sample selected by the Engineer from any location in the process. The frequency will be equal to or greater than 10% of that required of the Contractor as stated in "Required Sampling and Testing". The Engineer may select any or all split samples for assurance testing. Results of quality assurance tests will be provided to the Contractor within 3 working days after the sample has been obtained. Differences between the Contractor's and the Department's split sample test results will be considered acceptable if within the following limits:

<u>Test Parameter</u>	<u>Acceptable Limits of Precision</u>
12.5 mm Sieve	±6.0
9.5 mm Sieve	±5.0
4.75 mm Sieve	±5.0
2.36 mm Sieve	±5.0
0.075 mm Sieve	±2.0
Binder Content, %	±0.5
Maximum Specific Gravity Mix, G_{mm}	±0.020
SGC Bulk Specific Gravity, G_{mb}	±0.030
QA Retest of QC Gyrotory Compacted Volumetric Specimens	±0.015

The Engineer will immediately investigate the reason for differences if any of the following occur:

- (1) QA test results of QC split sample does not meet above limits of precision, or
- (2) QA test results of QC split sample does not meet the individual test control limits or the specification requirements, or
- (3) QA verification sample test results exceed the allowable retesting tolerances.

If the potential for a pavement failure exist, the Engineer may suspend production, wholly or in part, in accordance with Article 108-7 while the investigation is in progress. The Engineer's investigation may include, but not be limited to the following:

- (1) Joint testing of any remaining split samples,
- (2) Review and observation of the QC technician's sampling and testing procedures,
- (3) Evaluation and calibration of QC testing equipment,
- (4) Comparison testing of other retained quality control samples,

If additional mix samples or core samples are necessary to resolve the difference, these samples will be taken as directed and tested jointly by the Contractor's quality control and Department's quality assurance personnel. If reasons for the difference cannot be determined, payment for the mix in question will be determined in accordance with Article 105-3. If the reason for the difference is determined to be an error or other discrepancy in the quality control test results, the applicable quality assurance test results or verification test results will be used to determine compliance with the applicable mix or density specification requirements.

The Engineer will periodically witness the sampling and testing being performed by the Contractor. If the Engineer observes that the sampling and quality control tests are not being performed in accordance with the applicable test procedures, the Engineer may stop production until corrective action is taken. The Engineer will promptly notify the Contractor of observed deficiencies, both verbally and in writing. The Engineer will document all witnessed samples and tests.

(F) Acceptance of Mix

The Engineer will base final acceptance of the mix on the results of random testing made on split samples during the assurance process and validation of the Contractor's quality control process as shown elsewhere in this provision.

(G) Thickness Quality Management

- (1) **Quality Control of Compacted HIR Mix Thickness**
The Contractor shall perform quality control of the compacted HIR mix thickness in accordance with these provisions.

The minimum frequency of checking the thickness shall be one randomly located 6 inch core for each 2000 linear feet or fraction thereof per day of completed HIR lane width pavement with a minimum of three cores per day. If core sample control is used for density control, the required density core samples shall also be used to determine thickness compliance. If the Contractor elects to use nuclear density control, the core samples for thickness shall be located and taken in accordance with the random sampling procedures for density core samples in the current HMA/QMS Manual and shall be logged on the QC-5 Form.

The thickness shall be determined by the average measurement of cores taken from the compacted HIR mix. Individual cores shall be measured at the approximate quarter points of the core and these four measurements averaged for the individual core thickness. Each average core thickness measurement shall be

to the nearest 1/8 inch and reported on the QC-5 Form. The thickness of all cores for each day's placement shall be averaged to determine compliance with these specifications.

When the day's average thickness is less than the depth specified on the plans by more than 1/4 inch, corrective action shall be initiated. When two consecutive days' averages from the above sets of measurements exceed the tolerance specified, work shall be stopped until the process is corrected.

(2) Quality Assurance of Compacted HIR Mix Thickness:

(a) Thickness Quality Assurance

The Departments quality assurance program for compacted mix thickness will consist of the following:

1. By re-measuring randomly selected quality control core measurements at a frequency equal to or greater than 5% of the frequency required of the Contractor;
2. By measuring randomly selected comparison core samples taken adjacent to the Contractor's QC core samples (8 inches center-to-center) at a frequency equal to or greater than 5% of the frequency required of the Contractor,
3. By conducting verification core measurements independently of the Contractor's quality control measurements at a frequency equal to or greater than 10% of the required QC sample frequency; and
4. By periodically observing measurements performed by the Contractor.
5. Comparison and verification core samples will be taken in the presence of a DOT technician and immediately turned over to that technician for measurement.

(b) Limits of Precision

Differences between the Contractor's and the Department's thickness measurements will be considered acceptable if within the following limits of precision:

Remeasurement of QC Measurement	+/- 1/8 inch
Comparison QA Core Measurement	+/- 1/8 inch
QA Verification Core Measurement	+/- 1/4 inch

The Engineer will immediately investigate the reason for the differences if any of the following occur:

1. QA core sample measurement(s) does not meet the above limits of precision, or
2. QA comparison or verification core sample measurement(s) is less than the depth specified on the plans by more than 1/4 inch.

(3) Acceptance of Compacted HIR Mix Thickness

The Department will evaluate the finished asphalt pavement for thickness compliance using the Contractor's thickness quality control test results, the Department's quality assurance test results, and by observation of the Contractor's thickness quality control process as outlined in Subarticle 8.1. Any pavement found to be deficient in thickness by more than ¼ inch shall be evaluated for acceptance in accordance with Article 105-3 of the *Standard Specifications*.

(H) Field Compaction Quality Management

(1) Contractor Quality Control of Density

(a) General

Perform quality control of the compaction process in accordance with these provisions and applicable requirements of Article 610-9 and 610-10 of the *Standard Specifications*. The Contractor may elect to use either cored sample density procedures or nuclear gauge density procedures. Provide to the Department at the pre-construction conference the method of density quality control that will be used on the project.

Establish acceptable control strips when required at locations approved by the Engineer. Construct control strips that are 300 feet in length at the paver laydown width being recycled and placed. When utilizing core sample control, place control strips anytime placement is proceeding on limited production due to failing densities. When utilizing nuclear density control, place control strips at the minimum frequencies specified in the Department's current *Nuclear Gauge Operator's Manual*. In addition, place control strips anytime deemed necessary by the Engineer.

Conduct density sampling and testing by either method based on test sections consisting of not more than 2000 linear feet or fraction thereof per day on pavement recycled and placed at the paver laydown width.

Perform the sampling and testing at the minimum test frequencies as specified above. Should the density testing frequency fail to meet the minimum frequency as specified above, all mix without the required density test representation will be considered unsatisfactory and if allowed to remain in place, will be paid for at 50 percent of the contract unit bid price for the mixture.

Conduct all QC nuclear density testing the same day that the mix being tested is placed and compacted. Obtain all core samples no later than the beginning of the next production day, not to exceed three (3) calendar days. Test QC core samples and submit test results within one working day of the time the samples are taken. Should the specified density tests not be completed within the allowable time cease production at that point until such time the required tests are completed. Failure to provide samples may result in suspension of all project operations.

