DIVISION 400

ASPHALT PAVEMENTS

SECTION 401 — ASPHALT MIXING PLANT REQUIREMENTS

401.01 DESCRIPTION. Provide and maintain a plant and all equipment necessary to produce and test asphalt mixtures.

401.02 EQUIPMENT.

401.02.01 All Asphalt Mixing Plants. Ensure that all asphalt mixing plants are inspected and approved by the Department before initial use and a minimum of once annually thereafter. For initial approval, submit a "Contractor's Master Certification of Asphalt Mixing Plant and Related Equipment" form for each plant to the Engineer. For previously approved plants, submit an "Annual Renewal Certification for Previously Approved Plants and Related Equipment" form to the Engineer before beginning each season. When significant changes are made in the plant equipment or in the method of operation at an approved plant, reapply for approval.

Ensure the manufacturer's plate, listing the maximum capacity of the plant, is attached to the plant. Do not operate the plant at a production rate greater than the operational capacity of any plant component. Operate the plant so that it produces a fully coated mixture within the specified properties, gradation tolerances, and asphalt binder tolerances.

When plants are in operation, the Department will require one computer with a printer attached on the site of operations for the purpose of recording and submitting test data. Ensure the computer is installed with and utilizes the following minimum system requirements: Microsoft Office 2003 Professional (full installation). Additionally, the Department will require that each Company provide at least one Internet access site for sending and receiving electronic mail.

A) Field Laboratory. Furnish and maintain a field laboratory facility according to Subsection 106.03.02. A field laboratory may be a building, trailer, or space within a building, provided the space is completely closed to the remainder of the building. Provide means for visually monitoring mixing plant operations. Do not use laboratories for storage.

Provide a laboratory inspected and qualified according to the Department's Quality Assurance Program for Materials Testing and Acceptance and conforming to the following minimum requirements:

1) a floor space of 250 square feet with a minimum width of 7 feet;
2) provisions for heating and cooling within the range of 65 to 80 °F;
3) adequate lighting; and
4) a sufficient number of electric wall outlets (110-120v) to accommodate all equipment.

In addition to the equipment required to perform testing according to the AASHTO standards and Kentucky Methods (KM), equip each laboratory with the following minimum furnishings and equipment, conforming to the applicable specifications, as required for the type of construction specified in the Contract:

1) one workbench, at least 2.5 feet wide by 6 feet long;
2) one desk or table and 2 chairs;
3) a fire extinguisher located near the door; and
4) a first-aid kit.

When using solvent extractions for asphalt binder content determination, provide equipment and solvent for either the centrifuge (Method A) or the vacuum extractor (Method B) according to KM 64-405. Ensure that the extractor stand is fully enclosed and equipped with fans capable of exhausting at least 1,450 cubic feet per minute. Build duct-work across the entire backside of the workbench with

an access port into an enclosed cabinet, so as to direct any fumes or dust from the top of the workbench into the enclosed cabinet. The Engineer will furnish a sketch of an acceptable exhaust system upon request. The Engineer will approve other configurations if he determines that they meet the intended purpose. Mount all control switches outside the cabinet and in accordance with all applicable safety standards.

B) Aggregate Storage. Provide sufficient storage for separate stockpiles, bins, or stalls for each size of aggregate. Keep different sizes separated until delivery through the cold feed proportioning devices. Maintain the storage area in an orderly condition with walkways between any stockpiles that are not separated by bins or stalls. Provide adequate provisions for sampling aggregates from the stockpiles.

C) Asphalt Binder Equipment. Provide tanks for storage of asphalt binders equipped for heating the material to the temperature required in Subsection 401.03.01. When direct-fire heating systems are utilized, heat the tank without letting the flames contact it.

Provide a circulating system for the asphalt binder of a capacity that ensures continuous circulation between the storage tank and proportioning unit during the entire operating period.

Place the discharge end of the asphalt binder circulating pipe at the opposite end of the circulating pump, near the bottom of the storage tank.

Heat and insulate all pipelines and fittings to prevent heat loss.

Provide a storage tank with a capacity that ensures continuous plant operation and uniform temperature of the asphalt binder when it is introduced into the mixture. Provide means for accurately measuring the volume of asphalt binder in the storage tank at any time. Provide separate storage for each type and grade of asphalt binder stored at each plant site.

Provide a sampling outlet that is readily accessible and free from obstruction in each storage tank or in the asphalt binder feed lines connecting the plant storage tanks to the asphalt plant. When the sampling valve is located in the feed line, provide it between the pump and the return line discharge in a location that is readily accessible and free from obstruction. Provide a drainage receptacle for flushing the outlet before sampling.

D) Feeder for Drier. Provide a mechanical feeder that is an apron, belt, reciprocating plate, or vibrating type with accurate and separate adjustments for total and proportional feed. Install total and proportional feed adjustments that are continuously variable and capable of being fixed in any position.

E) Drier. Provide a drier capable of drying and heating the aggregate to the moisture content and temperature requirements set forth in the applicable mixture specifications without leaving any visible unburned residue on the aggregate when discharged from the drier.

F) Screens. Provide plant screens between the cold feed and the weigh bridge to prevent oversized material and to separate all aggregates, RAP, and RAS so they may be recombined consistently within the specification limits for the asphalt mixture being produced for all new or relocated asphalt plants.

G) Bins. Except for drum-mix plants, provide the plant with a hot-bin storage of a sufficient capacity to ensure uniform and continuous operation.

Use bins that are divided into at least 3 compartments and arranged to ensure storage of appropriate fractions of the aggregates. Use bins that are designed such that samples of dry, screened aggregates may be readily sampled from each compartment.

Provide each compartment with an overflow pipe that prevents material from backing up into other bins or into contact with the screen.

Provide dry storage for mineral filler and provisions for accurate proportioning.

Equip each compartment with an alarm to indicate when there is a low supply

of material. Equip batch plants with an actuating device that prevents material from being drawn from other compartments when material is low in the compartment being used.

H) Asphalt Binder Control Unit. Provide a means, either by weighing or metering, to obtain the proper quantity of asphalt binder. Ensure that metering devices are accurate to within ± 1.0 percent by weight when tested for accuracy. Provide a calibration tank with a minimum capacity of 250 gallons that is mounted on load cells for checking the accuracy of the metering system. Use asphalt binder scales that conform to Subsection 401.02.02 B).

When metering the quantity of asphalt binder, check the delivery of the meter by actual weight.

For drum mixing plants, calibrate the asphalt binder delivery system and metering device in the presence of the Engineer before starting production at the beginning of each construction season, each time the plant is relocated, after making significant changes in the plant equipment, after revising the method of operation, and whenever the Engineer deems it necessary.

Maintain the specified temperatures of asphalt binder in the pipelines, meters, buckets, spray bars, and other containers or flow lines.

I) Recordation. Provide an automatic graphic or digital record of the production quantities according to AASHTO M 156.

J) Thermometers. Provide a non-recording thermometer in the asphalt binder feed line between the storage tank and the charging valve. When a non-recording thermometer is installed in the asphalt binder storage tank(s), the Department will not require a non-recording thermometer in the feed line.

Provide a non-recording thermometer near the discharge of the aggregate bin, unless the aggregate dryer is equipped with an automatic burner control system capable of heating the aggregate and consistently maintaining the temperature of the asphalt mixture within ± 15 °F.

K) Control of Mixing Time. Use a plant equipped with means for governing mixing time.

L) Dust Collectors. Equip the plant with an effective dust collector capable of either wasting the collected dust or using it in the mixture.

M) Power Sprayer. Furnish a power sprayer to apply a fine uniform spray or mist of material conforming to Subsection 403.02.05 in truck beds to prevent the adherence of asphalt mixtures during hauling.

N) Signs. Place a sign on or near the plant visible to all asphalt mixture haulers prior to loading, stating "TRUCKS HAULING STATE MATERIAL WILL NOT BE LOADED WHEN BEDS CONTAIN CONTAMINATING MATERIAL AND MUST BE TARPED PRIOR TO LEAVING PLANT."

O) Other Requirements. Provide adequate and safe stairways to the mixer platform and guarded ladders for other plant units at all locations necessary to provide access to all plant operations. Provide a sturdy platform of sufficient height to inspect and sample the mixture after discharge into the haul units.

P) Safety Requirements. Ensure that all plants and plant sites conform to the safety, health, and sanitation requirements of Subsection 107.01.01.

401.02.02 Special Requirements for Batch Plants.

A) Weigh Box or Hopper. Provide equipment that weighs each bin size of aggregate into a weigh box or hopper that is suspended on scales and holds a full batch size of aggregate. Provide gates that prevent leakage when closed.

B) Scales. Provide springless, dial type, or another approved type of scales for any aggregate weigh box or hopper, and for weighing asphalt material. Provide scales of standard make and design having tolerances on overregistration and underregistration not exceeding 0.5 percent of the indicated weight when tested for accuracy.

Ensure that the change in load required to noticeably alter the position of rest

of the indicating element(s) of a non-automatic indicating scale is not greater than 0.1 percent of the nominal scale capacity.

Ensure that graduation intervals for scales are less than 0.1 percent of the nominal scale capacity and are plainly visible.

On dial scales, reduce parallax effects to the practical minimum with clearance between the indicator index and scale graduations not exceeding 0.06 inches.

Provide scales equipped with adjustable set points or pointers for marking the weight of each material to be weighed into the batch.

Ensure the component batching scales are inspected and certified as specified in Subsection 109.01.02.

Provide no fewer than 10 test weights, each of at least 50 pounds nominal weight and stamped with its actual weight, for the purpose of testing and calibrating the scales. For each scale, provide a suitable cradle or platform for applying test loads. Keep test weights clean and conveniently located for calibration of the scale or provide means for testing and calibrating the scales by a commercial scale company when the Engineer requests.

The Department will allow batch plants to operate with no screens, other than a scalper screen, provided:

1) The plant is equipped with an aggregate weighing device (belt scales) that provides positive weight control;
2) The system controls aggregate flow from each bin;
3) The system controls the proportion from each bin in relation to the total aggregate flow;
4) The system provides the plant operator with a continuous digital display of the flow rate from each bin and the total aggregate flow rate; and
5) The system provides an alarm or automatic shut-off on the aggregate feed that operates when the flow from any individual feeder is interrupted.

Calibrate each cold feeder, along with the aggregate weighing devices, according to Subsection 401.02.04 A) and B).

C) Bins. For batch plants equipped with the aggregate weighing devices that Subsection 401.02.02 B) specifies, the Department will not require 3 separate hot aggregate bin compartments.

D) Asphalt Materials Bucket. If using a bucket, provide one large enough to handle a batch in a single weighing.

Provide a filling system that prevents asphalt binder material from overflowing, splashing, or spilling outside the bucket during filling and weighing.

Use a steam or oil-jacketed bucket or a bucket with properly insulated electric heating units. Arrange the bucket so it delivers the asphalt binder in a thin uniform sheet or in multiple sprays over the full length of the mixer.

E) Mixer Unit for Batch Method. Include at the plant a batch mixer of an approved twin pugmill type. Ensure that the mixer does not leak or cause segregation during discharge.

Provide a blade clearance from all fixed and moving parts that does not exceed 1 1/2 inches.

