609-10 ACCEPTANCE

Final acceptance of the asphalt pavement will be made by the Department in accordance with the following:

(A) Mix Acceptance

The Engineer will base final acceptance of the mix on the results of random testing made on split samples during the QA process and validation of the Contractor's QC process as outlined in Articles 609-6 and 609-7.

(B) Density Acceptance

The Department will evaluate the asphalt pavement for density compliance after the asphalt mix has been placed and compacted using the Contractor's QC test results, the Department's QA test results and by observation of the Contractor's density QC process as outlined in Articles 609-7 and 610-14.

609-11 MEASUREMENT AND PAYMENT

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 or density deficiencies.

Produce and construct all asphalt mixtures and pavements in accordance with these *Standard 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.

If the mix or pavement represented by the falsified results is removed and replaced, payment will be made for the actual quantities of materials required to replace the falsified quantities, not to exceed the original amounts.

SECTION 610
ASPHALT CONCRETE PLANT MIX PAVEMENTS

610-1 DESCRIPTION

Perform the work covered by this section including, but not limited to, the construction of one or more courses of asphalt mixture placed on a prepared surface in accordance with these Specifications and in reasonably close conformity with the lines, grades, thickness and typical sections shown on the plans. This work includes producing, weighing, transporting, placing and compacting the plant mix; furnishing aggregate, asphalt binder, anti-strip additive and all other materials for the plant mix; furnishing and applying tack coat as specified; furnishing scales; maintaining the course until final acceptance of the project; making any repairs or corrections to the course that may become necessary; providing and conducting QC as specified in Section 609; and surface testing of the completed pavement. The design requirements for the various mix types are given in Section 610 for Superpave mix types, Section 650 for OGAFC, Section 652 for PADC and Section 661 for UTBWC.

Provide and conduct the QC and required testing for acceptance of the asphalt mixture in accordance with Section 609.

Define "warm mix asphalt (WMA)" as additives or processes that allow a reduction in the temperature at which asphalt mixtures are produced and placed. WMA is allowed for use at the Contractor's option when shown in the contract or as approved by the Engineer.

610-2 MATERIALS

Refer to Division 10.

Item	Section
Anti-Strip Additives	1012-1(G)
Asphalt Binder, Performance Grade	1020-2

Item	Section
Coarse Aggregate	1012-1(B)
Fine Aggregate	1012-1(C)
Mineral Filler	1012-1(D)
Reclaimed Asphalt Pavement (RAP)	1012-1(F)
Reclaimed Asphalt Shingles (RAS)	1012-1(E)
Silicone	1012-1(H)

Use only WMA additives or processes listed on the NCDOT Approved Product List maintained by the Materials and Tests Unit.

610-3 COMPOSITION OF MIXTURES (MIX DESIGN AND JOB MIX FORMULA)

(A) Mix Design-General

Prepare the asphalt mix design using a mixture of coarse and fine aggregate, asphalt binder, mineral filler and other additives when required. Size, uniformly grade and combine the several aggregate fractions in such proportions that the resulting mixture meets the grading and physical requirements of the Specifications for the specified mix type. Materials that will not produce a mixture within the design criteria required by the Specifications will be rejected, unless otherwise approved.

At least 10 days before start of asphalt mix production, submit, in writing and in electronic form, the mix design and proposed JMF targets for each required mix type and combination of aggregates to the Engineer for review and approval. Prepare the mix design using a Department certified mix design technician in an approved mix design laboratory and in accordance with the procedures outlined in Section 4.5 of the *HMA/QMS Manual.*

For the final surface layer of the specified mix type, use a mix design with an aggregate blend gradation above the maximum density line on the 2.36 mm and larger sieves.

Reclaimed Asphalt Pavement (RAP) or Reclaimed Asphalt Shingles (RAS) may be incorporated into asphalt plant mixes in accordance with Article 1012-1 and the following applicable requirements.

RAP may constitute up to 50% of the total material used in recycled mixtures, except for mix types S12.5D, S9.5D and mixtures containing RAS. RAS material may constitute up to 6% by weight of total mixture for any mix. When both RAP and RAS are used, do not use a combined percentage of RAS and RAP greater than 20% by weight of total mixture, unless otherwise approved. When the percent of binder contributed from RAS or a combination of RAS and RAP exceeds 20% but not more than 30% of the total binder in the completed mix, the virgin binder PG grade shall be one grade below (both high and low temperature grade) the binder grade specified in Table 610-3 for the mix type, unless otherwise approved. When the percent of binder contributed from RAS or a combination of RAS and RAP exceeds 30% of the total binder in the completed mix, the Engineer will establish and approve the virgin binder PG grade. Use approved methods to determine if any binder grade adjustments are necessary to achieve the performance grade for the specified mix type.

For type S12.5D and S9.5D mixes, the maximum percentage of reclaimed asphalt material is limited to 20% and shall be produced using virgin asphalt binder grade PG 76-22. For all other recycled mix types, the virgin binder PG grade shall be as specified in Table 610-4 for the specified mix type.

When the percentage of RAP is greater than 20% but not more than 30% of the total mixture, use RAP meeting the requirements for processed or fractionated RAP in accordance with Section 1012-1.

When the percentage of RAP is greater than 30% of the total mixture, use an approved stockpile of RAP in accordance with Subarticle 1012-1(C). Use approved test methods to determine if any binder grade adjustments are necessary to achieve the performance grade for the specified mix type. The Engineer will establish and approve the virgin asphalt binder grade to be used.

If a change in the source of RAP or RAS be made, a new mix design and JMF may be required in accordance with Article 1012-1. Samples of the completed recycled mixture may be taken by the Department on a random basis to determine the PG grading on the recovered asphalt binder in accordance with AASHTO M 320. If the grading is determined to be a value other than required for the specified mix type, the Engineer may require the Contractor to adjust any combination of the grade, the percentage of additional asphalt binder or the blend of reclaimed material to bring the grade to the specified value.

(B) Mix Design Criteria

Design and produce asphalt concrete mixtures that conform to the gradation requirements and design criteria in Table 610-2 and Table 610-3 for the mix type specified. The mix type designates the nominal maximum aggregate size and the design traffic level.