Retain quality control density core samples at the Contractor's QC laboratory located on or near the project for 5 calendar days, commencing the day the samples are tested, or until permission for disposal is granted by the quality assurance personnel, whichever occurs first. Retain the Department's quality assurance comparison and verification core samples in a sealed container at the above laboratory site until obtained by quality assurance personnel. Store all retained density samples on a smooth, flat surface in a cool, dry, and protected location.

Check core samples may be taken by the Contractor for any of the following reasons:

1. When core sample control is being used and a test section core sample(s) is more than 2.0 percent below the average of all core samples from the same lot, that core(s) samples may be checked,
2. When a control strip fails and a core sample(s) is more than 2.0 percent below the average of the control strip, that core(s) may be checked.

For each core sample that is to be checked, take 3 check samples as follows: one adjacent to the initial sample and one ten feet in each direction, longitudinally, of the initial sample. The results of these 3 check samples will be averaged and this average will be used in lieu of the initial core results in question. The initial core sample results will not be used if check samples are taken.

Check samples shall be taken within 2 calendar days of the date of the initial sample. Only one set of check samples per sample location will be allowed. If full depth cores are necessary at these check sample locations, separation of the layer to be tested will be the responsibility of the Contractor. Take all check samples in the presence of a representative of the Engineer. In addition, a QA comparison core sample(s) may be taken adjacent to one or more of these check samples.

(b) Pavement Samples (Cores)

When cored samples are required by either density method, obtain cores from the full layer depth of the compacted pavement at random locations determined in accordance with procedures in the Department's *HMA/QMS Manual*. If full depth cores are taken, the Contractor is responsible for separating the layer of mix to be tested in a manner such that it is not damaged. The use of a separator medium beneath the layer to be tested is prohibited.

Pavement layers may be cooled by approved artificial methods to allow cutting the core samples as quickly as possible. No additional compensation will be made for the costs of artificial cooling.

Take pavement specimens for density testing purposes utilizing a 6 inch core drill. Use approved coring equipment that is capable of taking a representative sample of the compacted pavement. In the event a malfunction of the coring equipment occurs, use other approved means to obtain the required samples. Repair the coring equipment and restore to use within three working days.

Where samples have been taken, clean the inside surfaces of the sample hole, dry, properly apply tack coat, place and compact new mix of the same type to conform with the surrounding area within one working day of the sample being taken. Use a circular tamp or other approved device to achieve compaction.

(c) Core Sample Density Procedures

In addition to the above requirements, perform core sample density control procedures as noted herein. When cored sample control is being used, the testing frequency will be a minimum of one random 6 inch core sample taken from each test section, except take a minimum of at least three core samples from each mix type and/or lot placed on a given day.

An initial control strip is not required at the beginning of placement of each job mix formula but may be performed by the Contractor for use in determining the necessary compactive effort and roller patterns. Cored sample control strips will be required if production and placement is being performed under limited production procedures due to failing densities.

(d) Nuclear Gauge Density Procedures

Perform nuclear density control procedures in accordance with the Department's most current *Nuclear Gauge Operator's Manual*. This *Manual* may be obtained through the Department's M & T Soils Laboratory. Determine density by the backscatter method of testing using a thin-lift nuclear gauge, with printer, which has been approved by the Department. Furnish, maintain, and operate the nuclear gauge. Furnish an operator that has been certified by the Department.

Provide a gauge that has been calibrated within the previous 12 months by an approved calibration service. Maintain documentation of such calibration service for a 12 month period.

Conduct all QC nuclear density tests the same day the mix being tested is placed and compacted. Furnish summary of density results to the Engineer no later than the end of each day's production. Furnish a copy of the nuclear gauge printout(s) to the Engineer upon request.

Determine target density for testing by constructing control strip(s) in accordance with and at the frequencies prescribed in the *Nuclear Gauge Operator's Manual*. Core samples from the control strips may be checked in accordance with the criteria established above.

Conduct sampling and testing as specified based on test sections consisting of not more than 2000 linear feet or fraction thereof per day on pavement recycled and placed at the paver laydown width. The nuclear density testing frequency will consist of five random gauge readings (one random reading from each of five equally spaced increments) from each test section. In addition, take at least five gauge readings during any day's production of a given mix type. Random locations for gauge readings will be determined in accordance with the procedures in the Department's most current *Nuclear Gauge Operator's Manual*. Test section pavement shall be of the same mix design as the pavement used in the applicable control strip.

(e) Limited Production Procedure

Proceed on limited production when three consecutive failing density lots occur, not to exceed two production days, or two consecutive failing nuclear control strips occur for the same mix type. A failing density lot is defined as one in which the average results of all density test sections fail to meet the minimum specification requirement for that applicable mix type. A failing nuclear control strip is defined as one in which the average of the 5 core samples results fail to meet the minimum specification requirement for that applicable mix type.

Limited production is defined as being restricted to the remixing, placement, and compaction of the quantity of HIR mix generated from the incorporation of one load of admixture or 1000 linear feet of remixed pavement at the laydown width, whichever is greater. A 300 foot density control strip shall be located at the approximate midpoint of this pavement.

Remain on limited production until such time as satisfactory density results are achieved or until two control strips have been attempted without achieving acceptable density test results. If the Contractor fails to achieve satisfactory density after two control strips have been attempted, cease production of that mix type until such time as the cause of the failing density test results can be determined.

Should the Contractor not operate by the limited production procedures as specified above, the two consecutive failing production days and all mix produced thereafter will be considered unacceptable. This material shall either be reprocessed, or removed and replaced with material that complies with the Specifications, unless otherwise approved by the Engineer.

(I) Quality Assurance of Density

The Department shall furnish certified plant and roadway technicians responsible for its' quality assurance of density. The Departments quality assurance program for density will consist of the following:

- (1) By retesting randomly selected quality control test sections (either cores or nuclear);
- (2) By periodically observing tests performed by the Contractor;
- (3) By testing randomly selected comparison core samples taken adjacent to the Contractor's quality control core samples (8" center-to-center) at a frequency equal to or greater than 5% of the frequency required of the Contractor;
- (4) By conducting verification sampling and testing on test sections (either core or nuclear) independently of the Contractor's quality control test sections at a frequency equal to or greater than 10% of the required QC sample frequency;
- (5) By periodically directing the recalculation of random locations for the Quality Control core or nuclear density test sites.

Comparison and verification core samples will be taken in the presence of a Department QA technician and either delivered directly to the appropriate QA Lab by a DOT technician or placed in a sealed container and delivered to the Contractor's QC Lab for QA testing.

Results of all density quality assurance tests will be provided to the Contractor within 3 working days after the samples have been obtained by the QA personnel.

Differences between the Contractor's quality control and the Department's quality assurance test results will be considered acceptable if within the following limits.