Provide a mixer with an accurate time lock. Control the operation of a complete mixer cycle by locking the weigh-box gate after charging the mixer until closing of the mixer gates at the completion of the cycle. Ensure that the asphalt materials bucket remains locked throughout the dry-mixing period and that the mixer gates remain locked throughout the dry and wet mixing periods. (The dry-mixing period is the interval of time between the opening of the weigh-box gate and the application of asphalt binder. The wet-mixing period is the interval of time between the start of the introduction of asphalt binder and the opening of the

mixer gate.)

401.02.03 Special Requirements for Automatic Batching. Provide a system with equipment for accurately proportioning batches of the various components of the mixture by weight in the proper sequence and for controlling the sequence and timing of mixing operations. Equip the plant with adjustable timing devices and other time-delay circuits that integrate the individual components of batching and mixing operations with the auxiliary interlock cut-off circuits necessary to stop the automatic cycling of the batching operations whenever the quantity of any ingredient falls outside the tolerance specified below:

BATCH TOLERANCES	
Material	Percent of Total Batch Weights
Batch Aggregate Component	± 1.5
Mineral Filler	± 0.5
Asphalt Binder	± 0.1
Zero Return (Aggregate)	± 0.5
Zero Return (Asphalt Binder)	± 0.1

Ensure that the accumulated weight of the batches is within 2.0 percent of the total batch weight. Record batch quantities according to AASHTO M 156.

401.02.04 Special Requirements for Dryer Drum Plants.

A) Aggregate Weighing Device. Provide an aggregate weighing device that includes a compensating adjustment for aggregate weight changes due to such factors as moisture content, wasting collected fines, and adding mineral filler. Provide a device that is capable of being set to the nearest 0.1 percent. Ensure that the weighing devices (belt scales) are accurate within ± 0.5 percent.

B) Feeder for Drier. Provide a scalping screen of appropriate size in advance of the weighing device.

Control aggregate flow from each bin. Control the proportion from each bin in relation to the total aggregate flow. Provide the plant operator with a continuous digital display of the flow rate from each bin and the total aggregate flow rate. When devices other than belt scales are used to control individual aggregate proportions or when belt scales do not have the capability to control the proportioning from each bin in relation to the total aggregate flow, provide an alarm that operates when the sum of the individual cold feeds differs by more than 3 percent from the measured weight of the total aggregate feed.

Provide an aggregate feed system with belt scales or other devices to provide positive weight control of the total aggregate feed. Ensure that the total aggregate flow is automatically coupled with the asphalt binder proportioning device. Calibrate each cold feeder using the gate openings and aggregate sizes specific to each mix type.

Provide an alarm or automatic shut-off on the total aggregate feed that operates when the flow from any individual feeder or the flow of asphalt binder to the drum is interrupted.

Provide means for obtaining representative samples of individual and combined aggregate from belts or feeders before their introduction into the dryer.

Calibrate the aggregate weigh bridge(s), in the presence of the Engineer before starting production at the beginning of each construction season, each time the plant is relocated, after making significant changes in the plant equipment, after revising the method of operation, and whenever the Engineer deems necessary.

C) Drier. Use a dryer drum mixer capable of simultaneously heating, mixing, and thoroughly coating the aggregate with a controlled amount of asphalt binder in a rotating cylindrical drum. The Department may allow coating of the aggregate with asphalt binder in a separate chamber with an approved design.

Equip the dryer drum plant with approved thermometric instruments at the discharge chute of the drum mixer. Equip the system with automatic burner controls regulated by approved temperature-sensing devices.

D) Surge and/or Storage Bin. Provide a surge and/or storage bin conforming to Subsection 401.03.02 C).

E) Dust Collector. Use a dust collector capable of proportioning collected dust in the vicinity of the asphalt injection device.

F) Production Quality Control. Stop mixing operations immediately if, at any time, a failure of the automatic electronic weighing system of the aggregate feed, asphalt binder feed, or water injection system control occurs. Do not manually operate the proportioning controls.

G) Water/Chemical Injection System. Provided each system has prior approval as specified in Subsection 402.01.01, the Department will allow the use of injection systems for the purpose of incorporating the material into the asphalt binder for production of Warm Mix Asphalt (WMA) or as a compaction aid.

Ensure the equipment for water/chemical injection meets the following requirements:

1) Injection equipment computer controls are automatically coupled to the plants controls (manual operation is not permitted);
2) Injection equipment has variable controls that introduce ratios based on production rates of mixtures;
3) Injects water/chemical into the flow of asphalt binder prior to contacting the aggregate;
4) Provides alarms on the injection system that operate when the flow of water or chemical is interrupted or deviates from the prescribed rate.

401.03 CONSTRUCTION.

401.03.01 Preparation of Mixtures. Deposit the coarse and fine aggregates in the cold elevator(s) at a rate to ensure correct and uniform temperature control of the heating and drying operations.

If the supplier heats the asphalt binder outside the specified range, let it reach a temperature within the specified range before mixing it with the aggregates. The Engineer may retest or reject asphalt mixture, in storage at the plant, that has been heated by the Contractor outside the specified range. Do not use asphalt binder while it is foaming in a storage tank.

Maintain the temperature of the component materials and asphalt mixture within the ranges listed in the following table:

MIXING AND LAYING TEMPERATURES (°F)			
Material		Minimum	Maximum
Aggregates		240	330
Aggregates used with Recycled Asphalt Pavement (Reclaimed Materials)		240	—
Asphalt Binders	PG 58-28*	230	330
	PG 64-22	230	330
	PG 76-22	285	350
Asphalt Mixtures at Plant (Measured in Truck)	PG 64-22 HMA	250	330
	PG 76-22 HMA	310	350
	PG 64-22 WMA**	230	330
	PG 76-22 WMA**	250	350
Asphalt Mixtures at Project (Measured in Truck When Discharging)	PG 64-22 HMA	230	330
	PG 76-22 HMA	300	350
	PG 64-22 WMA**	210	330
	PG 76-22 WMA**	240	350

* See Section 409 – Asphalt Mixtures Using Reclaimed Materials.
** See Section 109- Measurement and Payment

401.03.02 Mixing and Holding. Measure each size of aggregate and the asphalt binder separately. Regulate the proportion for each component to produce a mixture within the limits of the job-mix formula (JMF) and having all particles coated with asphalt binder.

Thoroughly mix the hot aggregates at the temperatures specified, and proportion them by weight.

The Engineer may establish maximum mixing times when deemed necessary.

A) Batch Plants. Use the following mixing times, unless the Engineer determines that longer times are necessary, to produce acceptable mixtures:

1) Three seconds minimum for mixing the dry aggregates, beginning at the time of the opening of the aggregate weigh hopper discharge gate;
2) Fifteen seconds maximum for introducing asphalt binder in an even distribution throughout the full length of the mixer, beginning at the end of the dry-mixing interval;
3) Twenty-five seconds minimum for mixing the aggregates and asphalt binder, beginning with the start of flow of the asphalt binder to the mixer;
4) When the time for introducing the asphalt binder exceeds 10 seconds, mix the asphalt binder and aggregates, after all asphalt binder has been introduced, a minimum of 15 seconds; and
5) Thirty seconds minimum for the total mixing time from the time of the opening of the aggregate weigh hopper discharge gate until the time of the opening of the mixer discharge gate.

When the Engineer extends either the time for dry-mixing or the time for introducing the asphalt binder into the mixer, or both, extend the minimum total mixing time to the same time as the sum of the dry-mixing and asphalt binder introduction time.

B) Dryer Drum. For a dryer drum mixing plant, the Engineer will not establish the mixing time. However, maintain production at the rate required to obtain a satisfactory aggregate coating and a uniform mixture conforming to the mixture specifications.

C) Surge or Storage Systems. Provided each system has prior approval, the Department will allow surge or storage systems for hot asphalt mixtures. The Engineer will approve the surge or storage system if tests indicate the system is capable of conveying, retaining, and delivering the asphalt mixture without balling

or hardening, appreciable loss of mixture temperature, segregation of the aggregates, or excessive oxidation of the asphalt binder. Add a silicone additive to the asphalt binder for mixtures to be stored beyond the day of mixing. The Engineer may withdraw approval of a surge or storage system when tests or inspections indicate the system is having a detrimental effect on the asphalt mixture.

Insulate bins intended for storage, and seal the top and bottom of the bins to prevent infiltration of outside air. When using bins for storage, ensure they are nearly full in order to provide a non-oxidizing condition. Maintain mixture temperatures within those specified for Asphalt Mixtures at Plant according to Subsection 401.03.

Completely empty surge bins by the end of each working day. When the bins cannot be emptied, store the asphalt mixtures overnight in a manner that prevents damage. Obtain the Engineer's approval for storage longer than overnight, up to 72 hours.

The Engineer will reject any asphalt mixture damaged in any way by use of a surge or storage system.

401.04 MEASUREMENT. Reserved.

401.05 PAYMENT. Reserved.

SECTION 402 — CONTROL AND ACCEPTANCE OF ASPHALT MIXTURES

402.01 DESCRIPTION. Provide the process control and quality control testing for the Department's acceptance determination of all classes and types of asphalt mixtures which may be furnished either as hot mix asphalt (HMA) or warm mix asphalt (WMA) produced with water injection systems.

402.01.01 Warm Mix Asphalt (WMA) Evaluation and Approval. The Department will evaluate trial production of WMA by use of a chemical, wax, or water injection system provided the system is installed according to the manufacturer's requirements and satisfies the requirements of Section 401. Evaluation will include production and placement of WMA to demonstrate adequate mixture quality including volumetric properties and density by Option A as specified in Subsection 402.03.02 D). Do not place WMA for evaluation on Department projects. Provided production and placement operations satisfy the applicable quality levels, the Department will approve WMA production on Department projects using the system as installed on the specific asphalt mixing plant evaluated.

402.02 MATERIALS AND EQUIPMENT.

402.02.01 Personnel. Provide a qualified Superpave Mix Design Technologist (SMDT) to be responsible for the submission and adjustment of the mix designs. Provide a qualified Superpave Plant Technologist (SPT) to be present during production and to perform the daily inspection, process-control, adjustments of the job mix formula, and quality control testing at the plant site for the Department's acceptance determination.

The Department will use a qualified SMDT for approval of all mix designs and a qualified SPT for verification testing.

402.03 CONSTRUCTION.

402.03.01 Responsibilities.

A) Composition of Mixtures. A JMF is defined as a single percentage for each specified sieve size for aggregate gradations and a specified asphalt binder content (AC) expressed to the nearest 0.1 percent. The Department will require an approved JMF within the specified gradation requirements for each mixture required on the project. Submit the JMF for the Engineer's approval according to KM 64-421.

B) Setup. Notify the District Materials Engineer of the intent to start a minimum of 24 hours before beginning production of each type of mixture. Furnish the facilities, equipment, personnel, and all other resources needed to comply with KM 64-426 and KM 64-435. Provide a Quality Control Plan (QCP), and complete the setup duties of KM 64-421. Complete the process control operations of KM 64-426. When the Engineer directs, obtain samples for Department use.

C) Process Control. After the setup period, perform the process control operations of KM 64-426.

402.03.02 Contractor Quality Control and Department Acceptance.

A) General. The Department will accept asphalt mixtures from the plant on a lot basis. A lot is 4,000 tons. A sublot is 1,000 tons. Monitor and evaluate the AC, air voids (AV), voids-in-mineral aggregate (VMA), density, and gradation. Document and report all quality control tests for the Department's acceptance determination on the Asphalt Mixtures Acceptance Workbook (AMAW). Submit the completed AMAW for each lot to the Department within 5 working days after

the completion of the lot.