Surface mix designs will be tested by the Department for rutting susceptibility. Rut depth requirements for each surface mix type and traffic level are specified in Table 610-3. Mix designs that fail to meet these requirements will be unacceptable and shall be redesigned by the Contractor such that rut depths are acceptable.

Table 610-2 provides gradation control points to be adhered to in the development of the design aggregate structure for each mix type. Aggregate gradations shall be equal to or pass between the control points, unless approved in writing. Table 610-2 provides the mix design criteria for the various mix types.

Use an anti-strip additive in all Superpave asphalt mixes. It may be hydrated lime or a chemical additive or a combination of both as needed to meet the retained strength requirements as specified in Table 610-3. When a chemical additive is used, add at a rate of not less than 0.25% by weight of binder in the mix. When hydrated lime is used, add at a rate of not less than 1.0% by weight of the total dry aggregate.

When WMA is used, submit the mix design without including the WMA technology.

(C) Job Mix Formula (JMF)

Establish the JMF gradation target values within the design criteria specified for the particular type of asphalt mixture to be produced. Establish the JMF asphalt binder content at the percentage that will produce voids in total mix (VTM) at the midpoint of the specification design range for VTM, unless otherwise approved. The formula for each mixture will establish the following: blend percentage of each aggregate fraction, the percentage of reclaimed aggregate, if applicable, a single percentage of combined aggregate passing each required sieve size, the total percentage and grade of asphalt binder required for the mixture (by weight of total mixture), the percentage and grade of asphalt binder to be added to the mixture (for recycled mixtures), the percentage of chemical anti-strip additive to be added to the asphalt binder or percentage of hydrated lime to be added to the aggregate, the temperature at that the mixture is to be discharged from the plant, the required field density and other volumetric properties.

When WMA is used, document the additive or process used and recommended rate on the JMF submittal. Verify the JMF based on plant produced mixture from the trial batch.

The mixing temperature at the asphalt plant will be established on the JMF. Unless otherwise requested, refer to Table 610-1 to establish the JMF temperature.

TABLE 610-1
MIXING TEMPERATURE AT THE ASPHALT PLANT

Binder Grade	JMF Temperature
PG 64-22	300°F
PG 70-22	315°F
PG 76-22	335°F

When using RAP or RAS with a different binder than specified, use mixing and compaction temperatures in Table 610-1 based on the original binder grade for that mix type shown in Table 610-3.

When WMA is used, the Asphalt Design Engineer (after consultation with the Contractor) will set the mixing temperature at the plant within the allowable temperature range of 225°F to 275°F. When WMA is used in conjunction with RAS, the Asphalt Design Engineer will set the mixing temperature at 275°F.

Have on hand at the asphalt plant the approved mix design and JMF issued by the Department, before beginning the work.

The JMF for each mixture will remain in effect until modified in writing, provided the results of QMS tests performed in accordance with Section 609 on material currently being produced conform with specification requirements. When a change in sources of aggregate materials is to be made, a new mix design and JMF will be required before the new mixture is produced, unless otherwise approved. When a change in sources of RAP or RAS material is to be made, a new mix design and/or JMF may be required in accordance with Article 1012-1. When unsatisfactory results or other conditions make it necessary, the Engineer may revoke the existing JMF or establish a new JMF.

TABLE 610-2
SUPERPAVE AGGREGATE GRADATION CRITERIA
(Percent Passing Control Points)

Standard Sieves (mm)	Mix Type (Nominal Max. Aggregate Size)							
	9.5 mm[A]		12.5 mm[A]		19.0 mm		25.0 mm	
	Min	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
50.0	-	-	-	-	-	-	-	-
37.5	-	-	-	-	-	-	100	-
25.0	-	-	-	-	100	-	90.0	100
19.0	-	-	100	-	90.0	100	-	90.0
12.5	100	-	90.0	100	-	90.0	-	-
9.50	90.0	100	-	90.0	-	-	-	-
4.75	-	90.0	-	-	-	-	-	-
2.36	32.0[B]	67.0[B]	28.0	58.0	23.0	49.0	19.0	45.0
1.18	-	-	-	-	-	-	-	-
0.075	4.0	8.0	4.0	8.0	3.0	8.0	3.0	7.0

A. For the final surface layer of the specified mix type, use a mix design with an aggregate blend gradation above the maximum density line on the 2.36 mm and larger sieves.

B. For Type SF9.5A, the percent passing the 2.36 mm sieve shall be a minimum of 60% and a maximum of 70%.

TABLE 610-3
SUPERPAVE MIX DESIGN CRITERIA

Mix Type	Design ESALs[A] millions	Binder PG Grade[B]	Compaction Levels G_{mm} @		Max. Rut Depth (mm)	Volumetric Properties			
			N_{ini}	N_{des}		VMA % Min.	VTM %	VFA Min.-Max.	$\%G_{mm}$ @ N_{ini}
SF9.5A	< 0.3	64 - 22	6	50	11.5	16.0	3.0 - 5.0	70 - 80	≤ 91.5
S9.5B	0.3 - 3	64 - 22	7	65	9.5	15.5	3.0 - 5.0	65 - 80	≤ 90.5
S9.5C	3 - 30	70 - 22	7	75	6.5	15.5	3.0 - 5.0	65 - 78	≤ 90.5
S9.5D	> 30	76 - 22	8	100	4.5	15.5	3.0 - 5.0	65 - 78	≤ 90.0
S12.5C	3 - 30	70 - 22	7	75	6.5	14.5	3.0 - 5.0	65 - 78	≤ 90.5
S12.5D	> 30	76 - 22	8	100	4.5	14.5	3.0 - 5.0	65 - 78	≤ 90.0
I19.0B	< 3	64 - 22	7	65	-	13.5	3.0 - 5.0	65 - 78	≤ 90.5
I19.0C	3 - 30	64 - 22	7	75	-	13.5	3.0 - 5.0	65 - 78	≤ 90.0
I19.0D	> 30	70 - 22	8	100	-	13.5	3.0 - 5.0	65 - 78	≤ 90.0
B25.0B	< 3	64 - 22	7	65	-	12.5	3.0 - 5.0	65 - 78	≤ 90.5
B25.0C	> 3	64 - 22	7	75	-	12.5	3.0 - 5.0	65 - 78	≤ 90.0
	Design Parameter					**Design Criteria**			
All Mix Types	Dust to Binder Ratio ($P_{0.075}$ / P_{be})					0.6 - 1.4			
	Tensile Strength Ratio (TSR)					85% Min.[C,D]			

A. Based on 20 year design traffic.
B. Volumetric Properties based on specimens compacted to Ndes as modified by the Department.
C. TSR for Type B 25.0 and Type B 25.0C mixes is 80% minimum.
D. AASHTO T 283 Modified (No Freeze-Thaw cycle required).