Test	Acceptable Limits of Precision
Retest of QC Core Sample	±1.2% (% Compaction)
Comparison QA Core Sample	±2.0% (% Compaction)
QA Verification Core Sample	±2.0% (% Compaction)
Nuclear Comparison of QC Test Section (Average of 5 Tests in Test Section)	±2.0 %(% Compaction)
QA Nuclear Verification Test	±2.0% (% Compaction)

The Engineer will immediately investigate the reason for differences if any of the following occur:

- (1) QA test results does not meet above limits of precision, or
- (2) QA comparison test results does not meet the minimum specification requirements,
- (3) QA verification test results does not meet the minimum specification requirements

If the potential for a pavement failure exist, the Engineer may suspend production, wholly or in part, in accordance with Article 108-7 while the investigation is in progress. The Engineer's investigation may include, but not be limited to the following:

- (1) Review and observation of the QC technician's sampling and testing procedures,

- (2) Evaluation and calibration of QC testing equipment,
- (3) Joint comparison testing of other retained quality control core samples, and/or additional density core samples.
- (4) Joint comparison testing of random nuclear density test sections, if applicable

If additional core samples are necessary to resolve the difference, these samples will be taken as directed and tested jointly by the Contractor's quality control and Department's quality assurance personnel. If reasons for the difference cannot be determined, payment for the mix in question will be determined in accordance with Article 105-3. If the reason for the difference is determined to be an error or other discrepancy in the quality control test results, the applicable quality assurance test results or verification test results will be used to determine compliance with the applicable mix or density specification requirements.

The Engineer will periodically witness the sampling and testing being performed by the Contractor. If the Engineer observes that the sampling and quality control tests are not being performed in accordance with the applicable test procedures, the Engineer may stop production until corrective action is taken. The Engineer will promptly notify the Contractor of observed deficiencies, both verbally and in writing. The Engineer will document all witnessed samples and tests.

(J) Acceptance of Density

The Department will evaluate the asphalt pavement for density compliance after the asphalt mix has been placed and compacted using the Contractor's quality control test results, the Department's quality assurance test results, and by observation of the Contractor's density quality control process.

Minimum density requirements will be as specified for each mix type in Article 663-5 of the *Standard Specifications*. Density compliance for nuclear gauge control will be as provided in the Department's Nuclear Gauge Operator's Manual. Density compliance for core samples will be determined by use of the average maximum specific gravity (G_{mm}) until a moving average of four maximum specific gravities is attained. Once a moving average is established for the maximum specific gravity, the last moving average in effect at the end of the same day's production will then be used to determine density compliance.

The pavement will be accepted for density on a lot by lot basis. A lot will consist of 1 day's production of a given mix type on the project except that individual map sections will be evaluated as separate lots, unless otherwise approved by the Engineer. The Engineer will determine the final quantity of each lot.

A failing lot for density purposes is defined as a lot, for which the average of all test sections fails to meet the minimum specification requirement. In addition, any lot or portion of a lot that is obviously unacceptable will be rejected for use in the work.

Acceptance of all failing lots will be made under the provisions of Article 105-3 of the *Standard Specifications*.

Any reduction in pay due to failing densities will be in addition to any reduction in pay due to failing mix property test results on the same mix.

(K) Measurement and Payment

Produce and construct all hot in-place recycled (HIR) asphalt mixtures and pavements in accordance with these provisions. There will be no direct payment for work covered by this provision. Payment at the contract unit prices for the various asphalt related items will be full compensation for all work covered by these specifications.

**QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS:
(OGAFC, PADC, and ULTRATHIN HMA Version)**

(3-22-07)

SPI

Description

Produce and construct Open Graded Asphalt Friction Course, Permeable Asphalt Drainage Course, and Ultrathin Hot Mix Asphalt Concrete Wearing Surface asphalt mixtures and pavements. All materials and work shall conform to Division 6 of the *Standard Specifications* except as modified herein. Perform all applicable quality control activities in accordance with the Department’s *Hot Mix Asphalt Quality Management System (HMA/QMS) Manual* unless otherwise approved.

Description of Responsibilities

(A) Quality Control (QC)

Provide and conduct a quality control program. A quality control program is defined as all activities, including mix design, process control inspection, plant and equipment calibration, sampling and testing, and necessary adjustments in the process that are related to production of a pavement which meets all requirements of the Specifications.

(B) Quality Assurance (QA)

The Department will conduct a quality assurance programs. A quality assurance program is defined as all activities, including inspection, sampling, and testing related to determining that the quality of the completed pavement conforms to specification requirements.

Mix Design/Job Mix Formula Requirements

All mix design and job mix formula requirements of Article 661-2 of the *Standard Specifications* and the contract documents shall apply. In addition, submit Superpave gyratory compactor printouts for all specimens required to be compacted during the mix design process.

Field Verification Of Mixture And Job Mix Formula Adjustments

Conduct field verification of the mix at each plant within 30 calendar days prior to initial production of each mix design, when required by the Allowable Mix Adjustment Policy, and when directed as deemed necessary.

Field verification testing consists of performing a minimum of 1 test series on mix sampled and tested in accordance *Required Sampling and Testing Frequencies*. Obtain the mix verification sample and split in accordance with the Department’s *HMA/QMS Manual*. Do not begin normal

plant production until all field verification test results have been completed and the mix has been satisfactorily verified by the Contractor's Level II Technician. Verification is considered satisfactory when the mix meets all applicable individual test control limits as specified elsewhere in these provisions, except that the drain down test will meet the requirements as specified in Section 661 of the *Standard Specifications* for the applicable mix type.

In addition to the required sampling and testing for field verification, perform all preliminary inspections and plant calibrations as shown in the *HMA/QMS Manual*.

Retain records of these calibrations and mix verification tests, including Superpave Gyratory Compactor (SGC) printouts, at the QC laboratory. In addition, furnish copies, including SGC printouts, to the Engineer for review and approval within 1 working day after beginning production of the mix.

Conduct the initial mix verification of all new mix designs with the plant set up to produce the aggregate blend and binder content in accordance with the initially approved job mix formula (JMF). If the Contractor and/or the Engineer determine from results of quality control tests conducted during mix verification that adjustments to the job mix formula are necessary to achieve specified mix properties, adjustments to the JMF may be made within tolerances permitted by specifications for the mix type being produced, subject to approval. All JMF adjustments will be approved and documented in writing by the Engineer.

Failure by the Contractor to fully comply with the above mix verification requirements will result in immediate production stoppage by the Engineer. Do not resume normal production until all mix verification sampling, testing, calibrations, and plant inspections have been performed and approved. Any mix produced that is not verified may be assessed a price reduction at the Engineer's discretion in addition to any reduction in pay due to mix and/or surface deficiencies.

Contractor's Quality Control System

(A) Personnel Requirements

Obtain all certifications in accordance with the Department's QMS Asphalt Technician Certification Program as shown in the *HMA/QMS Manual*. Perform all sampling, testing, data analysis and data posting by or under the direct supervision of a certified QMS Asphalt Plant Technician.

Provide a certified Asphalt Plant Technician Level I to perform quality control operations and activities at each plant site at all times during production of material for the project. A plant operator who is a certified Asphalt Plant Technician Level I may be utilized to meet this requirement when daily production for each mix design is less than 100 tons provided the randomly scheduled increment sample is not within that tonnage. When performing in this capacity, the plant operator will be responsible for all quality control activities that are necessary and required. Absences of the Level I Technician, other than those for normal breaks and emergencies, shall be pre-approved by the appropriate QA Supervisor or his designated representative. Any extended absence of the Technician that has not been approved will result in immediate suspension of production by the Engineer. All mix produced during this absence will be accepted in accordance with Article 105-3 of the *Standard Specifications*.