B) Sampling. Obtain all samples from the truck bed at the asphalt mixing plant. The Department will determine when to obtain the quality control samples using the random-number feature of the mix design submittal and approval spreadsheet. The Department will randomly determine when to obtain the verification samples required in Subsections 402.03.03 and 402.03.04 using the Asphalt Mixture Sample Random Tonnage Generator. Take one sample for each sublot. At the beginning of each production day, do not take any quality control samples before the production of 50 tons. If the random number falls within the first 50 tons, take the sample from the first loaded truck following the truck containing the 50th ton produced.

C) Setup. The setup period is the first sublot of production. No new, or multiple setup periods will be permitted without obtaining written approval from the Engineer for these additional periods. After the first sublot no changes from the approved mix designs are permitted without first obtaining written approval from the Engineer. Keep plant and production adjustments within the specified approved mix design and specification requirements. The Department will approve no more than three mix designs per contract, per pay item, per plant. Within the same performance grade, changing asphalt binder supplier is permitted by notifying the Engineer and noting the new supplier and the supplier source code on the Asphalt Mixture Acceptance Workbook. Perform volumetric testing for AC, AV, and VMA within the first 2 hours of project production. By the end of the first sublot, test to document that the mixture meets a 0.90 minimum pay value for each of these properties. For mixtures with a total-project quantity between 500 and 1,000 tons, perform a minimum of one process control test for AC, AV, VMA, and gradation, and report the results to the Engineer. The Department will monitor the setup duties and testing and may test to confirm the setup results. When any of the mixture properties do not meet the minimum pay value, cease all shipments to the project and adjust procedures or mixture properties until they are acceptable. Provide the Engineer with documentation of the acceptable test results. Provide the Engineer with a copy of the random number chart established for the total tonnage for the mixture specified. Develop the rolling pattern during the first sublot. When necessary during setup, adjust the AC up to ± 0.3 percent provided all other properties stay within their specified acceptance limits. Ensure the adjusted AC remains above the minimums specified in Subsection 403.03.03 C)2). Obtain the Engineer's approval to make this adjustment on all Specialty Mixtures. Ensure the JMF gradation does not fall outside of the ranges as listed in AASHTO M 323 for all asphalt mixtures.

D) Testing Responsibilities. Beginning with the second sublot, complete the following tests:

1) AC. Perform one evaluation corresponding to each AV/VMA analysis per sublot. Test according to KM 64-405 or AASHTO T 308.
2) AV. Prepare and analyze one set of 2 specimens per sublot. Test according to KM 64-435.
3) VMA. Analyze the set of 2 specimens corresponding to each AV analysis per sublot. Test according to KM 64-435.

Retain the AV/VMA specimens and one additional corresponding Gmm sample for 5 working days for mixture verification testing by the Department. For Specialty Mixtures, retain a mixture sample for 5 working days for mixture verification testing by the Department. When the Department's test results do not verify that the Contractor's quality control test results are within the acceptable tolerances according to Subsection 402.03.03, retain the samples and specimens from the affected sublot(s) for the duration of the

project.

4) Gradation. Perform one gradation determination for every two sublots of production. Test according to KM 64-407, KM 64-433, or KM 64-620. Determine the gradation from samples corresponding to the same production time period as the AC determination. Otherwise, obtain a cold feed sample according to KM 64-401. Ensure the JMF gradation does not fall outside the ranges as listed in AASHTO M 323 for all asphalt mixtures.
5) Dust-to-Binder Ratio. Determine the dust-to-binder ratio to ensure it falls within the range of 0.6 to 1.6 for surface mixtures, 0.6 to 1.6 for base mixtures, and 1.0 to 2.0 for No. 4 surface mixtures. If the dust-to-binder ratio is outside the range, make immediate corrections to the mixture. After corrections have been made, if the dust-to-binder ratio is still outside the range cease production, and make adjustments, until the mixture meets the required dust-to-binder ratio range.
6) Density. The Contract will state the compaction option to be used.

Option A. The Department will randomly locate and mark core locations after compaction is complete. Perform coring by the end of the following work day. Immediately provide the cores to the Engineer at the coring site. Replace all cores the Engineer deems damaged. When directed by the Engineer, saw cores at the project site to the thickness actually placed. Fill each core hole with compacted asphalt mixture or non-shrink grout within 3 working days. The Department will perform acceptance testing for density from the furnished cores according to KM 64-442. The Department will base values on the percent of solid density for the sublot's G_{mm} value.

Mainline - Furnish 4 cores per sublot to the Engineer for density determination. Under inspection by Department personnel, core the finished course at locations randomly selected by the Engineer according to KM 64-113. For random locations falling near the pavement driving lane joints, obtain the core as close to the location as possible without having any part of the core circumference coming closer than 6 inches to the pavement edge or joint.

Joint - For surface mixtures placed on driving lanes and ramps, furnish 2 cores per sublot to the Engineer for density determination. Under inspection by Department personnel, core the finished course at locations randomly selected in the longitudinal direction by the Engineer according to KM 64-113. Select the transverse direction such that some part of the core circumference is within 3.0 ± 0.5 inches of the longitudinal joint.

Option B. The Department will not require any cores. Density will be accepted based on compliance with the requirements of Subsection 403.03.10.

E) Shoulder Mixtures. The Department will accept shoulder mixtures as follows:

1) Placed Monolithically With the Mainline. Perform Tests 1), 2), and 3) of Part D) above as part of the mainline mixture. Do not take cores from the shoulder for quality control testing.
2) Placed Separately. Perform Tests 1), 2), and 3) of Part D) above. Do not take cores from the shoulders for quality control testing.

F) Specialty Mixtures. The Department will accept Open-Graded Friction Course (OGFC), Asphalt-Treated Drainage Blanket (ATDB), Asphalt Mixture for Pavement Wedge, Leveling and Wedging, Scratch Course, asphalt mixtures for temporary applications, and asphalt mixtures for Base Failure Repair as follows. Perform one AC and one gradation determination per sublot. Determine the gradation from samples corresponding to the same production time period as the

AC determination. Obtain and test the gradation samples according to KM 64-407, KM 64-433, or KM 64-620.

G) Mixtures with Reclaimed Materials. Furnish the grade of asphalt binder determined according to KM 64-427. Furnish a reclaimed material sample and a minimum of 3 representative AC and extracted gradation determinations with the mixture design submittal. For the reclaimed material perform AC and extracted gradation determination according to KM64-426.

H) Unsatisfactory Work.

1) Based on Lab Data. After the setup period, when the Contractor or Department determines any individual sublot pay value would be below 0.90 for AC, AV, or VMA in any QC or QA test, make adjustments as necessary and immediately perform the tests again. If the second round of tests determines any individual sublot pay value would have been below 0.90 for AC, AV, or VMA, cease all shipments to the project and adjust procedures or mixture composition until they are acceptable. Document acceptable materials and work before restarting operations. When a second round of tests are required, report the actual random number acceptance test results on the AMAW for the sublot.

   When the Engineer determines that safety concerns or other considerations prohibit an immediate shutdown, continue work and the Department will make an evaluation of acceptability according to Subsection 402.03.05.

2) Based on Field Review. If the Department determines that a portion of in-place material is unsatisfactory, the Department may require that the location be cored. The Department will then test the material for AC and Density. The Department will consider the work unsatisfactory and require corrective work to the affected area when a property met or exceeded a 1.00 pay value in the sublot acceptance test and the core shows the property having a pay value of below 0.90. Additionally, the Department will consider the work unsatisfactory and require corrective work to the affected area when the property of the core falls outside the following thresholds, regardless of the sublot quality control test results:

PROPERTY	THRESHOLD
AC	≥ ± 0.9% deviation from JMF
Density	≤ 89.0% or ≥ 97.5%

402.03.03 Mixture Verification. For volumetric properties, the Department will perform a minimum of one verification test for AC, AV, and VMA according to the corresponding procedures as given in Subsection 402.03.02. The Department will randomly determine when to obtain the verification sample using the Asphalt Mixture Sample Random Tonnage Generator.

For specialty mixtures, the Department will perform one AC and one gradation determination per lot according to the corresponding procedures as given in Subsection 402.03.02. However, Department personnel will not perform AC determinations according to KM 64-405. The Contractor will obtain a quality control sample at the same time the Department obtains the mixture verification sample and perform testing according to the procedures given in Subsection 402.03.02. If the Contractor's quality control sample is verified by the Department's test results within the tolerances provided below, the Contractor's sample will serve as the quality control sample for the affected sublot. The Department may perform the mixture verification test on the Contractor's equipment or on the Department's equipment.

A) Evaluation of Sublot(s) Verified by Department. Provided the differences are within the tolerances listed below, the Department will use the Contractor's test values to compute the appropriate lot pay value. When differences between test results are not within the tolerances listed below, the Department will retest the Contractor's retained samples for the affected sublots. The Department's results will be used in the computation of the appropriate Lot Pay Adjustment.

COMPARISON OF DEPARTMENT AND CONTRACTOR TESTING (applied when evaluating sublot(s) that Department verified)	
Test	Tolerance (%)
AC	± 0.5
AV and VMA	± 1.0 (same equipment) ± 1.5 (different equipment)
1/2 inch and larger	± 5
3/8 inch, No. 4, No. 8, and No. 16	± 4
No. 30, No. 50, and No. 100	± 3
No. 200	± 2

For volumetric properties, the Department will perform a statistical comparison between the Department's test results and the Contractor's test results for AC, AV, and VMA for the sublot(s) verified by the Department. The Department will perform this comparison using the paired *t*-test (with a level of significance of 0.025) as provided in the AMAW. When the paired t-test indicates that the Contractor's data and Department's data are possibly not from the same population, the Department will investigate the cause for the difference according to Subsection 402.03.05 and implement corrective measures as the Engineer deems appropriate.

B) Evaluation of Sublots Not Verified by Department. For volumetric properties, the Department will perform a comparison between the Department's test results and the average of the Contractor's test results for AC, AV, and VMA for the sublots not verified by the Department. Provided the differences are within the tolerances listed below, the Department will use the Contractor's test values to compute the appropriate lot pay value. When differences between test results are not within the tolerances listed below, the Department will resolve the discrepancy according to Subsection 402.03.05. When the Department's test results are ultimately determined to be correct, the Department's results will be used in the computation of the appropriate Lot Pay Adjustment.

COMPARISON OF DEPARTMENT AND CONTRACTOR TESTING (applied when evaluating sublots that Department did not verify)	
Test	Tolerance (%)
AC	± 0.6
AV	± 1.5
VMA	± 1.2

For volumetric properties, the Department will perform a statistical comparison between the Department's test results and the Contractor's test results for AC, AV, and VMA for the sublots not verified by the Department. The Department will perform this comparison using the *F*-test and *t*-test (with a level of significance of 0.025) as provided in the AMAW. When the F-test or t-test indicates that the Contractor's data and Department's data are possibly not from the same population, the Department will investigate the cause for the difference

according to Subsection 402.03.05 and implement corrective measures as the Engineer deems appropriate.

C) Test Data Patterns. Primarily by the use of control charts generated from the AMAW and as required by KM 64-426, the Department will monitor the test results of the acceptance testing for each sublot to identify patterns within the data. When patterns indicate substantial differences between the verified and non-verified sublots, the Department will perform further comparative testing according to subsection 402.03.05.