TABLE 610-4
SUPERPAVE APPLICABLE VIRGIN ASPHALT GRADES

Mix Type	Percentage of RAP in Mix		
	Category 1[A]	Category 2[B]	Category 3[C]
	% RAP ≤ 20%	*21% ≤ % RAP ≤ 30%*	*% RAP > 30%*
All A and B Level Mixes, I19.0C, B25.0C	PG 64-22	PG 64-22	Established by Engineer
S9.5C, S12.5C, I19.0D	PG 70-22	PG 64-22	Established by Engineer
S9.5D and S12.5D	PG 76-22	-	-

A. Category 1 RAP has been processed to a maximum size of 2".
B. Category 2 RAP has been processed to a maximum size of 1" by either crushing and or screening to reduce variability in the gradations.
C. Category 3 RAP has been processed to a maximum size of 1", fractionating the RAP into 2 or more sized stockpiles.

610-4 WEATHER, TEMPERATURE AND SEASONAL LIMITATIONS FOR PRODUCING AND PLACING ASPHALT MIXTURES

Do not produce or place asphalt mixtures during rainy weather, when the subgrade or base course is frozen or when the moisture on the surface to be paved would prevent proper bond. Do not place asphalt material when the air temperature, measured in the shade away from artificial heat at the location of the paving operation and the road surface temperature in the shade is less than the temperatures shown in Table 610-5.

Do not place surface course material that is to be the final layer of pavement between December 15 and March 16 of the next year if it is 1" or greater in thickness or between November 15 and April 1 of the next year if it is less than 1" in thickness, unless otherwise approved. Do not place open-graded asphalt friction course between October 31 and April 1 of the next year, unless otherwise approved.

As an exception to the above, when in any day's operations the placement of a layer of asphalt base course material or intermediate material 2" or greater in thickness has started, it may continue until the temperature drops to 32°F.

Do not place plant mix base course or intermediate course that will not be covered with surface course during the same calendar year or within 15 days of placement if the plant mix is placed in January or February. Failure by the Contractor to cover the plant mix as required above will result in the Engineer notifying the Contractor in writing to cover the plant mix with a sand seal. Apply the sand seal in accordance with Section 660, except that Articles 660-3 and 660-11 will not apply. In the event the Contractor fails to apply the sand seal within 72 hours of receipt of such notice, the Engineer may proceed to have such work performed with Department forces and equipment.

TABLE 610-5
PLACEMENT TEMPERATURES FOR ASPHALT

Asphalt Concrete Mix Type	Minimum Air Temperature	Minimum Surface Temperature
B25.0B, C	35°F	35°F
I19.0B, C, D	35°F	35°F
SF9.5A, S9.5B	40°F	50°F[A]
S9.5C, S12.5C	45°F	50°F
S9.5D, S12.5D	50°F	50°F

A. 35°F if surface is soil or aggregate base for secondary road construction.

610-5 ASPHALT MIXTURE PRODUCTION

(A) General

Use plants that are either of the batch mixing, continuous mixing or drum mixing type, and so designed, equipped and operated that the weighing, proportioning and mixing of the materials will result in a uniform and satisfactory asphalt mixture meeting these Specifications. All plants shall conform to requirements of Subarticle 610-5(B) for the preparation of asphalt mixtures. In addition, batch mixing and drum mixing plants shall conform to the specific requirements of Sections 6.5 and 6.6, respectively, of the *HMA/QMS Manual*.

Before production of the mix, stockpile aggregates for a sufficient period of time to facilitate the drainage of free moisture. Keep the different aggregate sizes separated until they have been delivered to the cold feeders. Keep the separate stockpiles readily accessible for sampling. When mineral filler is required in the mix, feed or weigh-in separately from the other aggregates.

Introduce the asphalt binder and other additives, when required, into the mixture at the amounts and percentages specified by the JMF. No working tolerance will be allowed. Introduce the dried and heated aggregates and mineral filler, when required, in amounts and at temperatures such that the mixture produced is within the production control limits of Subarticle 609-6(D). Provide a positive means of controlling mixing time to obtain complete and uniform coating of the aggregate particles and thorough distribution of the asphalt binder throughout the aggregate. Produce the mixture at the asphalt plant within ± 15°F of the temperature established on the JMF.

All asphalt plants shall be certified by the Department as meeting these *Standard Specifications*. Certification is effective from the date of issuance and is non-expiring subject to continued compliance. The Department will check the plant on an annual basis or as deemed necessary by the Engineer. Any plant that is relocated, modified or changes ownership shall be recertified before use.

Any completely automatically controlled asphalt plant that, due to the basic design of the plant, does not meet all these Specifications for conventional batch mixing, continuous mixing or drum mixing may be used on a project by project basis provided a uniformly consistent mix meeting all mix requirements can be produced and the plant has been approved in writing.

(B) Requirements for All Plants

(1) Equipment for Preparation of Asphalt Binder

Equip tanks for the supplying of asphalt binder to the plant to uniformly heat and hold the material at the required temperature before introduction into the mixer unit. Provide a circulating system for asphalt materials, that is capable of the proper mixing of additives. Provide a system with adequate pump or pumps to charge the mixing unit and unload asphalt material simultaneously. Include provisions for measuring and sampling plant supply tanks.