Provide and have readily available a certified Asphalt Plant Technician Level II to supervise, coordinate, and make any necessary adjustments in the mix quality control process in a timely manner. The Level II Technician may serve in a dual capacity and fulfill the Level I Technician requirements specified.

Provide a certified QMS Roadway Technician with each paving operation at all times during placement of asphalt. This person is responsible for monitoring all roadway paving operations and all quality control processes and activities, to include stopping production or implementing corrective measures when warranted.

Post in the quality control laboratory an organizational chart, including names, telephone numbers and current certification numbers of all personnel responsible for the quality control program while asphalt paving work is in progress.

(B) Field Laboratory Requirements

Furnish and maintain a Department certified laboratory at the plant site. A minimum of 320 square feet of floor space (exclusive of toilet facilities), equipment, and supplies necessary for performing Contractor quality control testing is required. Provide convenient telephone and fax machine access for QMS personnel at the plant site.

Provide testing equipment meeting the requirements of the test methods herein identified. Provide equipment that is properly calibrated and maintained. Allow all measuring and testing devices to be inspected to confirm both calibration and condition. If at any time the Engineer determines that the equipment is not operating properly or is not within the limits of dimensions or calibration described in the applicable test method, the Engineer may stop production until corrective action is taken. Maintain and have available a record of all calibration results at the laboratory.

(C) Plant Mix Quality Control

(1) General

Include in the quality control process the preliminary inspections, plant calibrations and field verification of the mix and JMF. In addition, conduct at a minimum but not limited to, the sampling, testing, and determination of all parameters outlined in these provisions using test methods and minimum frequencies as specified herein. Perform additional sampling and testing when conditions dictate. Obtain, split, and retain all scheduled samples at randomly selected locations in accordance with the Department's *HMA/QMS Manual*, except as modified below. Log all samples taken on forms provided by the Department. Provide documentation. Identify any additional quality control samples taken and tested at times other than the regularly scheduled random samples or directed samples that take the place of regularly scheduled as process control (PC) samples on the appropriate forms. Process Control test results shall not be plotted on control charts nor reported to Quality Assurance Laboratory.

Obtain minimum 25 lb. samples for PADDC and Ultrathin HMA. Split and retain in accordance with procedures in the Department's *HMA/QMS Manual*. For OGAF C Types FC-1, FC-1 Modified and FC-2 Modified, obtain minimum 1500-2000 gram samples each for QC, QA, and for retained samples. OGAF C QC samples

shall be tested immediately. Place QA samples and retained samples of OGAFc in lubricated gill cans and store for possible testing in accordance with the procedures established below.

Retain the untested split portion of quality control aggregate and mix samples and the tested TSR specimens for 5 calendar days at the plant site, commencing the day the samples are tested. Permission for disposal may be given by Quality Assurance personnel prior to these minimum storage periods. Retain the split portion of the Contractor's mix verification and referee mix samples until either procured by or permission for disposal is given by QA. Store all retained samples in a dry and protected location.

(2) Required Sampling and Testing Frequencies

All mix sampling, testing, data analysis and data posting shall be performed or directly supervised by a certified QMS Asphalt Plant Technician.

Maintain minimum test frequencies as established in the schedule below. Complete all tests within 24 hours of the time the sample is taken, unless specified otherwise within these provisions. Should the specified tests not be completed within the required time frame, cease production at that point until such time the tests are completed.

Should the Contractor's testing frequency fail to meet the minimum frequency requirements as specified, all mix without the specified test representation will be considered unsatisfactory. If the Engineer allows the mix to remain in place, payment will be made at 50 percent of the contract unit bid price for the mixture.

If desired, innovative equipment or techniques not addressed by these specifications to produce or monitor the production of mix may be utilized, subject to approval.

Quality Control Minimum Sampling and Testing Schedule

Sample and test the completed mixture from each mix design (OGAFc and Ultrathin HMA) or job mix formula (PADc) at the following minimum frequency during mix production:

<u>Accumulative Production Increment</u>	<u>Number of Samples per Increment</u>
500 tons	1

If production is discontinued or interrupted before the accumulative production increment tonnage is completed, continue the increment on the next production day(s) until the increment tonnage is completed. Obtain a random sample within the specified increment at the location determined in accordance with the Department's *HMA/QMS Manual*. Conduct quality control sampling and testing on each random sample as scheduled below. When daily production of each mix design exceeds 100 tons and a regularly scheduled test series random sample location for that mix design is not reached during that day's production, perform a test series as scheduled below. This test series does not substitute for the regularly scheduled random sample for that increment.

Perform the following test series on all regularly scheduled random samples:

Asphalt Mixture - Sampled From Truck at Plant (AASHTO T-168 Modified) (Split Sample Required)

- (a) Asphalt Binder Content, % (Contractor may select either option below)
 - 1. Ignition Furnace (AASHTO T 308 Modified)
 - 2. Other (Contractor may request and use other means of determining percent asphalt binder subject to approval by the Engineer)
- (b) Gradation on Recovered Blended Aggregate from Mix Sample (AASHTO T-30 Modified) (Graded on all sieves specified on the job mix formula.)

In addition to the above schedule, conduct the following sampling and testing as indicated:

- (a) Aggregate Stockpile Gradations (AASHTO T 27 and T 11) (Sampled from stockpiles or cold feed system as follows; split samples not required)
 - 1. Coarse Aggregates (Approved Standard Sizes)
 - a. At beginning of production*
 - b. Weekly thereafter*
 - 2. Fine Aggregates (Stone Screenings, Natural Sands, Etc.)
 - a. At or within 1 week prior to mix verification (Gradations valid for multiple mix designs).
 - b. Weekly after mix verification *
 - c. Anytime production is stopped due to plant mix gradation related problems.
 - 3. Reclaimed Asphalt Shingle Material (RAS) Binder Content and Gradation (AASHTO T 308 Modified or T 164 and AASHTO T 30 Modified) (sample from stockpiles or cold feed system at beginning of production and weekly thereafter). Have RAS approved for use in accordance with Article 1012-1 (F). (Split Sample Required)

*In lieu of the aggregate stockpile gradations performed by QC personnel, gradation quality control data conducted by the aggregate producer, which is representative of the Contractor's current stockpiles, may be furnished.

- (b) Combined Aggregate Moisture Content (AASHTO T 255) Drum Plant Only (sampled from stockpiles or cold feed system a minimum of once daily).
- (c) Asphalt Drain Down Test Procedure, AASHTO T 305; Copy of procedure may be obtained from the M & T Asphalt Design Engineer. Mix sampled from truck at plant within the first day's production and weekly thereafter. **Note:** Drain Down Test not required for Permeable Asphalt Drainage Course.

(d) Retained Tensile Strength (TSR) - (AASHTO T 283 Modified)

Note: TSR only required for Ultrathin HMA.