D) Independent Assurance Testing. The Department will perform independent-assurance testing (IAST) at the frequency prescribed by the Department's Materials Field Sampling and Testing Manual.

402.03.04 Testing Equipment and Technician Verification. For mixtures with a minimum quantity of 20,000 tons and for every 20,000 tons thereafter, the Department will obtain an additional verification sample at random using the Asphalt Mixture Sample Random Tonnage Generator in order to verify the integrity of the Contractor's and Department's laboratory testing equipment and technicians. The Department will obtain a mixture sample of at least 150 lb at the asphalt mixing plant according to KM 64-425 and split it according to AASHTO R 47. The Department will retain one split portion of the sample and provide the other portion to the Contractor. At a later time convenient to both parties, the Department and Contractor will simultaneously reheat the sample to the specified compaction temperature and test the mixture for AV and VMA using separate laboratory equipment according to the corresponding procedures given in Subsection 402.03.02. The Department will evaluate the differences in test results between the two laboratories. When the difference between the results for AV or VMA is not within ± 2.0 percent, the Department will investigate and resolve the discrepancy according to Subsection 402.03.05.

402.03.05 Dispute Resolution. When differences between the Department and Contractor continue to exist and impact acceptability or payment, resolve the dispute according to Subsection 113.07.

402.04 MEASUREMENT. The Department will measure asphalt mixtures by the ton. On initial treatment and resurfacing jobs, the Department will not measure material placed in excess of the 5-percent tolerance specified in Subsection 403.03.06.

The Department will not measure for payment any extra materials, methods, or construction techniques, determined by the Engineer not to be a part of the specified construction, used to protect, maintain, or repair any portion of the uncompleted work during the winter months.

The Department will not measure the filling of core sample holes of asphalt mixtures for payment and will consider them incidental to the asphalt mixture.

When Reshape and Compact is not listed as a bid item, the Department will not measure the preparation of the foundation for the mixture courses.

The Department will not measure anti-strip additive for payment and will consider it incidental to the asphalt mixture.

For initial treatment, the Department will not measure excavation at bridge ends and related disposal of materials for payment and will consider it incidental to the asphalt mixture.

The Department will not measure construction of rolled rumble strips or pavement wedge texturing for payment and will consider them incidental to the asphalt mixture.

402.04.01 Weight. The Department will weigh asphalt mixtures according to Section 109. The actual weight equals the pay weight except when the aggregates used have a combined bulk specific gravity in excess of 2.75. When the combined bulk specific gravity is greater than 2.75, the Department will determine the pay weight according to the

following formula:

$$T = W [\%AC + \%MF + (\%Aggregate \times 2.75)/G] / 100$$

Where:

- T = Pay weight.
- W = Actual weight.
- %AC = Percent, by weight, of asphalt binder in the total mixture.
- %Aggregate = Percent, by weight of total mixture, of mineral aggregates excluding mineral filler.
- G = Calculated combined, bulk, oven-dry, specific gravity of aggregates used in the mixture, excluding mineral filler.
- %MF = Percent, by weight, of mineral filler.

The Department will determine the bulk, oven-dry specific gravity for the fine and coarse aggregates according to KM 64-605 and AASHTO T 85, respectively. The Department will determine the frequency of testing for specific gravity of the actual project aggregates to determine the pay weight.

402.04.02 Thickness on New Construction. When the core thickness exceeds the compacted plan thickness by more than 1/2 inch, the Department will deduct the thickness exceeding the 1/2-inch tolerance. When calculating the deduction for excess thickness, the Department will not include in the thickness measurements any leveling course placed at the Contractor's expense or any materials placed on top of the completed base at the direction of the Engineer.

When the Engineer determines the asphalt base is deficient in thickness by more than 1/2 inch from the compacted plan thickness, the Department will measure material required according to Subsection 403.03.06 B) for the overlay as asphalt base. The Department will only measure the calculated quantity necessary to bring the deficient area to the plan thickness. The Department will not measure material placed in excess of the plan thickness to achieve smooth transitions or to match grades.

When the Engineer waives the overlaying requirement, he will make a reduction in payment for the theoretical quantity of asphalt base as determined deficient.

The Department will not measure initial thickness check coring or coring of corrective work for payment and will consider it incidental to the asphalt mixture.

402.05 PAYMENT.

402.05.01 Specialty Mixtures. The Department will calculate pay for OGFC, ATDB, Asphalt Mixture for Pavement Wedge, Leveling and Wedging, Scratch Course, asphalt mixtures for temporary applications, and asphalt mixtures for Base Failure Repair according to the Lot Pay Adjustment Schedule for Specialty Mixtures. The Department will assign a pay value for AC and gradation within each sublot and average the sublot pay values to determine the pay value for each lot.

402.05.02 Asphalt Mixtures, HMA and WMA, Including Mixtures With Reclaimed Material. The Department will pay for the mixture at the Contract unit bid price and apply a Lot Pay Adjustment for each lot placed based on the degree of compliance with the specified tolerances. Using the appropriate Lot Pay Adjustment Schedule, the Department will assign a pay value for the applicable properties within each sublot and average the sublot pay values to determine the pay value for a given property for each lot. The Department will apply the Lot Pay Adjustment for each lot to a defined unit price of $50.00 per ton. The Department will calculate the Lot Pay Adjustment using all possible incentives and disincentives. Final payment will be made for each mixture bid item for a project, using the cumulative lot pay values. Each lots pay value will be averaged to determine the final overall bid item pay value but will not allow the bid item pay value to

exceed 1.00.

A) First Sublot (Setup). When the Engineer determines the first sublot's individual pay values are 0.90 or greater, the Department will use 1.00 pay values for all properties in the sublot. When the Engineer determines any of the first sublot's individual pay values are less than 0.90, the Department will apply a pay value of 0.85 or less for that property and may require corrective work.

B) After the First Sublot (Setup). The Department will use the Contractor's test results for each sublot to determine the pay values for the applicable properties provided the mixture's values are acceptable according to Subsection 402.03.03. When the Contract specifies compaction Option A, the Department will use the Department's test results for each sublot to determine the pay value for Lane and Joint Density.

When the randomly determined samples for AC, AV, VMA, and gradation (when applicable) fall outside the final sublot, the Department will calculate payment for these properties using the test results from the previous sublot.

When the final sublot contains a tonnage amount resulting in less than the full amount of randomly selected cores, the Department will calculate payment for Lane and Joint Density using the available test results for the final sublot.

C) HMA, WMA and Reclaimed Material Mixtures Placed on Shoulders or Placed as Asphalt Pavement Wedge.

1) Placed monolithically with the Mainline – Width of 4 feet or less. The Department will pay as mainline mixture.
2) Placed monolithically with the Mainline – Width of greater than 4 feet. The Department will pay as mainline mixture but use 1.00 for the Lane and Joint Density Pay Value for shoulder or Asphalt Pavement Wedge quantities.
3) Placed Separately. The Department will use 1.00 for the Lane and Joint Density Pay Value.

D) Asphalt Mixtures for Temporary Pavement. When the Engineer determines the individual pay values are 0.90 or greater, the Department will use a 1.00 pay value for all properties. When the Engineer determines any of the individual pay values are less than 0.90, the Department will apply a pay value of 0.85 or less for that property and may require corrective work.

LOT PAY ADJUSTMENT SCHEDULE FOR SPECIALTY MIXTURES (TEST DEVIATION FROM JMF)		
	Pay Value	Deviation From JMF (%)
Asphalt Binder Content	1.00	0.0-0.5
	0.98	0.6
	0.95	—
	0.90	0.7
	0.85	0.8
	0.75	≥ 0.9
1 1/2 inch Sieve	1.00	0-13
	0.98	14
	0.95	15-16
	0.90	17-20
	0.85	21-23
	0.75	≥ 24
1 inch, 3/4 inch, and 1/2 inch Sieves	1.00	0-9
	0.98	10
	0.95	11-12
	0.90	13-14
	0.85	15-16
	0.75	≥ 17
3/8 inch, No.4, No. 8, No. 16, and No. 30 Sieves	1.00	0-8
	0.98	9
	0.95	10
	0.90	11-12
	0.85	13-14
	0.75	≥ 15
No. 50 Sieve	1.00	0-6
	0.98	7
	0.95	8
	0.90	9
	0.85	10
	0.75	≥ 11
No. 100 Sieve	1.00	0-3
	0.98	—
	0.95	4
	0.90	5
	0.85	—
	0.75	≥ 6
No. 200 Sieve	1.00	0.0-2.0
	0.98	2.5
	0.95	3
	0.90	—
	0.85	3.5
	0.75	≥ 4.0
Fineness Modulus	1.00	0.0-3.0
	0.98	0.31-0.34
	0.95	0.35-0.39
	0.90	0.40-0.46
	0.85	0.47-0.55
	0.75	≥ 0.56

LOT PAY ADJUSTMENT SCHEDULE
COMPACTION OPTION A
BASE AND BINDER MIXTURES

Lot Pay Adjustment = ($50.00) (Quantity) {[0.10 (AC Pay Value) + 0.25 (AV Pay Value) + 0.25 (VMA Pay Value) + 0.40 (Lane Density Pay Value)] - 1.00}

WEIGHTED VALUES				
	AC	AV	VMA	Lane Density
Weight (%)	10	25	25	40

AC	
Pay Value	Deviation From JMF (%)
1.00	≤ ± 0.5
0.95	± 0.6
0.90	± 0.7
(1)	≥ ± 0.8

VMA	
Pay Value	Deviation From Minimum
1.00	≥ min. VMA
0.95	0.1-0.5 below min.
0.90	0.6-1.0 below min.
(1)	> 1.0 below min.