(2) Anti-Strip Additive Equipment

When chemical anti-strip additive is to be added to the asphalt binder at the asphalt plant instead of at the terminal, equip the plant with an in-line blending system capable of metering the additive within plus or minus 10% of the amount specified. Provide a thermostatically controlled heating system capable of heating and maintaining the additive tanks, contents and distribution system at the additive supplier's recommended temperature for the additive being used. Interlock the additive metering system with the asphalt binder control equipment so as to automatically vary the additive feed rate to maintain the required proportions. Provide a system that will automatically indicate in the plant control room the amount or rate of flow, when flow is occurring and when flow is obstructed or stops. Inject the additive into the asphalt binder feed line before introduction into the aggregate. Equip the feed line with an in-line blending device capable of thoroughly mixing the additive with the asphalt binder before mixing with the aggregate. Provide a metering system capable of being calibrated, checked and monitored for accuracy and amount of additive used.

Equip the system with an in-line totalizing flow meter capable of measuring the actual quantity in gallons of anti-strip additive that is injected into the asphalt binder being introduced into the aggregate. Provide a system that is capable of being easily read but not capable of being reset. Install the totalizer meter in the anti-strip feedline beyond the calibration bypass and as close to the actual point of additive introduction into the feedline as practical.

When hydrated lime anti-strip additive is used, provide a separate bin or tank and feeder system to store and proportion the lime into the aggregate in either dry or slurry form. Mix the lime and aggregate by pugmill or other approved means to achieve a uniform lime coating of the aggregate before entering the drier. When the lime is added in dry form, the aggregate shall contain at least 3% free moisture. The stockpiling of lime treated aggregate will not be permitted. Control the lime feeder system by a proportioning device that is accurate to within ± 10% of the specified amount. Provide a proportioning device with a convenient and accurate means of calibration and that is interlocked with the aggregate feed or weigh system so as to maintain the correct proportion. Provide a flow indicator or sensor that is interlocked with the plant controls such that production of the mixture will be interrupted if there is a stoppage or reduction of the lime feed.

(3) Aggregate Cold Feed Equipment

Use cold bins and a feeder system to proportion the aggregates and feed them to the dryer. Use separate cold bins for each size aggregate and each natural sand being used to provide a uniform and continuous flow. Provide separate dry storage when mineral filler is required. Equip cold aggregate bins with feeder units having interlocking controls capable of maintaining a constant ratio between the relative quantities of each size aggregate at varying plant production rates.

Provide cold feeders that are capable of being easily and accurately calibrated to ensure full control of the mix gradation.

(4) Dryer

Use a plant with a dryer or dryers that continuously agitate the aggregate during the heating and drying process.

(5) Control Unit for Asphalt Binder

Provide satisfactory means, either by weighing or metering to introduce the proper amount of asphalt binder into the mix.

(6) Thermometric Equipment

(a) Asphalt Binder Thermometric Equipment

Provide a thermometric device of adequate temperature range fixed in the asphalt binder feed line.

(b) Dryer Thermometric Equipment

Equip the dryer with an automatic burner control device that uses an approved thermometric instrument located in the discharge chute to actuate the automatic controls.

(7) Pollution Control Equipment

Equip all plants with such pollution control equipment as is necessary to meet all applicable Federal, State and local pollution requirements. Register and certify all plants by applicable environmental regulatory agencies before being certified by the Department.

(8) Safety Requirements

Provide adequate safety devices at all points where accessibility to plant operations is required. Provide accessibility to the top of truck bodies by a platform or other suitable device to enable QC and QA personnel to obtain samples and mixture temperature data. Thoroughly guard and protect all gears, pulleys, chains, sprockets and other dangerous moving parts. Provide ample and unobstructed space on the mixing platform. Maintain a clear and unobstructed passage at all times in and around the truck loading area. Keep all work areas free from asphalt drippings.

(9) Production Consistency

Any asphalt plant that cannot consistently produce a high quality mix meeting these Specifications will be in non-compliance with these Specifications and may have its certification revoked.

Upon a malfunction of required automatic equipment on a batch mixing plant, the plant may continue to operate manually for the following 2 consecutive working days, provided acceptable mixture is being produced.

When a malfunction of required automatic equipment on a drum mixer or continuous plant occurs, manual operation of the plant will not be allowed except that if, in the opinion of the Engineer, an emergency traffic condition exists, the plant may be allowed to operate manually until the unsafe traffic condition is corrected. All mix produced by manual operation will be subject to Section 609.

610-6 HOT MIX STORAGE SYSTEMS

When a storage system is used, provide a system capable of conveying the mix from the plant to the storage bin and storing the mix without a loss in temperature, segregation or oxidation of the mix. Limit storage time to the ability of the storage system to maintain the mix within the Specification requirements. Material may be stored in storage bins without an approved heating system for no more than 24 hours.

Provide a continuous type or skip bucket type conveyor system. Enclose continuous type conveyors so that the mix temperature is maintained within specification requirements. Provide a system designed in such manner as to prevent segregation of the mix during discharge from the conveyor into the bins and equipped with discharge gates that will not cause segregation of the mix while loading the mix into trucks.

610-7 HAULING OF ASPHALT MIXTURE

Transport the mixture from the mixing plant to the point of use in vehicles that have tight, clean, smooth beds approved by the Department, that have been sprayed with an approved release agent material to prevent the mixture from adhering to the beds. Remove excess release agent before loading. Cover each load of mixture with a solid, waterproof tarp constructed of canvas, vinyl, or other suitable material. Securely fasten each tarp so as to overlap the top of the truck bed and prevent the entrance of moisture and the rapid loss of temperature Provide a 3/8" to 5/8" diameter hole on each side of the vehicle body near the center of the body and above the bed of the vehicle for the purpose of inserting a thermometer.

Assure temperature of the mixture immediately before discharge from the hauling vehicle is within a tolerance of +15°F to -25°F of the specified JMF temperature.

610-8 SPREADING AND FINISHING

Apply tack coat in accordance with Section 605.

Mixtures produced simultaneously from different plant sources cannot be intermingled by hauling to the same paver on the roadway unless the mixtures are being produced from the same material sources and same JMF.