1. Option 1

Mix sampled from truck at plant, tested, and results furnished to the Engineer within seven (7) calendar days after beginning production of each new mix design. From the split sample, QC will prepare and submit within 5 calendar days of the sample date, an additional set of specimens to the QA Lab for TSR testing (Split Sample Required).

2. Option 2

Mix sampled from truck at plant with one set of specimens prepared by the Contractor and then tested jointly by QA and QC at a mutually agreed upon lab site within the first seven (7) calendar days after beginning production of each new mix design. Specimens shall be tested on either a recording test press or a test press that maintains the peak load reading after the specimen has broken.

Additional TSR testing required prior to mix production in accordance with above procedures is required when a change is made in anti-strip additive dosage or when a new anti-strip additive source or grade is utilized, unless otherwise approved. Other TSR test(s) may be directed as deemed necessary. TSR testing not required for mix verification, but may be performed at that time.

(3) Control Charts

Maintain standardized control charts furnished by the Department at the field laboratory. For mix incorporated into the project, record test data from all regularly scheduled random samples or directed samples which replace regularly scheduled random samples, on control charts the same day the tests results are obtained. Process Control (PC) test results shall not be plotted on control charts nor reported to Quality Assurance Laboratory.

Results of quality assurance tests performed by the Engineer will be posted on the Contractor's control charts as data becomes available.

Record the following data on the standardized control charts:

(a) Aggregate Gradation Test Results:

1. 1/2" (Types P57 & FC-2 Mod. Only)
2. 3/8" (Excluding Type P57)
3. No. 4
4. No. 8
5. No. 200 Sieves

(b) Binder Content, %, P_b

Both the individual test values and the moving average of the last 4 data points shall be plotted on each chart. The Contractor's test data shall be shown in black and the moving average in red. The Engineer's assurance data will be plotted in blue. Denote the warning control limits with a dash

green line, the moving average control limits with a dashed blue line, and individual test limits with a dash red line.

Maintain a continuous moving average with the following exceptions. Re-establish a new moving average only when:

1. A change in the binder percentage or aggregate blend is made in the JMF, or,
2. When the Contractor elects to stop or is required to stop production after one or two moving average values, respectively, fall outside the warning limits or,
3. If failure to stop production after two consecutive moving averages exceed the warning limits occurs, but production does stop at a subsequent time, re-establish a new moving average beginning at the actual production stop point.

In addition, re-establish the moving averages for all mix properties. Moving averages will not be re-established when production stoppage occurs due to an individual test result exceeding the individual test limits and/or specifications.

All individual test results for regularly scheduled samples or directed samples which replace regularly scheduled samples are part of the plant quality control record and shall be included in moving average calculations with the following exception. When the Contractor’s testing data has been proven incorrect, use the correct data as determined by the Engineer in lieu of the Contractor’s data to determine the appropriate pay factor. In this case, replace the data in question and any related data proven incorrect.

(4) Control Limits

The following are established as control limits for mix production. Control limits for the warning and moving average limits are based on a moving average of the last 4 data points. Apply all control limits to data given on the job mix formula.

Mix Control Criteria	Control Limits,		
	%		
	Warning	Moving Average	Individual Test
Asphalt Binder Content	+/-0.3	+/-0.5	+/-0.7
1/2" Sieve (Types P57 & FC-2 Mod)	+/-4.0	+/-5.0	+/-8.0
3/8" Sieve (Excluding Type P57)	+/-4.0	+/-5.0	+/-8.0
No. 4 Sieve	+/-4.0	+/-5.0	+/-8.0
No. 8 Sieve	+/-4.0	+/-5.0	+/-8.0
No. 200 Sieve	+/-1.5	+/-2.0	+/-2.5
TSR (Ultrathin Only)	N/A	N/A	15%

(5) Warning Bands

Warning bands are defined as the area between the warning limits and moving average limits

(6) Corrective Actions

All required corrective actions are based upon initial test results and shall be taken immediately upon obtaining those results. In the event situations occur which

warrant more than one corrective action and/or adjustment, give precedence to the more severe of these actions. Stopping production when required takes precedence over all other corrective actions. Document all corrective actions.

Immediately cease production and immediately notify the Engineer when any of the following occur:

- (a) When an individual test result for a mix control criteria exceeds both the individual test control limits and the applicable specification design criteria, or,
- (b) When two consecutive field TSR values fail to meet the minimum specification requirement, or,
- (c) When two consecutive binder content test results exceed the individual limits.

Do not resume normal plant production until one of the following has occurred:

- (a) Option 1 - Approval has been granted by the appropriate QA Supervisor.
- (b) Option 2 - The mix in question has been satisfactorily verified. Normal production may resume based on the approval of the contractor's Level II technician, provided notification and the verification test results have been furnished to the QA Laboratory.

Failure to fully comply with one of the above provisions will result in immediate production stoppage by the Engineer. Normal production shall not then resume until a complete reverification process has been performed and approved by the Engineer.

Acceptance of all mix failing to meet the individual test control or minimum TSR requirements as described above will be determined in accordance with Article 105-3. In addition, any mix, which is deemed unacceptable, will be rejected for use in the work.

Failure to stop production when required due to an individual mix test not meeting the specified requirements shall subject all mix from the stop point tonnage to the point when the next individual test is back on or within the warning limits, or to the tonnage point when production is actually stopped, whichever occurs first, to being considered unacceptable.

Failure to stop production when required due to two consecutive TSR tests failing to meet the specification requirements will subject all mix from the stop point tonnage to the point when the next TSR test meets or exceeds the specification requirement, or to the tonnage point when production is actually stopped, whichever occurs first, to being considered unacceptable.

In either case, remove and replace this mix with materials that comply with the specifications at no additional costs to the Department, unless otherwise approved. Payment will be made for the actual quantities of materials required to replace the removed quantities, not to exceed the original amounts.

Immediately notify the Engineer when any moving average value exceeds the warning limit. If two consecutive moving average values for any one of the mix control criteria fall outside the warning limits, cease production of that mix and make adjustments. The

Contractor may elect to stop production after only one moving average value falls outside the warning limits. In either case, do not determine a new moving average until the fourth test after the elective or mandatory stop in production.

Do not resume normal plant production until one of the following has occurred:

- (a) Option 1 - Approval has been granted by the appropriate QA Supervisor.
- (b) Option 2 - The mix in question has been satisfactorily verified. Normal production may resume based on the approval of the contractor's Level II technician, provided notification and the verification test results have been furnished to the QA Laboratory.

Failure to fully comply with one of the above provisions will result in immediate production stoppage by the Engineer. Normal production shall not then resume until a complete reverification process has been performed and approved by the Engineer.

If the process adjustment improves the property in question such that the moving average after four additional tests is on or within the warning limits, the Contractor may continue production with no reduction in payment.

If the adjustment does not improve the property in question such that the moving average after four additional individual tests stays in the warning bands, the mix will be considered not to be within reasonably close conformity, but reasonably acceptable. Reduced payment for the mix in question will be applied starting from the plant sample tonnage at the stop point to the sample tonnage when the moving average is on or within the warning limits in accordance with the following table.