AV		
Pay Value	Test Result (%)	
	AADTT Class 2	AADTT Class 3 or 4
1.05	3.0-4.0	3.0-4.0
1.00 + 0.1 (AV-3.0)	1.5-2.9	2.0-2.9
1.00 + 0.1 (4.5-AV)	4.1-6.0	4.1-6.0
0.75	6.1-6.5	----
(1)	< 1.5 or > 6.5	< 2.0 or > 6.0

LANE DENSITY		
Pay Value	Test Result (%)	
	AADTT Class 2	AADTT Class 3 or 4
1.05	94.0-96.0	94.0-96.0
1.00	92.0-93.9 or 96.1-97.0	92.0-93.9 or 96.1-97.0
0.95	91.0-91.9	91.0-91.9
0.90	90.0-90.9 or 97.1-97.5	90.0-90.9 or 97.1-97.5
0.85	97.6-98.5	----
0.75	89.0-89.9	----
(1)	< 89.0 or > 98.5	< 90.0 or > 97.5

LOT PAY ADJUSTMENT SCHEDULE
COMPACTION OPTION A SURFACE MIXTURES

Lot Pay Adjustment = ($50.00) (Quantity) {[0.05 (AC Pay Value) + 0.25 (AV Pay Value) + 0.25 (VMA Pay Value) + 0.30 (Lane Density Pay Value) + 0.15 (Joint Density Pay Value)] - 1.00}

WEIGHTED VALUES					
	AC	AV	VMA	Lane Density	Joint Density
Weight (%)	5	25	25	30	15

AC	
Pay Value	Deviation From JMF (%)
1.00	≤ ± 0.5
0.95	± 0.6
0.90	± 0.7
(1)	≥ ± 0.8

VMA	
Pay Value	Deviation From Minimum
1.00	≥ min. VMA
0.95	0.1-0.5 below min.
0.90	0.6-1.0 below min.
(1)	>1.0 below min

AV		
Pay Value	Test Result (%)	
	AADTT Class 2	AADTT Class 3 or 4
1.05	3.0-4.0	3.0-4.0
1.00 + 0.1 (AV-3.0)	1.5-2.9	2.0-2.9
1.00 + 0.1 (4.5-AV)	4.1-6.0	4.1-6.0
0.75	6.1-6.5	----
(1)	< 1.5 or > 6.5	< 2.0 or > 6.0

LANE DENSITY		
Pay Value	Test Result (%)	
	AADTT Class 2	AADTT Class 3 or 4
1.05	94.0-96.0	94.0-96.0
1.00	92.0-93.9 or 96.1-97.0	92.0-93.9 or 96.1-97.0
0.95	91.0-91.9	91.0-91.9
0.90	90.0-90.9 or 97.1-97.5	90.0-90.9 or 97.1-97.5
0.85	97.6-98.5	----
0.75	89.0-89.9	----
(1)	< 89.0 or > 98.5	< 90.0 or > 97.5

JOINT DENSITY	
Pay Value	Test Result (%)
1.05	92.0-96.0
1.00	90.0-91.9 or 96.1-96.5
0.95	89.0-89.9
0.90	88.0-88.9 or 96.6-97.0
0.75	< 88.0 or > 97.0

(1) Considering the guidance given in KM 64-448, the Department will evaluate the acceptability of the material to determine if it will remain in place at a reduced pay factor or be removed and replaced at no expense to the Department.

At the Contractor's option and at no expense to the Department, the Department will allow the Contractor to core the pavement in question, up to a maximum of 4 cores per sublot, for the investigation of AC and Lane Density values corresponding to pay factors potentially necessitating removal and replacement. Under inspection by Department personnel, core the pavement in question and submit the samples to the Department for further investigative testing. The Department may not permit coring to investigate density results when the pavement in question has been subjected to significant traffic loading.

Any decision to remove and replace material must receive the concurrence of the Divisions of Construction and Materials. When the Department decides to require removal and replacement, the Department will determine the quantity of material to be removed and replaced in the following manner.

For AC, AV, and VMA, the Department will identify the most recent preceding test (process control, quality control, or verification) of minimum acceptable quality and determine the tonnage at which that sample was obtained. The Department will define this level of quality as test results for AC, AV, and VMA corresponding to the following pay values:

- 0.90 or greater for AC and VMA for all mixtures;
- 0.75 or greater for AV for AADTT Class 2 mixtures; and
- 0.90 or greater for AV for AADTT Class 3 or 4 mixtures.

The Department will also identify the most recent succeeding test (process control, quality control, or verification) of minimum acceptable quality and determine the tonnage at which that sample was obtained. The Department will define this level of quality as described above. The material to be removed and replaced will be that quantity from (a) halfway between the acceptable preceding test and the test corresponding to this footnote to (b) halfway between the test corresponding to this footnote and the acceptable succeeding test.

For Lane Density, the Department will require removal and replacement only when the results for all 4 cores in a sublot (or all available cores in a partial sublot) are as follows:

- less than 89.0 percent, or greater than 98.5 percent, of solid density for AADTT Class 2; or
- less than 90.0 percent, or greater than 97.5 percent, of solid density for AADTT Class 3 or 4.

The Department will require removal and replacement of the entire sublot of material in this case. The Department will apply a 0.65 pay factor to individual cores with these results for sublots allowed to remain in place.

Aside from the preceding guidelines, the Engineer may adjust the quantity to be removed and replaced depending on the investigative test results or specific project conditions. For any material allowed to remain in place, the Department will apply a 0.65 pay factor to the Contract unit bid price for the asphalt mixture in question. The Department will apply the 0.65 pay factor to the quantity of asphalt mixture represented by the test result indicating substandard properties (one sublot when the result originated from an acceptance test).

LOT PAY ADJUSTMENT SCHEDULE
COMPACTION OPTION B MIXTURES

Lot Pay Adjustment = ($50.00) (Quantity) {[0.35 (AC Pay Value) + 0.40 (AV Pay Value) + 0.25 (VMA Pay Value)] - 1.00}

WEIGHTED VALUES			
	AC	AV	VMA
Weight (%)	35	40	25

AC	
Pay Value	Deviation From JMF (%)
1.00	≤ ± 0.5
0.95	± 0.6
0.90	± 0.7
(2)	≥ ± 0.8

VMA	
Pay Value	Deviation From Minimum
1.00	≥min. VMA
0.95	0.1-0.5 below min.
0.90	0.6-1.0 below min.
(2)	> 1.0 below min.

AV		
Pay Value	Test Result (%)	
	AADTT Class 2	AADTT Class 3 or 4
1.05	3.0-4.0	3.0-4.0
1.00 + 0.1 (AV-3.0)	1.5-2.9	2.0-2.9
1.00 + 0.1 (4.5-AV)	4.1-6.0	4.1-6.0
0.75	6.1-6.5	----
(2)	< 1.5 or > 6.5	< 2.0 or > 6.0

(2) Considering the guidance given in KM 64-448, the Department will evaluate the acceptability of the material to determine if it will remain in place at a reduced pay factor or be removed and replaced at no expense to the Department.

At the Contractor's option and at no expense to the Department, the Department will allow the Contractor to core the pavement in question, up to a maximum of 4 cores per sublot, for the investigation of AC values corresponding to pay factors potentially necessitating removal and replacement. Under inspection by Department personnel, core the pavement in question and submit the samples to the Department for further investigative testing.

Any decision to remove and replace material must receive the concurrence of the Divisions of Construction and Materials. When the Department decides to require removal and replacement, the Department will determine the quantity of material to be removed and replaced in the following manner.

The Department will identify the most recent preceding test (process control, quality control, or verification) of minimum acceptable quality and determine the tonnage at which that sample was obtained. The Department will define this level of

quality as test results corresponding to the following pay values:

- 0.90 or greater for AC and VMA for all mixtures;
- 0.75 or greater for AV for AADTT Class 2 mixtures; and
- 0.90 or greater for AV for AADTT Class 3 or 4 mixtures.

The Department will also identify the most recent succeeding test (process control, quality control, or verification) of minimum acceptable quality and determine the tonnage at which that sample was obtained. The Department will define this level of quality as described above. The material to be removed and replaced will be that quantity from (a) halfway between the acceptable preceding test and the test corresponding to this footnote to (b) halfway between the test corresponding to this footnote and the acceptable succeeding test.

Aside from the preceding guidelines, the Engineer may adjust the quantity to be removed and replaced depending on the investigative test results or specific project conditions. For any material allowed to remain in place, the Department will apply a 0.65 pay factor to the Contract unit bid price for the asphalt mixture in question. The Department will apply the 0.65 pay factor to the quantity of asphalt mixture represented by the test result indicating substandard properties (one sublot when the result originated from an acceptance test).

SECTION 403 — PRODUCTION AND PLACEMENT OF ASPHALT MIXTURES

403.01 DESCRIPTION. This section includes general requirements that are applicable to all types of asphalt mixtures. Deviations from these general requirements are indicated in the specific requirements for each type mixture

Provide a Superpave Plant Technologist (SPT) or Superpave Mix Design Technician (SMDT) qualified by the Laboratories' Quality Acceptance program. Be available to address all Quality Control concerns arising during work performed under section 403.

Construct one or more courses of asphalt mixture on the prepared foundation according to these Specifications and the requirements of the type specified in the Contract.

403.02 MATERIALS AND EQUIPMENT.

403.02.01 Fine Aggregate. Conform to Section 804.

403.02.02 Coarse Aggregate. Conform to Section 805.

403.02.03 Asphalt Binder. Conform to Section 806.

403.02.04 Self-Leveling Silicone Rubber Sealant. Conform to Section 807.

403.02.05 Asphalt Release Agent. Provide materials conforming to KM 64-422. Ensure each shipment is accompanied by a certification of conformance.

403.02.06 Transport Equipment. Provide trucks for transporting asphalt mixtures that have tight, clean, and smooth metal beds that have been sprayed with a minimum amount of release agent. Drain excess release agents from truck beds. Do not load trucks that are contaminated with an unapproved release agent. When such contamination is identified after loading, reject the load. In either case, remove the truck and respective driver from the project for the duration of the project. Equip all trucks with covers made of heavy canvas, or similar material suitable for protecting the mixture from the weather, that completely cover the loaded material.

403.02.07 Asphalt Pavers. Use asphalt pavers that are self-propelled and capable of spreading and finishing all courses to the indicated widths and depths, line, grade, and cross section, with a smooth finish, uniform in density and texture, without requiring an undue amount of back-dressing for correcting irregularities. Equip the paver with the following:

1) a screed or strike-off assembly that easily adjusts to the required crown and will place the asphalt mixture in variable widths;
2) an auger and vibrator that operates along the full width of the screed;
3) a level that is attached to the screed and in full view of the operator;
4) automatic screed controls, with sensors for both sides of the paver, capable of sensing grade from an outside reference, sensing the transverse slope of the screed, and providing the automatic signals that operate the screed to maintain the desired grade and transverse slope;
5) a transverse slope controller that is capable of maintaining the screed at the desired slope within ± 0.1 percent; and
6) automatic feeder controls that properly adjust to maintain a uniform depth of material ahead of the screed.
7) Utilize a Durable Pavement Edge that produces material that is confined at the end gate and extrudes the asphalt material in such a way that results in a consolidated wedge-shape pavement edge of approximately 29-40 degrees as it leaves the paver (measured from a line parallel to the pavement surface). The device shall maintain contact to the graded material adjacent to the pavement and must be adjustable to allow for transition to cross roads, driveways, and obstructions without requiring

the paver to be stopped routinely. The device shall constrain the asphalt head and increase the density of the extruded profile. To achieve desired results, rolling is not required on the wedge. The desired pavement edge angle is 30 degrees. A listing of approved commercially manufactured Durable Pavement Edge systems will be available on the Department internet website (http://transportation.ky.gov/Construction/Pages/Kentucky-Standard-Specifications.aspx). If electing to not use a commercially manufactured Durable Pavement Edge system, proof shall be demonstrated that the device has been used on previous projects with acceptable results, or a test section shall be constructed prior to the beginning of work which demonstrates that the wedge is capable of producing consolidation to the satisfaction of the Engineer. The finished angle of the Durable Pavement Edge shall be between 29 to 40 degrees. A single-plate strike-off method shall not be allowed for bituminous paving.

403.02.08 Rollers. Provide self-propelled rollers that are capable of reversing smoothly. Equip steel-wheel rollers with adjustable scrapers, spray bars, and wetting pads to keep the wheels clean at all times.

403.02.09 Small Tools and Portable Equipment. Provide all necessary small tools and portable equipment required for satisfactory execution of the work and devices necessary for routine checks of finishing requirements. Do not use an unapproved release agent on any small tools or equipment incidental to the paving operation.

Provide standard 10-foot long straightedges. Have straightedges available on the project before the work is started and all times thereafter until completion of the work.