Perform this work in accordance with and using equipment meeting Section 9.5 of the *HMA/QMS Manual.*

Use a material transfer vehicle (MTV) when placing all asphalt concrete plant mix pavements which require the use of asphalt binder grade PG 76-22 and for all types of OGAFC, unless otherwise approved. Use a MTV for all surface mix regardless of binder grade placed on Interstate and US routes that have 4 or more lanes and median divided. Where required above, use the MTV when placing all full width travel lanes and collector lanes. Use MTV for all ramps, loops, Y-line travel lanes, full width acceleration lanes, full width deceleration lanes and full width turn lanes that are greater than 1,000 ft in length. Use a MTV meeting Section 9.5(E) of the *HMA/QMS Manual.*

Request the Engineer to waive the requirement for use of pavers for spreading and finishing where irregularities or obstacles make their use impractical. Spread, rake and lute the mixture by hand methods or other approved methods in these areas.

Operate the paver as continuously as possible. Pave intersections, auxiliary lanes and other irregular areas after the main line roadway has been paved, unless otherwise approved.

Repair any damage caused by hauling equipment across structures at no additional cost to the Department.

610-9 COMPACTION

Immediately after the asphalt mixture has been spread, struck off and surface and edge irregularities adjusted, thoroughly and uniformly compact the pavement. Compact the mix to the required degree of compaction for the type of mixture being placed.

Provide sufficient number and weight of rollers, except as noted, to compact the mixture to the required density while it is still in a workable condition. Obtain approval of equipment used in compaction from the Engineer before use. Where uniform density is not being obtained throughout the depth of the layer of material being tested, change the type and/or weight of the compaction equipment as necessary to achieve uniform density even though such equipment has been previously approved.

Compact all final wearing surfaces, except open-graded asphalt friction course, using a minimum of 2 steel-wheel tandem rollers, unless otherwise approved. Pneumatic-tire rollers with 2 tandem axles and smooth tread tires may be used for intermediate rolling.

Limit rolling for open-graded asphalt friction course to one coverage with a tandem steel-wheel roller weighing a maximum of 10 tons, with additional rolling limited to one coverage with the roller where necessary to improve the riding surface.

Steel-wheel tandem vibratory rollers specifically designed for the compaction of asphalt pavements may be used on all layers 1" or greater in thickness during the breakdown and intermediate rolling phase. Do not operate vibratory rollers in the vibratory mode during the finish rolling phase on any mix type or pavement course, open-graded asphalt friction course or on permeable asphalt drainage course.

When vibratory rollers are used, use rollers that have variable amplitude and frequency capabilities and that are designed specifically for asphalt pavement compaction. Provide rollers equipped with controls that automatically disengage the vibration mechanism before the roller stops when being used in the vibratory mode.

The Engineer may prohibit or restrict the use of vibratory rollers where damage to the pavement being placed, the underlying pavement structure, drainage structures, utilities or other facilities is likely to occur or is evident.

Do not use rolling equipment that results in excessive crushing of the aggregate or excessive displacement of the mixture.

In areas inaccessible to standard rolling equipment, thoroughly compact the mixture by the use of hand tampers, hand operated mechanical tampers, small rollers or other approved methods.

Use rollers that are in good condition and capable of being reversed without backlash to compact the mixture. Operate rollers with the drive wheels nearest the paver and at uniform speeds slow enough to avoid displacement of the mixture. Equip steel-wheel rollers with wetting devices that will prevent the mixture from sticking to the roller wheels.

Begin compaction of the material immediately after the material is spread and shaped to the required width and depth. Carry out compaction in such a manner as to obtain uniform density over the entire section. Perform compaction rolling at the maximum temperature at which the mix will support the rollers without moving horizontally. Complete the compaction (including both intermediate rolling) before the mixture cooling below a workable temperature. Perform finish rolling to remove roller marks resulting from the compaction rolling operations.

610-10 DENSITY REQUIREMENTS

TABLE 610-6
SUPERPAVE DENSITY REQUIREMENTS

Superpave Mix Type	Minimum % G_{mm} (Maximum Specific Gravity)
SF9.5A	90.0
S9.5X, S12.5X, I19.0X, B25.0X	92.0

Compact the asphalt plant mix to at least the minimum percentage of the maximum specific gravity listed in Table 610-6, except as noted below. Perform density sampling and testing on all pavements listed below unless otherwise approved:

(A) Full width travel lane pavements, including normal travel lanes, turn lanes, collector lanes, ramps and loops and temporary pavements;

(B) Pavement widening 4.0 ft or greater;

(C) Uniform width paved shoulders 2.0 ft or greater; and

(D) Wedging as outlined in the *HMA/QMS Manual*.

Compact base and intermediate mix types (surface mixes not included) used for pavement widening of less than 4.0 ft and all mix types used in tapers, irregular areas and intersections (excluding full width travel lanes of uniform thickness), using equipment and procedures appropriate for the pavement area width and/or shape. Compaction with equipment other than conventional steel drum rollers may be necessary to achieve adequate compaction. Occasional density sampling and testing to evaluate the compaction process may be required. Densities lower than that specified in Table 610-6 may be accepted, in accordance with Article 105-3, for the specific mix types and areas listed directly above.

610-11 JOINTS

(A) Transverse Joints

When the placing of the mixture is to be suspended long enough to permit the mixture to become chilled, construct a transverse joint.

If traffic will not pass over the end of the paving, a butt joint will be permitted, provided proper compaction is achieved. If traffic will pass over the joint, construct a sloped wedge ahead of the end of the full depth pavement to provide for proper compaction and protection of the full depth pavement. Construct the joint square to the lane alignment and discard all excess material. Place a paper parting strip beneath this wedge to facilitate joint construction unless waived by the Engineer.

Before paving operations are resumed, remove the sloped wedge and cut back into the previously constructed pavement to the point of full pavement depth. Coat the exposed edge of the previously constructed pavement with tack coat.

When laying of the mixture is resumed at the joint, complete and then test the construction of the joint in accordance with Article 610-12 while the mixture is still in a workable condition.

(B) Longitudinal Joints

Tack the exposed edge of all longitudinal joints before placing the adjoining pavement.