Payment for Mix Produced in the Warning Bands

Mix Property	Pay Factor Percent Bid Price for Mix**
1/2" Sieve (Types P57 & FC-2 Mod. Only)	90
3/8" (Excluding Type P57)	90
No. 4	90
No. 8	90
No. 200	90
Asphalt Binder Content	85

** When two or more properties are in question, only the lower pay factor will be applied to the mix unit bid price.

If the adjustment does not improve the property in question such that the moving average after four additional tests exceeds the moving average control limits, the mix will be considered not to be within reasonably close conformity with specifications. If the Engineer determines the mix is reasonably acceptable based on test data and an inspection of the completed pavement and allows it to remain in place, the mix will be accepted in accordance with Article 105-3. If the mix is determined to be unacceptable, the mix will be removed and replaced with materials that comply with the specifications. In either case, the adjustment or removal, respectively, for the mix in question will be applied starting from the plant sample tonnage at the stop point to the sample tonnage

when the moving average is on or within the warning limits. In addition, any mix that is deemed unacceptable will be rejected for use in the work.

Failure to stop production and make adjustments when required due to two consecutive moving average values falling outside the warning limits will subject all mix produced from the stop point tonnage to the tonnage point when the moving average is back on or within the warning limits or to the tonnage point when production is actually stopped, whichever occurs first, to being considered unacceptable. Remove this material and replaced with materials which comply with the specifications at no additional costs to the Department, unless otherwise approved. Payment will be made for the actual quantities of materials required to replace the removed quantities, not to exceed the original amounts.

(7) Allowable Retesting for Mix Deficiencies

The Contractor may elect to resample and retest for plant mix deficiencies when individual QC test(s) exceed one or more mix property target(s) by more than the tolerances indicated below. Perform the retesting within 10 days after initial test results are determined. Retesting shall be approved prior to being performed and in accordance with the Department's Guidelines for Retests of Plant Mix Deficiencies as shown in the *HMA/QMS Manual*. The Contractor, under the supervision of the Department's QA personnel will perform these retests. Retests for any mix deficiency other than as listed below will not be allowed unless otherwise permitted. Acceptance of the mix in question will be based on the retest data in accordance with Article 105-3.

The Department reserves the right to require the Contractor to resample and retest at any time or location as directed.

- | | | |
|----------------------------------------|----|-------------------------------------------------------|
| (a) % Binder Content | -- | by more than +/- 1.0% |
| (b) 1/2" Sieve (Types P 57 & FC-2 Mod) | -- | by more than +/- 9.0% |
| (c) 3/8" Sieve (Excluding Type P 57) | -- | by more than +/- 9.0% |
| (d) No. 4 sieve | -- | by more than +/- 9.0% |
| (e) No. 8 sieve | -- | by more than +/- 9.0% |
| (f) No. 200 sieve | -- | by more than +/- 3.0% |
| (g) TSR (Ultrathin only) | -- | by more by more than -15%
from Specification limit |

(8) Documentation (Records)

Document all quality control observations, records of inspection, samples taken, adjustments to the mix, and test results on a daily basis. Note the results of observations and records of inspection as they occur in a permanent field record. Record adjustment to mix production and test results on forms provided.

Identify any additional quality control samples taken and tested at times other than the regularly scheduled random samples or directed samples which take the place of regularly scheduled as process control (PC) samples on the appropriate forms. Process Control test results shall not be plotted on control charts nor

reported to Quality Assurance Laboratory. Process control sample test results are for the Contractor's informational purposes only.

Make all such records available to the Engineer, upon request, at any time during project construction. Complete all QC records and forms and distribute in accordance with the most current edition of the Department's *HMA/QMS Manual*. Maintain all QC records, forms and equipment calibrations for a minimum of 3 years from their completion date. Failure to maintain QC records and forms as required, or to provide these records and forms to the Engineer upon request, may result in production and/or placement stoppage until the problem is resolved.

Falsification of test results, documentation of observations, records of inspection, adjustments to the process, discarding of samples and/or test results, or any other deliberate misrepresentation of the facts will result in the revocation of the applicable person's QMS certification. The Engineer will determine acceptability of the mix and/or pavement represented by the falsified results or documentation. If the mix and/or pavement in question is determined to be acceptable, the Engineer may allow the mix to remain in place at no pay for the mix, asphalt binder and other mix components. If the mix and/or pavement represented by the falsified results are determined not to be acceptable, remove and replace with mix that complies with the Specifications. Payment will be made for the actual quantities of materials required to replace the falsified quantities, not to exceed the original amounts.

Quality Assurance

The Department's quality assurance program will be conducted by a certified QMS technician(s) and will be accomplished in the following ways:

Plant Mix Quality Assurance

- (A) By conducting assurance testing of split samples obtained by the Contractor at a frequency equal to or greater than 5% of the frequency required of the Contractor;
- (B) By periodically observing sampling and testing procedures performed by the Contractor;
- (C) By monitoring required control charts exhibiting test results of control parameters;
- (D) By directing the Contractor to take additional samples at any time and any location during production (in lieu of the next scheduled random sample for that increment);
- (E) By conducting verification sampling and testing on samples taken independently of the Contractor's quality control samples at a frequency equal to or greater than 10% of the QC sample frequency; or
- (F) By any combination of the above

The Engineer will periodically obtain quality assurance and verification samples for testing independently of the Contractor's quality control process. The Engineer will conduct assurance tests on both split QC samples taken by the Contractor and verification samples taken by the Department. These samples may be the regular quality control samples or a sample selected by

the Engineer from any location in the process, or verification samples taken at random by the Department. The Engineer may select any or all split samples for assurance testing.

Results of quality assurance tests will be provided to the Contractor within 3 working days after the sample has been obtained, except for verification TSR test results which will be provided within 7 calendar days.

Limits of Precision

Differences between the Contractor's and the Department's split sample test results will be considered acceptable if within the following limits of precision:

Mix Property	Acceptable Limits of Precision
Asphalt Binder Content	±0.5 %
1/2" Sieve (Types P 57 & FC-2 Mod. Only)	±6.0 %
3/8" Sieve (Excluding Type P 57)	±5.0 %
No. 4 Sieve	±5.0 %
No. 8 Sieve	±5.0 %
No. 200 Sieve	±2.0 %
TSR (Ultrathin HMA Only)	±15.0 %

The Engineer will immediately investigate the reason for differences if any of the following occur:

- (A) QA test results of QC split sample does not meet above limits of precision, or
- (B) QA test results of QC split sample does not meet the individual test control limits or the specification requirements, or
- (C) QA verification sample test results exceed the allowable retesting tolerances.

If the potential for a pavement failure exist, the Engineer may suspend production, wholly or in part, in accordance with Article 108-7 while the investigation is in progress. The Engineer's investigation may include, but not be limited to the following:

- (A) Joint testing of any remaining split samples,
- (B) Review and observation of the QC technician's sampling and testing procedures,
- (C) Evaluation and calibration of QC testing equipment, and/or
- (D) Comparison testing of other retained quality control samples

If additional mix samples or core samples are necessary to resolve the difference, these samples will be taken as directed and tested jointly by the Contractor's quality control and Department's quality assurance personnel. If reasons for the difference cannot be determined, payment for the mix in question will be determined in accordance with Article 105-3. If the reason for the difference is determined to be an error or other discrepancy in the quality control test results, the applicable quality assurance test results or verification test results will be used to determine compliance with the applicable mix specification requirements.