403.02.10 Material Transfer Vehicle (MTV). In addition to the equipment specified above, provide a MTV with the following minimum characteristics::

1) A system to independently deliver asphalt mixtures from the hauling equipment to the paving equipment;
2) A high capacity truck unloading system, capable of 600 tons per hour, that will receive asphalt mixtures from the hauling equipment;
3) A minimum combined capacity, including the MTV storage bin and paver hopper, of 25 tons of asphalt mixture;
4) An auger system in the storage bin to continuously blend the asphalt mixture prior to discharge to the conveyor system; and
5) A discharge conveyor, with the ability to swivel, to deliver the mixture to the paving spreader while allowing the MTV to operate from an adjacent lane.

403.03 CONSTRUCTION.

403.03.01 Seasonal and Weather Limitations. Do not load trucks with asphalt mixtures when the ambient air temperature is below 35 °F. Do not place asphalt mixtures on any wet surface, when the ambient air and existing surface temperatures on the project are less than those specified in the table below, or when weather conditions otherwise prevent the proper handling or finishing of the asphalt mixtures.

Between November 30 and April 1, do not place asphalt mixture courses that will become a permanent part of the work without obtaining the written approval from the Engineer. Make every effort to have all asphalt base and binder courses covered before November 30.

If all asphalt mixture courses are not completed before November 30, perform all further work necessary to protect and maintain the uncompleted work during the winter months. Perform any work necessary to repair or restore the uncompleted work before the beginning of spring paving operations. Perform all work necessary to protect, maintain, or repair the base subject to the Engineer's approval.

TEMPERATURE LIMITATIONS

Minimum Ambient Air Temperature and Minimum Temperature of the Existing Surface for Placing Asphalt Mixtures (°F)

Open-Graded Friction Course (OGFC)	60
SMA Base and Surface	50
Asphalt Mixture, Surface (PG76-22)	45
Asphalt Mixture, No. 4 Surface	50
Asphalt Mixture, Surface (one inch thick or less)	45
Leveling and Wedging and Scratch Course	45
Asphalt Mixture, Surface (thicker than one inch)	40
Asphalt Mixture for Pavement Wedge	40
Asphalt Mixture, Base and Binder	35
Asphalt-Treated Drainage Blanket	35

403.03.02 Preparation of Base. Prepare the foundation before placing the asphalt mixture courses. The preparation may include fine grading and recompaction of earth or blasted rock subgrades, or crushed or natural aggregate bases.

Maintain prepared subgrades and/or granular bases until placing the initial course of asphalt mixture to ensure that the foundation is true to the required grade and cross section.

Grade and shape existing traffic bound base to the required grade and cross section before applying any asphalt mixture course. Wet and roll any salvable floater material into the existing traffic bound base.

When required, apply curing seal, prime, or tack coat, or a combination, according to Section 406.

When applying the initial asphalt mixture surfacing on the traffic bound base, excavate as necessary at both ends of all bridges within the limits of the project. Excavate deep enough to apply the total thickness of the asphalt mixture courses being constructed. The excavation should be wide enough to accommodate the width of the course, or wider when directed, and as long as necessary, up to 100 feet, for smooth transitions from the top surface course to the bridge deck.

Sweep existing or previously placed asphalt mixture or concrete courses clean of all foreign material. Apply tack coat according to Section 406.

Remove existing markers installed in grooves, and fill the recess with the compacted asphalt mixture. The Department will not require filling of the grooves when milling of the existing pavement is included in the Contract and the milling operation removes the grooves.

Remove and dispose of the existing Type V markers off of the right-of-way. Fill the recess and any additional damaged area with compacted asphalt mixture within 24 hours of removal. Fill the damaged areas, even when the Contract includes milling, unless the Engineer determines the damaged areas are not hazardous to public traffic.

Adjust small drainage structures such as catch basins as required to match the finished pavement, or to provide proper drainage, according to Subsection 710.03.

Only when the Engineer directs, adjust manholes according to Subsection 710.03. Return manhole adjusting rings that are removed and not reused to the utility owner.

403.03.03 Preparation of Mixture.

A) Mixture Composition. Provide the appropriate mixture composition for the specified asphalt mixture, or substitute a higher aggregate type. When substituting a mixture of a higher AADTT class, provide a mixture of no more than one AADTT class higher than the specified asphalt mixture. Conform to the gradation requirements (control points) of AASHTO M 323 for the Superpave mixture. Unless the Engineer authorizes otherwise in writing, use the same type and source of ingredient aggregates and asphalt binder throughout the entire project for each type of mixture. For asphalt surface courses containing 100 percent polish-

resistant coarse aggregate, limit the portion of non-polish-resistant fine aggregate retained on the No. 4 sieve to 5 percent of the total combined aggregates.

When using a porous aggregate, increase the asphalt binder content (AC) as needed for asphalt binder absorption by the aggregate.

The following aggregate requirements are listed in order of the highest, Type A, to the lowest, Type D:

1) Type A. Provide 100 percent of the coarse aggregate from Class A sources. Ensure that 20 percent of the total combined aggregate is Class A polish-resistant fine aggregate. The Department will permit a maximum of 15 percent natural sand by weight of the total combined aggregate unless prior approval is obtained from the Division of Materials for greater amounts.

    - For No. 4A mixes provide 100 percent of the total combined aggregate from Class A sources.

2) Type B. The Department will permit a maximum of 15 percent natural sand by weight of the total combined aggregate unless prior approval is obtained from the Division of Materials for greater amounts.

    Select either of the 2 following options:

    a) Provide 100 percent of the coarse aggregate from Class B sources.
    b) Provide a combined aggregate, retained on the No. 4 sieve, that is a minimum of 50 percent from any Class A polish-resistant aggregate source except those identified as "Not permitted as the polish-resistant portion of Class B blends." Submit all Class B blends to the Department for review.

    For Option a) or b) above, ensure one of the following:

    - 20 percent or more of the total combined aggregate is Class A polish-resistant fine aggregate.
    - 30 percent or more of the total combined aggregate is Class B polish-resistant fine aggregate

    For No. 4B mixes provide one of the following:

    - 85 percent or more of the total combined aggregate is a combination of Class A and Class B polish-resistant aggregate.
    - 85 percent or more of the total combined aggregate is Class B polish-resistant aggregate.

3) Type D. The Department will permit a maximum of 15 percent natural sand by weight of the total combined aggregate unless prior approval is obtained from the Division of Materials for greater amounts.

B) Moisture Content of Mix. Determine the moisture content of the coated mixture according to AASHTO T 329 each time an asphalt content determination is performed. When moisture contents are greater than 0.25 percent, take corrective action to lower the moisture content. When moisture contents are 0.10 percent or greater, adjust the AC determination made on plant-produced mixture to reflect the actual AC as KM 64-434 directs.

C) Mix Design Criteria. Conform to the gradation requirements (control points) of AASHTO M 323 for the Superpave mixture type the Contract specifies.

1) Preliminary Mix Design. Perform the volumetric mix design according to AASHTO R 35 and conforming to AASHTO M 323. The Department will require a dust-to-binder ratio range of 0.6 to 1.4 for surface mixtures, 0.6 to 1.6 for base mixtures, and 1.0 to 2.0 for all No. 4 mixtures. Contrary to AASHTO M 323, the relative density at Nmax is ≤ 98.5 percent. Complete the volumetric mix design at the appropriate number of gyrations as given in the table below for the construction year AADTT. The Department will define the relationship between AADTT Classes, as given in the bid items for Superpave mixtures, and AADTT ranges as follows:

		Number of Gyrations		
Class	**AADTT**	$N_{initial}$	N_{design}	N_{max}
2	< 600	7	65	105
3	600 to 2999	7	65	105
4	≥ 3000	7	65	105

2) Selection of Optimum AC. Normally, the Department will approve the AC at an air-void content of 3.5 percent. The Engineer may assign an AC corresponding to other air-void levels as deemed appropriate. Ensure the optimum AC is a minimum of 5.3 percent by weight of the total mixture for all 0.5-inch nominal surface mixtures and 5.6 percent by weight of the total mixture for all 0.38-inch nominal surface mixtures.
3) Tensile Strength Ratio (TSR). Analyze the mixture for TSR according to ASTM D 4867 with one freeze/thaw cycle, 150-mm specimens compacted with a Superpave gyratory compactor, and a target degree of saturation of the conditioned specimens of 65 ± 5 percent.
4) Aggregate Consensus Properties. Ensure all mixtures satisfy the fine aggregate angularity (FAA), sand equivalent (SE), course aggregate angularity (CAA), and flat and elongated particles (F&E) values listed in the table below.

Aggregate Consensus Properties				
Class	**FAA (% min)**	**SE (% min)**	**CAA [1] (% min)**	**F&E (% max)**
2	40	40	85/80	10
3	43	45	95/90	10
4	45	50	100/100	10

[1] One crushed face / Two or more crushed faces.

Note: The Department will require a minimum of 45 percent for FAA for No. 4 mixtures and will not apply CAA and F&E requirements to No. 4 mixtures.

403.03.04 Transporting Material. For all types of sizes of HMA and WMA, load all tri-axle or larger trucks with a minimum of three drops, utilizing the three drop method to prevent segregation of the asphalt mixture. Securely fasten all covers in place on the truck before leaving the plant. During cool weather, or when an unexpected delay occurs, keep the loads covered until just before unloading. Insulate truck beds, when necessary, to maintain the specified temperature to the point of delivery. Do not use any truck that causes excessive segregation of mixture or that leaks.

403.03.05 Spreading and Finishing. Prevent segregation of the fine and coarse

aggregates during all phases of construction. Spread the mixtures with a paver. Heat the screed uniformly throughout its length. Do not allow flames to directly contact the mixture. Adjust the paver speed to provide the best results for the mixture being used and to coordinate with the rate of delivery of the mixture to the paver to provide a uniform placement rate without intermittent operation. Operate the screed or strike-off assembly without tearing, shoving, or gouging the mixture when laying the mixture. Operate vibrating screeds or other compacting features of the paver according to the manufacturer's recommendations during the placement of the pavement.

Use automatic screed and slope controls. However, if the Engineer determines that under certain conditions better results may be obtained without using the controls, then the Engineer may waive using either the grade control or slope control requirements, or both.

Notify the plant to stop shipment whenever the automatic screed controls break down or malfunction. Obtain the Engineer's approval to manually operate the equipment, or operate it by other methods, to place the remainder of material already in transit, provided the method of operation produces results otherwise conforming to this section.

Obtain vertical control for the outer edges of each mainline roadway from reference lines or by using a ski arrangement. The Department will allow obtaining horizontal control from the reference line. Automatically control the grade and slope for intermediate lines using reference lines, or a ski and a slope control device, or a dual ski arrangement.

Immediately after striking off and before rolling, visually inspect each course for irregularities, and correct if necessary. Keep hand raking of the mixtures to the absolute minimum. Ensure that the finished surface has a uniform appearance, free from segregated areas. Immediately remove and replace, as directed, all portions of a pavement course that are defective in mixture composition, show excessive segregation, or do not otherwise comply with the Contract.

Correct irregularities in alignment of the outside edge or edges of longitudinal joints by adding or removing material before compacting the edges.

Over uniform, narrow areas, such as widening or narrow, paved shoulders where the use of pavers would be impractical, spread by a mechanical spreader. Ensure that the material is placed to the required lines, grades, and cross section without segregation of the mixture.