Form longitudinal joints by allowing the paver to deposit the mixture adjacent to the joint to such depth that maximum compaction can be obtained along the joint. Pinch the joint by rolling immediately behind the paver.

When multi-lane multi-layer construction is required, offset the longitudinal joints in each layer from that in the layer immediately below by approximately 6". Construct the joints in the final layer, where possible, between designated travel lanes of the final traffic pattern.

610-12 SURFACE REQUIREMENTS AND ACCEPTANCE

Construct pavements using quality-paving practices as detailed herein. Construct the pavement surface smooth and true to the plan grade and cross slope. Immediately correct any defective areas with satisfactory material compacted to conform with the surrounding area.

Pavement imperfections resulting from unsatisfactory workmanship such as segregation, improper longitudinal joint placement or alignment, non-uniform edge alignment or excessive pavement repairs will be unsatisfactory. Pavement imperfections will be evaluated for acceptance in accordance with Article 105-3.

When directed due to unsatisfactory laydown or workmanship, operate under the limited production procedures. Limited production for unsatisfactory laydown is defined as being restricted to the production, placement, compaction and final surface testing (if applicable) of a sufficient quantity of mix necessary to construct only 2,500 ft of pavement at the laydown width.

Remain on limited production until such time as satisfactory laydown results are obtained or until 3 consecutive 2,500 ft sections have been attempted without achieving satisfactory laydown results. If the Contractor fails to achieve satisfactory laydown results after 3 consecutive 2,500 ft 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 problems rather than laydown procedures.

Mix placed under the limited production procedures for unsatisfactory laydown or workmanship will be evaluated for acceptance in accordance with Article l05-3.

Each pavement layer will be tested by the Contractor and the Engineer using a 10-ft stationary straightedge furnished by the Contractor. Any location on the pavement selected by the Department shall be tested as well as all transverse joints. Apply the straightedge parallel to the centerline of the surface. Do not exceed 1/8" variation of the surface being tested from the edge of the straightedge between any 2 contact points. Correct areas found to exceed this tolerance by removal of the defective work and replacement with new material, unless other corrective measures are permitted. Provide the work and materials required in the correction of defective work.

610-13 FINAL SURFACE TESTING AND ACCEPTANCE

On portions of this project where the typical section requires two or more layers of new pavement, perform smoothness acceptance testing of the longitudinal profile of the finished pavement surface using either an Inertial Profiler or a North Carolina Hearne Straightedge (Model No. 1).

Use an Inertial Profiler (Option 1) to perform smoothness acceptance testing of the longitudinal profile of the finished pavement surface. Furnish an inertial profiler(s) necessary to perform this work. Maintain responsibility for all costs related to the procurement, handling, and maintenance of these devices.

Furnish and operate the Hearne straightedge (Option 2) to determine and record the longitudinal profile of the pavement on a continuous graph.

Before beginning any paving operations, the Contractor shall select one of the above options and submit documentation to the Engineer on the selected option for smoothness acceptance.

(A) Option 1 - Inertial Profiler

Use an Inertial Profiler to measure the longitudinal pavement profile for construction quality control and smoothness acceptance. Use a profiler with line laser technology as single-point laser technology will not be allowed. Produce International Roughness Index (IRI) and Mean Roughness Index (MRI) values for measuring smoothness.

Use testing and recording software to produce electronic inertial road profiles in a format compatible with the latest version of FHWA's ProVAL (Profile Viewing and Analysis) software.

The Inertial Profiler shall be calibrated and verified in accordance with the most current version of AASHTO M 328. Provide certification documentation that the profiler meets AASHTO M 328 to the Engineer before the first day the Inertial Profiler is used on the project.

Configure the profiler to record the actual elevation of the pavement surface. Do not use the profiler's internal IRI calculation mode. The profile data shall be filtered with a cutoff wavelength of 300 ft. The interval at which relative profile elevations are reported shall be 1".

Provide IRI data in accordance with most current version of ASTM E1926. Use personnel trained to record and evaluate IRI data.

Provide a competent operator, trained in the operation of the Inertial Profiler Operation of the Inertial Profiling system shall conform to AASHTO R 57.

Provide the user selected Inertial Profiler settings to the Engineer for the project records. Certification of the Inertial Profiling system shall conform to AASHTO R 56.

Remove all objects and foreign material on the pavement surface prior to longitudinal pavement profile testing.

Operate the profiler at any speed as per the manufacturer's recommendations, however, the speed must be constant to within ± 3 mph of the intended speed and any required acceleration should be as gradual as possible. For example, if the intended speed were 30 mph, the acceptable range of speed for testing would be 27 to 33 mph.

Operate the Inertial Profiler in the direction of the final traffic pattern. Collect IRI data from both wheel paths during the same run. It is permissible to collect data one wheel path at a time if each wheel path is tested and evaluated separately. Define a "wheel path" as the 3 ft from the edge of the travel lane. MRI values are the average of the IRI values from both wheel paths. When using an inertial profiler that collects a single trace per pass, take care to ensure that the measurements from each trace in a travel lane start and stop at the same longitudinal locations. Unless otherwise specified, multiple runs are not necessary for data collection.

Operate the automatic triggering method at all times unless impractical. A tape stripe or traffic cone wrapped with reflective material may be used to alert the profiler's automatic triggering sensor to begin data collection. The profiler shall reach the intended operating speed before entering the test section. The runup and runout distances should be sufficient to obtain the intended operating speed and to slow down after testing is completed.

Divide the pavement surface for the project into sections which represent a continuous placement (i.e. the start of the project to bridge, intersection to intersection). Terminate a section 50 ft before a bridge approach, railroad track, or similar interruption. (Separate into 0.10-mile sections).

The evaluation of the profiles will be performed on a section basis. A section is 0.10 mile of a single pavement lane. For any section, which is less than 0.10 mile in length, the applicable pay adjustment incentive will be prorated on the basis of the actual length.

Mark the limits of structures and other special areas to be excluded from testing using the profiler's event identifier such that the exact locations can be extracted from the profile data file during processing.