The Engineer will periodically witness the sampling and testing being performed by the Contractor. If the Engineer observes that the sampling and quality control tests are not being performed in accordance with the applicable test procedures, the Engineer may stop production until corrective action is taken. The Engineer will promptly notify the Contractor of observed deficiencies, both verbally and in writing. The Engineer will document all witnessed samples and tests.

Acceptance

The Engineer will base final acceptance of the mix on the results of random testing made on split samples during the assurance process and validation of the Contractor's quality control process.

Measurement and Payment

Produce and construct all asphalt mixtures and pavements in accordance with these Specifications. There will be no direct payment for work covered by this specification. Payment at the contract unit prices for the various asphalt items will be full compensation for all work covered by these specifications.

ASPHALT PAVEMENTS - SUPERPAVE:

(7-18-06) (Rev 9-19-06)

RR 31

Revise the *2006 Standard Specifications* as follows:

Page 6-2, Article 600-9 Measurement and Payment

Delete the second paragraph.

Page 6-12, 609-5(C)2(c) add after (AASHTO T 209):

or ASTM D 2041

Page 6-13, last line on page & Page 6-14, Subarticle 609-5(C)2(e), delete and substitute the following:

(e) Retained Tensile Strength (TSR) - (AASHTO T 283 Modified), add subarticle (1) Option 1 before the first paragraph.

(1) Option 1

Add subarticle (2) Option 2 and the following sentence as the first sentence of the second paragraph:

(2) Option 2

Mix sampled from truck at plant with one set of specimens prepared by the Contractor and then tested jointly by QA and QC at a mutually agreed upon lab site within the first 7 calendar days after beginning production of each new mix design.

Page 6-28, 610-3(A) Mix Design-General, third sentence of the fourth paragraph:

Substitute 20% for 15%

First, second and third sentences of the fifth paragraph:

Substitute 20% for 15%

Page 6-44, 610-8, third full paragraph, replace the first sentence with the following:

Use the 30 foot minimum length mobile grade reference system or the non-contacting laser or sonar type ski *with at least four referencing stations mounted on the paver at a minimum length of 24 feet* to control the longitudinal profile when placing the initial lanes and all adjacent lanes of all layers, including resurfacing and asphalt in-lays, unless otherwise specified or approved.

Page 6-54, Article 620-4, add the following pay item:

Pay Item	Pay Unit
Asphalt Binder for Plant Mix, Grade PG 70-28	Ton

Page 6-69, Table 660-1 **Material Application Rates and Temperatures**, add the following:

Type of Coat	Grade of Asphalt	Asphalt Rate gal/yd ²	Application Temperature °F	Aggregate Size	Aggregate Rate lb./sq. yd. Total
Sand Seal	CRS-2 or CRS-2P	0.22-0.30	150-175	Blotting Sand	12-15

Page 6-75, 660-9(B), add the following as sub-item (5)

(5) Sand Seal

Place the fully required amount of asphalt material in one application and immediately cover with the seal coat aggregate. Uniformly spread the fully required amount of aggregate in one application and correct all non-uniform areas prior to rolling.

Immediately after the aggregate has been uniformly spread, perform rolling.

When directed, broom excess aggregate material from the surface of the seal coat.

When the sand seal is to be constructed for temporary sealing purposes only and will not be used by traffic, other grades of asphalt material meeting the requirements of Articles 1020-6 and 1020-7 may be used in lieu of the grade of asphalt required by Table 660-1 when approved.

Page 10-41, Table 1012-1, add the following:

Mix Type	Course Aggregate Angularity ^(b) ASTM D5821	Fine Aggregate Angularity % Minimum AASHTO T304 Method A	Sand Equivalent % Minimum AASHTO T176	Flat & Elongated 5:1 Ratio % Maximum ASTM D4791 Section 8.4
S 9.5 D	100/100	45	50	10

Page 10-45, Replace Table 1012-2 with the following:

TABLE 1012-2
NEW SOURCE RAP GRADATION and BINDER TOLERANCES
 (Apply Tolerances to Mix Design Data)

Mix Type	0-20% RAP			21-25% RAP			26%+ RAP		
	Base	Inter.	Surf.	Base	Inter.	Surf.	Base	Inter.	Surf.
P _b , %		± 0.7%			± 0.4%			± 0.3%	
1 1/2" (37.5)	±10	-	-	±7	-	-	±5	-	-
3/4" (19.0)	±10	±10	-	±7	±7	-	±5	±5	-
1/2" (12.5)	-	±10	±6	-	±7	±3	-	±5	±2
3/8" (9.5)	-	-	±8	-	-	±5	-	-	±4
No. 4 (4.75)	±10	-	±10	±7	-	±7	±5	-	±5
No. 8 (2.36)	±8	±8	±8	±5	±5	±5	±4	±4	±4
No.16 (1.18)	±8	±8	±8	±5	±5	±5	±4	±4	±4
No. 30 (0.600)	±8	±8	±8	±5	±5	±5	±4	±4	±4
No. 50 (0.300)	-	-	±8	-	-	±5	-	-	±4
No. 200 (0.075)	±4	±4	±4	±2	±2	±2	±1.5	±1.5	±1.5

GLASS BEADS:

(7-18-06)

RR 35

Revise the 2006 *Standard Specifications* as follows:

Page 10-223, 1087-4(C) Gradation & Roundness

Replace the second sentence of the first paragraph with the following:

All Drop-On and Intermixed Glass Beads shall be tested in accordance with ASTM D1155.

Delete the last paragraph.

ASPHALT BINDER CONTENT OF ASPHALT PLANT MIXES:

(1-1-02)

RR 43

The approximate asphalt binder content of the asphalt concrete plant mixtures used on this project will be as follows:

Asphalt Concrete Base Course	Type B 25.0 __	4.3 %
Asphalt Concrete Intermediate Course	Type I 19.0 __	4.7 %
Asphalt Concrete Surface Course	Type S 4.75A	7.0 %
Asphalt Concrete Surface Course	Type SF 9.5A	6.5 %
Asphalt Concrete Surface Course	Type S 9.5 __	6.0 %
Asphalt Concrete Surface Course	Type S 12.5 __	5.5 %

The actual asphalt binder content will be established during construction by the Engineer within the limits established in the *Standard Specifications*.

ASPHALT CONCRETE SURFACE COURSE COMPACTION:

(7-1-95)

RR 49

Compact the asphalt surface course on this project in accordance with Subarticle 610-9 of the *Standard Specifications* and the following provision:

Perform the first rolling with a steel wheel roller followed by rolling with a self-propelled pneumatic tired roller with the final rolling by a steel wheel roller.

AGGREGATES FOR ASPHALT PAVEMENTS AND SURFACE TREATMENTS

(Ultra-Thin):

(7-18-06)

RR 54

Revise the 2006 *Standard Specifications* as follows:

Page 10-40, Subarticle 1012-1(A), add the following at the end of the last paragraph, last sentence:

or ultra-thin bonded wearing course.