Over areas where machine spreading is impractical due to irregularities or obstructions, spread the mixture by approved methods. Place the material to avoid segregation and to reduce to a minimum the amount of patching required during compaction. Discard all coarse aggregate particles brought to the surface by raking. Do not scatter or broadcast excess mixture or particles across the surface of the uncompacted mat.

Spread all surface courses with allowances made for compacting to finish approximately 3/8 inch above forms, gutters, or similar construction.

The Department may allow shoulders and Asphalt Mixture for Pavement Wedge to be paved monolithically with the mainline if it is in the best interest of the Department. Obtain the Engineer's approval before doing so.

Do not place or compact asphalt mixture when the natural light is insufficient without providing artificial lighting satisfactory to the Engineer. Unless the Contract specifies nighttime paving, do not place binder, surface, or other asphalt mixture wearing courses at night, without first obtaining the Engineer's permission. The Engineer may require daytime paving if the Engineer deems the nighttime work unsatisfactory.

A) Use a MTV to place the asphalt mixture for all layers of pavement excluding drainage blanket in the driving lanes for all interstates and parkways. Use a MTV on other routes when required by the contract or proposal. The MTV is not required on ramps and/or shoulders unless specified in the contract. When the Engineer determines the use of the MTV is not practical for a portion of the project, the Engineer may waive its requirement for that portion of pavement.

403.03.06 Thickness Tolerances. Place asphalt mixtures at the lift thickness specified in the Contract. When lift thickness is not specified in the contract or when deviations to the

pavement thickness is approved by the Engineer, use the following table for application of asphalt mixture thickness.

Nominal Maximum Aggregate Size (Inches)	Lift Thickness (Inches)
1.50	4.50 – 5.00
1.00	3.00 – 4.50
0.75	2.25 – 3.50

A) Initial Treatment and Resurfacing Projects. Ensure that the total combined thickness of each class of asphalt base conforms to the Contract. Control the thickness by the rate of application. Place the mixture at the Contract-specified weight per square yard. Do not exceed the rate of application by more than 5 percent.

B) New Construction. Under the Engineer's supervision, perform coring for thickness checks according to KM 64-420, as soon as practical after completion of all, or a major portion, of the asphalt base. The Engineer will measure the cores. Fill all core holes either with compacted asphalt mixture or non-shrink grout. Complete all remedial overlay work before placing the final course.

When constructing an overlay, match the grades of the adjacent work such as storage lanes, approaches, entrances, etc., to the overlay section, whether these adjacent areas are deficient in thickness or not.

Ensure the total combined thickness of all layers is within ± 1/2 inch of the compacted plan thickness.

When there is an asphalt binder course, consider it as asphalt base for the purpose of determining compliance with thickness tolerances.

When the top layer of a new pavement is OGFC, sand seal surface, or sand asphalt surface, consider all asphalt mixtures beneath that course as asphalt base for the purpose of determining compliance with thickness tolerances.

When the Engineer determines the asphalt base is deficient in total thickness by more than 1/2 inch from the compacted plan thickness, overlay the full width of the pavement to bring the pavement to the required plan thickness. When placing additional material is not feasible due to structures, drainage, or other engineering reasons, the Engineer may waive the requirement for overlaying.

403.03.07 Joints. When curbs, gutters, pavement, and other structures adjoin the new construction, coat all contact surfaces of the existing construction and joints of previously placed new construction, both longitudinal and transverse, with tack.

When the pavement construction consists of 2 or more courses, offset the longitudinal joint a minimum of 6 inches. Place the longitudinal joint in the final surface course along the dividing line between the lanes. Clean adjacent surfaces of all loose materials so the joint shall receive full compaction from the rollers.

Place and spread all courses as continuously as possible, keeping the number of joints to a minimum. When a transverse joint is necessary, complete the spreading of the material by the finishing machine, and adjust the course to a straight line, square with the pavement. Before work is resumed, cut back the joint on the previous run, exposing the full depth of the course. Remove all excess material. Check the joint with a 10-foot straightedge at intervals of 2 feet or less immediately after initial rolling. Immediately correct any irregularities not conforming to Subsection 403.03.11 either by additional raking or adding hot material, or both. Discard all coarse aggregate particles brought to the surface by raking. Do not scatter or broadcast excess mixture or particles across the surface of the uncompacted mat. Roll joints to compress the material and to produce as tight a joint as possible.

Avoid cold longitudinal joints when practical by either placing the full width of the course in one pass, operating pavers in echelon, or moving pavers back each day after placing sufficient tonnage in each traffic lane so the course placed will be the full width of

the pavement at the end of each day. Obtain the Engineer's approval for the method of paving.

Comply with Subsection 402.03.02 D) for density of joint cores obtained from surface mixtures when Option A applies.

403.03.08 Shoulder Rumble Strips and Pavement Texturing.

Unless directed otherwise by the Engineer, DO NOT install centerline, edgeline, and/or shoulder rumble strips where the posted speed limit is 45 MPH or less. Before sawing centerline and/or edgeline rumble strips, pre-mark the pavement surface and obtain the Engineer's approval for the proposed location, alignment, and control guides. After sawing the centerline and/or edgeline rumble strips, apply permanent centerline and/or edgeline striping, according to Section 713, on the sawed rumble strip locations approved by the Engineer. Before sawing shoulder rumble strips, obtain the Engineer's approval of the proposed layout, location and alignment. Notify the Engineer if questions arise regarding changes in striping and/or rumble patterns. If necessary, the Engineer may obtain guidance from the District Traffic Engineer and/or the Division of Traffic Operations.

403.03.09 Leveling and Wedging, and Scratch Course.

A) Leveling and Wedging. Conform to the gradation requirements (control points) of AASHTO M 323 for base, binder, or surface as the Engineer directs. Submit a JMF to the engineer for AC approval according to KM 64-421. The Engineer may adjust the gradation requirements of the asphalt mixture being used for leveling and wedging in order to provide smooth transitions.

Upon completing each course of asphalt mixture and before spreading the next course, check the surface of that course by a stringline for deviations from a uniform grade. Correct any such deviations from the required uniformity by applying additional material, spreading, and rolling as directed.

When construction of the previous course is included in the same Contract, mill any high joints or other high areas as required in addition to leveling and wedging.

When leveling and wedging is included on resurfacing projects, check the existing surface by stringline for deviations from a uniform grade. Correct the courses in the same manner with an application of the type mixture specified by the Engineer.

When an asphalt mixture has been included in the proposal for leveling and wedging, perform this work at the locations designated before starting the normal paving operations. Thoroughly clean the areas to receive the corrective work, and apply the same tack material as specified for the courses being constructed. Do not apply the material as a scratch course over the entire area of the existing pavement. Do not apply the material monolithically with the surface course.

Spread the asphalt mixture for leveling and wedging with a motor-patrol grader or paver. After spreading, thoroughly compact the mixture.

B) Scratch Course. When required by the Contract, place an asphalt mixture as a scratch course. Conform to the gradation requirements (control points) of AASHTO M 323 for base, binder, or surface as the Engineer directs. Submit a JMF to the Engineer for AC approval according to KM 64-421. Apply the mixture over the entire area of the existing pavement before constructing the final surface course; do not apply material monolithically with the surface course. Set the paver to a minimum thickness as directed to correct rutting, adverse warping, dipping, and other imperfections in the existing pavement and to provide a smooth, level surface for the final surface course.

Compact with a pneumatic-tired roller to ensure proper compaction in rutted

and warped areas in the existing pavement.

When required by conditions on the project, the Engineer may adjust the gradation requirements of the specified mixture.

403.03.10 Compaction. Compact asphalt mixtures by Option A or B, as specified in the Contract.

Operate the rollers to eliminate all roller marks and obtain the specified compaction. Operate vibratory rollers of a design, weight, and frequency that produces the specified compaction without damaging the mat.

During the initial rolling of each course, visually inspect its surface for any irregularities that may develop. Remove and replace areas in which the material is not in compliance as specified in Subsection 403.03.05.

Do not allow the rollers at any time to stand on the material being placed immediately behind the paver. When rolling is temporarily suspended, stop the rollers as far behind the paver as practical.

Move the rollers at a slow but uniform speed with the drive roll or wheels nearest the paver. Immediately correct any displacement due to reversing the direction of a roller, or from other causes, using rakes and adding fresh mixture when required. While rolling, do not displace the line and grade of the edges of the asphalt mixture. When the Engineer allows, use a pneumatic-tired roller for final rolling on base courses.

To prevent adhesion of the material to the wheels of steel-wheeled rollers, keep the wheels moistened with water, but do not use excess water. Do not use kerosene, oil, or other harmful liquids. The Department will allow a small quantity of detergent to be mixed with the water.

Compact areas adjacent to manholes, curbs, narrow widening, and other small areas inaccessible to a roller, by mechanical tampers.

A) Compaction Under Option A. Develop the rolling pattern during the first sublot.

B) Compaction Under Option B. Provide initial or breakdown rolling consisting of one complete coverage by a 3-wheel roller or tandem roller weighing at least 10 tons and having a compressive capability on the rear wheels of at least 325 pounds per linear inch of wheel width. Ensure that 3-axle, steel-wheeled rollers weigh at least 12 tons. Ensure that 2-axle, steel-wheeled, tandem rollers weigh at least 10 tons. For initial or breakdown rolling, provide rollers that are equipped with wheels having a diameter of 40 inches or more. Perform the rolling immediately after spreading and finishing the mixture.

Provide intermediate rolling consisting of at least 3 complete coverages with a tandem roller weighing at least 10 tons. Start intermediate rolling after completing the breakdown rolling as closely as possible without causing undue displacement, cracking, or shoving of the material.

For intermediate rolling of 1 1/2-inch and 1-inch nominal size mixes, a pneumatic-tired roller may be used. Use pneumatic-tired rollers that weigh at least 12 tons and have 7 to 9 tires capable of inflation pressures up to 125 psi. Maintain an inflation pressure in all tires within ± 5 psi of the manufacturer's recommended pressure. Arrange the tires so that the gap between the tires of the front axle is covered by the tires of the rear axle. Mount wheels to provide equal contact pressure under each wheel. Use a tire tread that is satisfactory to the Engineer. Maintain tire size and inflation pressure such that the contact pressure is at least 80 psi.

Perform final rolling of the uppermost layer or surface course with a tandem roller. Operate the roller, at all times, parallel to the centerline. When the Engineer allows, use a pneumatic-tired roller for final rolling on base courses.

Begin rolling at the sides and progress to the center on crowned surfaces. Begin rolling at the low side and progress to the high side on superelevated sections. Operate the rollers parallel to the centerline, and lap successive trips of each roller uniformly to the previous trip. During breakdown rolling, the Engineer

may allow the course to be rolled without the required lap of the wheels on successive trips. End alternate trips of the rollers on transverse lines at least 3 feet apart. Regulate starting and stopping of the rollers to avoid distorting the surface.

403.03.11 Surface Tolerances. Check the surface of each course with templates, straightedges, or stringlines. Check the surfaces of the finished courses longitudinally with a 10-foot straightedge placed parallel to the centerline over the width of the surface.

Ensure the following:

1) The finished surfaces of the base and binder courses do not deviate more than 1/4 inch from the 10-foot straightedge.
2) The finished surface of the final surface course does not deviate more than 1/8 inch from the 10-foot straightedge.
3) The cross slope of all courses does not deviate more than 1/4 inch in 5 feet from the required cross slope.
4) The asphalt surface conforms to all requirements for a final surface course when the top portion of a new pavement consists of a wearing course underlain by asphalt surface.