Unless otherwise authorized by the Engineer, perform all smoothness testing in the presence of the Engineer. Perform smoothness tests on the finished surface of the completed project or at the completion of a major stage of construction as approved by the Engineer. Coordinate with and receive authorization from the Engineer before starting smoothness testing. Perform smoothness tests within 7 days after receiving authorization. Any testing performed without the Engineer's presence, unless otherwise authorized, may be ordered retested at the Contractor's expense.

After testing, transfer the profile data from the profiler portable computer's hard drive to a write once storage media (DVD-R or CD-R) or electronic media approved by the Engineer. Label the disk or electronic media with the Project number, Route, file number, date, and termini of the profile data. Submit the electronic data on the approved media to the Engineer immediately after testing and this media will not be returned to the Contractor.

Submit documentation and electronic data of the evaluation for each section to the Engineer within 10 days after completion of the smoothness testing. Submit the electronic files compatible with ProVAL and the evaluation in tabular form with each 0.10 mile segment occupying a row. Include each row with the beginning and ending station for the section, the length of the section, the original IRI values from each wheel path, and the MRI value for the section. Each continuous run for a section will occupy a separate table and each table will have a header that includes the following: the project contract number, county, the roadway number or designation, a lane designation, the JMF used for the final lift, the dates of the smoothness runs, and the beginning and ending station of the continuous run. Summarize each table at the bottom.

Traffic control and all associated activities included in the pavement smoothness testing of the pavement surface will be the responsibility of the Contractor.

(1) Acceptance for New Construction

IRI and MRI numbers recorded in inches per mile will be established for each 0.10-mile section for each travel lane of the surface course designated by the contract. Areas excluded from testing by the profiler will be tested using a 10-ft straightedge in accordance with Article 610-12.

Table 610-7 provides the acceptance quality rating scale of pavement based on the final rideability determination.

TABLE 610-7
MRI PRICE ADJUSTMENT PER 0.10-MILE SECTION

MRI after Completion (Inches Per Mile)	Price Adjustment Per Lane (0.10-Mile Section)
45.0 and Under	$200.00
45.1-55.0	PA = 600 – (10 * MRI)
55.1-70.0	Acceptable (No Pay Adjustment)
70.1-90.0	PA = 650 – (10 * MRI)
Over 90.1	Corrective Action Required

This price adjustment will apply to each 0.10-mile section based on the Mean Roughness Index (MRI), the average IRI values from both wheel paths.

When corrections to the pavement surface are required, the Engineer shall approve the Contractor's method of correction. Methods of correction shall be milling and inlay, remove and replace or other methods approved by the Engineer. To produce a uniform cross section, the Engineer may require correction to the adjoining traffic

lanes or shoulders. Corrections to the pavement surface, the adjoining traffic lanes and shoulders will be at no cost to the Department.

Where corrections are made after the initial smoothness testing, the pavement will be retested by the Contractor to verify that corrections have produced the acceptable ride surface. No incentives will be provided for sections on which corrective actions have been required. The Contractor will have one opportunity to perform corrective action(s).

(2) Localized Roughness

Areas of localized roughness shall be identified through the "Smoothness Assurance Module" provided in the ProVAL software. Use the "Smoothness Assurance Module" to optimize repair strategies by analyzing the measurements from profiles collected using inertial profilers. The ride quality threshold for localized roughness shall be 125"/mile at the continuous short interval of 25 ft. Submit a continuous roughness report to identify sections outside the threshold and identify all localized roughness, with the signature of the Operator included with the submitted IRI trace and electronic files.

The Department will require that corrective action be taken regardless of final IRI. Re-profile the corrected area to ensure that the corrective action was successful. If the corrective action is not successful, the Department will assess a penalty or require additional corrective action.

Corrective work for localized roughness shall be approved by the Engineer before performing the work and shall consist of either replacing the area by milling and inlaying or other methods approved by the Engineer. Any corrective action performed shall not reduce the integrity or durability of the pavement that is to remain in place. Milling and inlay or any corrective actions shall meet the specifications requirements for ride quality over the entire length of the correction. Notify the Engineer 5 days before commencement of the corrective action.

Localized roughness correction work shall be for the entire traffic lane width. Pavement cross slope shall be maintained through corrective areas.

(B) Option 2 - North Carolina Hearne Straightedge

Push the straightedge manually over the pavement at a speed not exceeding 2 mph. 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. As an exception, lanes adjacent to curb and gutter, expressway gutter, or shoulder berm gutter may be tested in the left wheel path. 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, use a 10-ft 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 no 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 1,000 ft in length, ramps less than or equal to 1,000 ft in length, turn lanes less than or equal to 1,000 ft 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 1,000 ft in length, ramps, full width turn lanes greater than 1,000 ft in length and collector lanes.

At the beginning and end of each day's testing operations, and at such other times as determined 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 Section in the Construction Unit.

Plot the straightedge graph at a horizontal scale of approximately 25 ft/in with the vertical scale plotted at a true scale. Record station numbers and references (bridges, approach slabs, culverts, etc.) on the graphs. 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", 0.3" and 0.4" to evaluate the graph for acceptance. The 0.2" and 0.3" 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" and 0.3" 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" blanking band is used to further evaluate deviations on an individual basis. The 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 2,500 ft 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 2,500 ft 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 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 2,500 ft 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 3 consecutive 2,500 ft 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 before proceeding on the project.

If the Contractor fails to achieve satisfactory laydown results after 3 consecutive 2,500 ft 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 l05-3.

The pay adjustment schedule for the Cumulative Straightedge Index (CSI) test results per lot is in Table 610-8.

TABLE 610-8
PAY ADJUSTMENT SCHEDULE FOR CUMULATIVE STRAIGHTEDGE INDEX
(Obtained by adding SE Index of up to 25 consecutive 100 ft test sections)

CSI[A]	Acceptance Category	Corrective Action	Pay Adjustment Before Corrective	Pay Adjustment 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)	

A. Either Before or After Corrective Actions

Correct any deviation that exceeds a 0.4" blanking band such that the deviation is reduced to 0.3" 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 4-0 or better. If the CSI indicates Allowed corrective action, the Contractor may elect to take necessary measures to reduce the CSI instead of accepting the disincentive. Take corrective actions as specified if the CSI indicates Required corrective action. The CSI after corrective action shall 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 of the entire lot. No disincentive will apply after corrective action if the CSI is 4-0 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, before any corrective work. Where corrective actions have been taken, payment will be based on the CSI determined after correction, not to exceed 100% payment.