Page 10-41, Table 1012-1, add the following as the last row of the Table:

<i>UBWC</i>	40	45	10
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Page 10-42, Subarticle 1012-1(B)(6), add as the last sentence:

The percentage loss for aggregate used in UBWC shall be no more than 35%.

RESURFACING EXISTING BRIDGES:

(7-1-95)

RR 61

The Contractor's attention is directed to the fact that he will be required to resurface the bridges on this project if directed by the Engineer.

Place the surface so as to follow a grade line set by the Engineer with the minimum thickness as shown on the sketch herein or as directed by the Engineer. State Forces will make all necessary repairs to the bridge floors prior to the time that the Contractor places the proposed surfacing. Give the Engineer at least 15 days notice prior to the expected time to begin operations so that State Forces will have sufficient time to complete their work.

At all bridges that are not to be resurfaced, taper out the proposed resurfacing layer adjacent to the bridges to insure a proper tie-in with the bridge surface.

PATCHING EXISTING PAVEMENT:

(1-15-02) (Rev.7-18-06)

RR 88 Rev

Description

The Contractor's attention is directed to the fact that there are areas of existing pavement on this project that will require repair prior to resurfacing. Patch the areas that, in the opinion of the Engineer, need repairing. The areas to be patched will be delineated by the Engineer prior to the Contractor performing repairs.

Materials

The patching consists of Asphalt Concrete Base Course, Asphalt Concrete Intermediate Course, Asphalt Concrete Surface Course, or a combination of base, binder and surface course.

Construction Methods

Remove existing pavement at locations directed by the Engineer in accordance with Section 250 of the *Standard Specifications*.

The Contractor's attention is directed to the fact that all patching of existing pavement performed under this contract shall be performed with the use of a milling machine. This machine shall have a minimum cutting width of 36", be of sufficient size and capacity to perform the work. The machine shall have been designed and built exclusively for pavement milling operations and shall have sufficient power, traction and stability to

accurately maintain depth of cut and slope. Multiple passes may be required to remove deteriorated pavement.

Place Asphalt Concrete Base Course, in lifts not exceeding 5 1/2 inches. Utilize compaction equipment suitable for compacting patches as small as 3.5 feet by 6 feet on each lift. Use an approved compaction pattern to achieve proper compaction. If patched pavement is to be open to traffic for more than 48 hours prior to overlay, use Asphalt Surface Course in the top 1.25 inches of the patch.

Schedule operations so that all areas where pavement has been removed, will be repaired on the same day of the pavement removal and all lanes of traffic restored.

Measurement and Payment

Patching Existing Pavement will be measured and paid for as the actual number of tons of asphalt plant mix complete in place that has been used to make completed and accepted repairs. The asphalt plant mixed material will be measured by being weighed in trucks on certified platform scales or other certified weighing devices. The above price and payment will be full compensation for all work covered by this provision, including but not limited to **milling**, removal and disposal of pavement; furnishing and applying tack coat; furnishing, placing, and compacting of asphalt plant mix; furnishing of asphalt binder for the asphalt plant mix; and furnishing scales.

Patching Existing Pavement will be considered a minor item. In the event that the item of Patching Existing Pavement overruns the original bid quantity by more than 100 percent, the provisions of Article 104-5 of the *Standard Specifications* pertaining to revised contract unit price for overrunning minor items will not apply to this item. Any provisions included in the contract that provides for adjustments in compensation due to variations in the price of asphalt binder will not be applicable to payment for the work covered by this provision.

Payment will be made under:

Pay Item	Pay Unit
Patching Existing Pavement	Ton

AGGREGATE PRODUCTION:

(11-20-01) (Rev. 11-21-06)

RR 109

Provide aggregate from a producer who uses the current Aggregate Quality Control/Quality Assurance Program which is in effect at the time of shipment.

No price adjustment is allowed to contractors or producers who use the program. Participation in the program does not relieve the producer of the responsibility of complying with all requirements of the *Standard Specifications*. Copies of this procedure are available upon request from the Materials and Test Unit.

CHANGEABLE MESSAGE SIGNS

(11-21-06)

RR 111

Revise the *2006 Standard Specifications* as follows:

Page 11-9, Article 1120-3, Replace the 3rd sentence with the following:

Sign operator will adjust flash rate so that no more than two messages will be displayed and be legible to a driver when approaching the sign at the posted speed.

CONCRETE BRICK AND BLOCK PRODUCTION:

(11-20-01) (Rev. 11-21-06)

RR 112

Provide concrete brick and block from a producer who uses the current Solid Concrete Masonry Brick/Unit Quality Control/Quality Assurance Program that is in effect on the date that material is received on the project.

No price adjustment is allowed to contractors or producers who use the program. Participation in the program does not relieve the producer of the responsibility of complying with all requirements of the *Standard Specifications*. Copies of this procedure are available upon request from the Materials and Test Unit.

PAVEMENT MARKING LINES MEASUREMENT AND PAYMENT:

(11-21-06)

RR 120

Revise the *2006 Standard Specifications* as follows:

Page 12-14, Subarticle 1205-10, delete the first sentence of the first paragraph and replace with the following:

Pavement Marking Lines will be measured and paid for as the actual number of linear feet of pavement marking lines per application that has been satisfactorily placed and accepted by the Engineer.

GUARDRAIL ANCHOR UNITS, TYPE 350:

(4-20-04)

RR 121

Description

Furnish and install guardrail anchor units in accordance with the details in the plans, the applicable requirements of Section 862 of the *Standard Specifications*, and at locations shown in the plans.

Materials

The Contractor may at his option, furnish any one of the guardrail anchor units.

Guardrail anchor unit (ET-2000) as manufactured by:

Trinity Industries, Inc.
2525 N. Stemmons Freeway
Dallas, Texas 75207
Telephone: 800-644-7976

The guardrail anchor unit (SKT 350) as manufactured by:

Road Systems, Inc.
3616 Old Howard County Airport
Big Spring, Texas 79720
Telephone: 915-263-2435

Prior to installation the Contractor shall submit to the Engineer:

(A) FHWA acceptance letter for each guardrail anchor unit certifying it meets the requirements of NCHRP Report 350, Test Level 3, in accordance with Section 106-2 of the Standard Specifications.

(B) Certified working drawings and assembling instructions from the manufacturer for each guardrail anchor unit in accordance with Section 105-2 of the Specifications.

No modifications shall be made to the guardrail anchor unit without the express written permission from the manufacturer. Perform installation in accordance with the details in the plans, and details and assembling instructions furnished by the manufacturer.

Construction Methods

Guardrail end delineation is required on all approach and trailing end sections for both temporary and permanent installations. Guardrail end delineation consists of yellow reflective sheeting applied to the entire end section of the guardrail in accordance with Section 1088-3 of the *Standard Specifications* and is incidental to the cost of the guardrail anchor unit.

Measurement and Payment

Measurement and payment will be made in accordance with Articles 862-6 of the *Standard Specifications*.

Payment will be made under:

Pay Item	Pay Unit
Guardrail Anchor Units, Type 350	Each