Areas excluded from testing by the N.C. Hearne Straightedge will be tested by using a non-mobile 10-ft straightedge. Assure that the variation of the surface from the testing edge of the straightedge between any 2 contact points with the surface is not more than 1/8". 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.

610-14 DENSITY ACCEPTANCE

The Department will evaluate the asphalt pavement for density acceptance after the asphalt mix has been placed and compacted using the Contractor's QC test results, the Department's QA test results (including verification samples) and by observation of the Contractor's density QC process conducted in accordance with Section 609. Minimum density requirements for all mixes will be as specified in Table 610-6. Density acceptance will be as provided herein. Core sample densities will be determined by use of the average maximum specific gravity (G_{mm}), until a moving average of the last 4 maximum specific gravities is established. Once a moving average of the last 4 maximum specific gravities is established, the last G_{mm} moving average in effect at the end of the same day's production will then be used to determine density acceptance.

The pavement will be accepted for density on a lot by lot basis. A lot will consist of one day's production of a given JMF on a contract. As an exception, separate lots will be established when one of the following occurs:

(A) Portions of pavement are placed in both New and Other construction categories as defined below. A lot will be established for the portion of the pavement in the New construction category and a separate lot for the portion of pavement in the Other construction category.

(B) Pavement is placed on multiple resurfacing maps. Unless otherwise approved before paving, a lot will be established for each individual resurfacing map or portion thereof.

(C) Pavement is placed by multiple paving crews. A lot will be established for the pavement placed by each paving crew.

(D) Pavement is placed in different layers. A lot will be established for each layer.

(E) Control strips are placed during limited production.

The Engineer will determine the final category and quantity of each lot for acceptance purposes. The New construction category will be defined as pavements of uniform thickness, exclusive of irregular areas, meeting all 3 of the following criteria:

(1) Pavement placed on a new aggregate or soil base compacted to the specified density or pavement placed on a new asphalt mix layer (excluding wedging and leveling);

(2) Pavement that is within a designated travel lane of the final traffic pattern; and

(3) Pavement that is 4.0 ft or wider.

As an exception, when the first layer of mix is a surface course and is being placed directly on an unprimed aggregate or soil base, the layer will be included in the Other construction category.

The Other construction category will include all pavements except as described above.

A failing lot for density acceptance purposes is defined as a lot for which the average of all test sections, and portions thereof, fails to meet the minimum specification requirement. If additional density sampling and testing, beyond the minimum requirement, is performed and additional test sections are thereby created, then all test results shall be included in the lot average. In addition, any lot or portion of a lot that is obviously unacceptable will be rejected for use in the work.

If the Engineer determines that a given lot of mix that falls in the New category does not meet the minimum specification requirements but the work is reasonably acceptable, the lot will be accepted at a reduced pay factor in accordance with the following formula. The reduced pay factor will apply only to the mix unit price.

$$\textbf{Reduced Pay Factor} = 100 + \left[\left(\frac{Actual\ \ Density - Specified\ \ Density}{2} \right) x30 \right]$$

Where:

Actual Density = the lot average density, not to exceed 2.0% of the specified density

Specified Density = the density in Table 610-6 or as specified in the contract

All failing lots in the Other category will be evaluated for acceptance in accordance with Article 105-3.

Any density lot not meeting minimum density requirements detailed in Table 610-6 will be evaluated for acceptance in accordance with Article 105-3. If the lot is determined not to be acceptable, the mix will be removed and replaced with mix meeting and compacted to the requirement of these *Standard Specifications.*

610-15 MAINTENANCE

Maintain the plant mix pavement in an acceptable condition until final acceptance of the project. Immediately repair any defects or damage that may occur. Perform maintenance to damaged or defective pavement and repeat as often as may be necessary to keep the base or pavement in an acceptable condition.

610-16 MEASUREMENT AND PAYMENT

Hot Mix Asphalt Pavement will be paid at the contract unit price per ton that will be the actual number of tons of each type of hot mix asphalt pavement incorporated into the completed and accepted work in accordance with Article 106-7.

No direct payment will be made for providing and using the materials transfer vehicle or any associated equipment, as the cost of providing same will be included in the contract unit bid price per ton for the mix type to be placed.

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

A high frequency of asphalt plant mix or density deficiencies may result in future deficient asphalt being excluded from acceptance at an adjusted contract unit price in accordance with Article 105-3. This acceptance process will apply to all asphalt produced or placed and will continue until the Engineer determines a history of quality asphalt production and placement is reestablished.

Furnishing asphalt binder will be paid as provided in Article 620-4 for *Asphalt Binder for Plant Mix* for each grade required.

Provide the work and materials required in the correction of defective work or sand seal base course as required at no cost to the Department. If the Engineer has such work performed with Department forces and equipment, the cost of such work performed by Department forces will be deducted from monies due or to become due to the Contractor.

No direct payment will be made for final surface testing covered by this section. Payment at the contract unit prices for the various items covered by those sections of the *Standard Specifications* directly applicable to the work constructed will be full compensation for all work covered by Article 660-11 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.

Payment will be made under:

Pay Item	**Pay Unit**
Asphalt Concrete Base Course, Type B25.0B	Ton
Asphalt Concrete Base Course, Type B25.0C	Ton
Asphalt Concrete Intermediate Course, Type I19.0B	Ton
Asphalt Concrete Intermediate Course, Type I19.0C	Ton
Asphalt Concrete Intermediate Course, Type I19.0D	Ton
Asphalt Concrete Surface Course, Type SF9.5A	Ton
Asphalt Concrete Surface Course, Type S9.5B	Ton
Asphalt Concrete Surface Course, Type S9.5C	Ton
Asphalt Concrete Surface Course, Type S9.5D	Ton
Asphalt Concrete Surface Course, Type S12.5C	Ton
Asphalt Concrete Surface Course, Type S12.5D	Ton