Correct all irregularities exceeding the allowable tolerances. Correct surface course irregularities by removing and replacing the entire lift thickness or by overlaying. Do not remove the irregular areas of the surface course by surface grinders.

On resurfacing projects, when no provisions are made for constructing leveling and wedging courses, scratch courses, or milling, the Engineer will waive the specified requirements for surface tolerances.

403.03.12 Transverse Joints. When specified in the Contract, cut transverse joints in overlays of JPC pavement, base, and shoulders. Seal with self-leveling silicone rubber sealant.

403.03.13 Pavement Marking. Apply and maintain pavement marking as specified in Section 112.

403.03.14 Durable Pavement Edge. The contractor will have the option to pave roadway shoulders monolithically with mainline pavement or by separate operation. However, if the shoulder is placed monolithically, with mainline material, the Durable Pavement Edge shoe shall be used for the placement of the asphalt. For divided highways, the Durable Pavement Edge must be added to both median and outside bituminous shoulders when the paved shoulder width is 6 feet or narrower.

Construct the edge to the depth width and slope the contract specifies where existing conditions permit. Remove the sod or perform trench excavation only when necessary to obtain the specified depth and width. Do not remove solid rock. Provide enough area to construction the Durable Pavement Edge so that the Durable Pavement Edge will be placed on solid material, free of debris such as loose material, grass, weeds or mud. The edge should be compacted such that there is no loose material. Short sections of handwork will be allowed for pavement transitions and turnouts.

Durable Pavement Edge is not intended for the following:
1) Centerline pavement joint.
2) Joint between paved side road and mainline.
3) Bridge decks.
4) Adjacent to concrete barrier.
5) Adjacent to curb and gutter.
6) Edges between adjoining pavements.
7) Centerline pavement joints.Mainline and taper joint.

8) Mainline and turning joints.

The Durable Pavement Edge shall be applied when all of the following criteria are met, unless otherwise directed by the Engineer:
1) New bituminous pavement/shoulder or bituminous overlay is being construction with at least 1-(one) inch of paving depth.
2) The posted speed limit is 40 mph or higher.
3) Pavements/shoulders that are not adjacent to curbing; and
4) Pavements/shoulders that are not adjacent to barrier wall.

The Durable Pavement Edge may be omitted in the following situations with the approval of the Engineer:
1) Areas where existing drop-offs at the edge of existing pavement exceed 5 inches.
2) Areas where the distance from the pavement to the Durable Pavement Edge catch point exceeds 9 inches or where slopes are steeper than 3:1.

403.04 MEASUREMENT.

403.04.01 Removing Type V Pavement Markers. The Department will measure the quantity by each individual unit. The Department will determine the quantity by dividing the length of each run of markers by the markers' average spacing, plus one.

The Department will not measure other marker types for removal, disposal, or filling of their grooves for payment. The Department will consider all of this work incidental to the surfacing items in the Contract.

403.04.02 Adjust Manhole. The Department will measure the quantity by each individual unit.

403.04.03 Asphalt Mixtures. The Department will measure the quantity according to Subsection 402.04. The Department will not measure rolled rumble strips or pavement wedge texturing for payment and will consider them incidental to this bid item.

403.04.04 Leveling and Wedging. For resurfacing projects, when leveling and wedging is listed as a bid item, the Department will measure the quantity in tons according to Subsection 402.04. For reconstruction and new construction, the Department will measure the quantity of leveling and wedging placed on the first base course in tons as base material. The Department will not measure leveling and wedging used to correct irregularities in subsequent courses for payment and will consider it incidental to placing the course.

403.04.05 Asphalt Scratch Course. The Department will measure the quantity according to Section 402.04.

403.04.06 Protective and Restorative Work. The Department will not measure for payment any extra materials, methods, or construction techniques, determined by the Engineer not to be a part of the specified construction, used to protect, maintain, or repair any portion of the uncompleted work during the winter months.

403.04.07 Centerline, Edgeline, and Shoulder Rumble Strips. The Department will measure the quantity of sawed rumble strips in linear feet. The Department will measure permanent striping in accordance with Section 713. The Department will measure temporary striping, when required, by Section 112, the Traffic Control Plan, and/or when directed by the Engineer. When bicycle gaps are required in the rumble pattern, the Department will include the length of the bicycle gaps in the measurement of the rumble.

The Department will not measure the areas where rumble strips are omitted, such as at intersections, crosswalks, bridges, railroad crossings, etc. The Department will not measure temporary striping that is only used for pre-marking centerline and/or edgeline rumble strips. The Department will not measure the removal of existing pavement markings, pre-marking and layout, surface preparation, corrective work, labor, equipment, and any incidentals necessary to construct rumble strips, and will consider these items incidental to the installation of the rumble strips.

403.04.08 Asphalt Placement with MTV. The Department will not measure the MTV for payment and will consider its use incidental to the asphalt mixture.

403.04.09 Durable Pavement Edge. The Department will not consider the Durable Pavement Edge for payment and will consider its use incidental to the asphalt mixture.

403.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

403.05.01 Adjust Manhole. The Department will make payment for the completed and accepted quantities according to Subsection 408.05.02.

403.05.02 Asphalt Mixtures. The Department will make payment for the completed and accepted quantities according to Section 402.

403.05.03 Leveling and Wedging. The Department will make payment for the completed and accepted quantities according to the Lot Pay Adjustment Schedule for Specialty Mixtures in Section 402.

403.05.04 Asphalt Scratch Course. The Department will make payment for the completed and accepted quantities according to the Lot Pay Adjustment Schedule for Specialty Mixtures in Section 402.

403.05.05 Adjust Manhole Frame to Grade. The Department will make payment for the completed and accepted quantities according to Subsection 408.05.02.

Code	Pay Item	Pay Unit
06600	Remove Pavement Marker Type V	Each
01791	Adjust Manhole Frame to Grade	Each
02697	Edgeline Rumble Strips	Linear Foot
20458ES403	Centerline Rumble Strips	Linear Foot
02696	Shoulder Rumble Strips	Linear Foot
-----	Asphalt Mixture, Type	Ton

The Department will consider payment as full compensation for all work required under this section.

SECTION 404 — OPEN-GRADED FRICTION COURSE (OGFC)

404.01 DESCRIPTION. Construct one course of hot-mixed, hot-placed, OGFC approximately 3/4-inch thick on a foundation provided by either new or existing pavements.

404.02 MATERIALS AND EQUIPMENT.

404.02.01 Aggregates. Conform to Subsection 403.02 and the following:

A) Fine Aggregate. Limit sands from sources other than Class A polish-resistant fine aggregate sources to 20 percent of the total aggregate in the mixture.

B) Coarse Aggregate. Provide 100 percent Class A polish-resistant aggregate.

404.02.02 Asphalt Binder. Provide the PG binder specified in the Contract conforming to Section 806.

404.02.03 Anti-stripping Additive. Select from the Department's List of Approved Materials.

404.02.04 Tack. Conform to Section 406.

404.02.05 Reclaimed Materials. Limit the use of reclaimed materials to a maximum of ten percent in the mixture.

404.03 CONSTRUCTION. Conform to Section 403, except as provided in this section and in the Contract. The OGFC is intended to provide a coarse-textured, well-draining, skid-resistant wearing surface. Construct this course at a higher elevation than adjacent gutters to provide proper lateral drainage of water through the course.

For multiple lanes in the same direction, place the material continuously in one lane each day. Protect it from traffic until it has cured overnight.

When placing OGFC on two-lane, two-way pavements, operate the paver according to Subsection 403.03.05.

404.03.01 Weather Limitations. Follow weather limitations outlined in Subsection 403.03.01.

404.03.02 Leveling and Wedging. Perform the necessary leveling, wedging, and patching to repair an existing pavement before beginning construction of this surface course.

404.03.03 Tack Coat. Apply according to Section 406, except as follows. When furnishing emulsions for the tack coat, do not dilute the emulsions. Apply undiluted SS-1, SS-1h, or RS-2 at an approximate rate of 0.8 pounds (0.1 gallons) per square yard.

404.03.04 Preparation of Mixtures. Submit the JMF for OGFC for approval according to Subsection 402.03. Conform to the gradation requirements specified. The Department will perform a mix design according to KM 64-424.

Test the approved JMF of the mixture according to KM 64-433 or KM 64-620, and ensure that it conforms to the requirements shown in the table below.

During the operation of the plant, conform to the following tolerances from the approved JMF, and also maintain the master gradation ranges below at all times.

SIEVE SIZE	MASTER GRADATION RANGE (Percent Passing by Weight)	JMF TOLERANCES
1/2 inch	100	
3/8 inch	90-100	
No. 4	25-50	± 6%
No. 8	5-15	± 4%
No. 16	-	
No. 200	2.0-5.0	

Obtain the Engineer's approval for the percent by weight of asphalt binder in the mixture. Do not deviate from the established AC by more than 0.4 percent. Test the mixture according to KM 64-405, KM 64-436, KM 64-437, KM 64-438, or AASHTO T 308.

Use the anti-stripping additive at the rate of 0.5 percent by weight of asphalt binder.

Maintain temperatures of the ingredient materials and the mixture within the following ranges:

MIXING AND LAYING TEMPERATURES (°F)			
Material		Minimum	Maximum
Aggregates		240	330
Asphalt Binders	PG 64-22	230	330
	PG 76-22	285	350
Asphalt Mixtures at Plant (Measured in Truck)	PG 64-22	230	265
	PG 76-22	275	320
Asphalt Mixtures at Project (Measured in Truck When Discharging)	PG 64-22	175	265
	PG 76-22	260	320

Spread the OGFC at an approximate rate of 65 pounds per square yard to provide an approximate thickness of 3/4 inch.

Roll in the static mode with a steel-wheeled, tandem roller weighing between 5 and 8 tons. Begin rolling immediately after placing the course. Limit rolling to the minimum necessary for consolidating the mixture and bonding it to the underlying surface. Avoid excessive rolling and breakage of the aggregate.

404.04 MEASUREMENT. The Department will measure the quantity in tons according to Subsection 402.04. The Department will not measure asphalt tack coat and anti-strip additives for payment and will consider them incidental to this item of work.

404.05 PAYMENT. The Department will calculate payment by the Lot Pay Adjustment Schedule for Specialty Mixtures in Section 402.

The Department will apply the schedule's tolerances to the average of the absolute values of deviations from the JMF.

When the deviation is on the fine side of the JMF, the Engineer will evaluate each occurrence and determine if it is detrimental to the pavement performance. The Department will evaluate the acceptability of the material to determine if it will remain in place at a reduced pay factor or be removed and replaced at no expense to the Department.

When a pay factor less than 1.00 is determined for gradation on more than one sieve, the Department will use the lowest single pay factor determined.

When a pay factor less than 1.00 is determined for both AC and gradation on one or more sieves, the Engineer will evaluate and determine if the deficiencies will have a cumulative negative influence on the mixture. If so, the Engineer will apply both the reduced pay factor for the AC and the largest deduction for the gradation failures. If not,

the Engineer will apply the larger single deduction.

The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
00266-00268	Asphalt Surface, Open-Graded, Grade	Ton

The Department will consider payment as full compensation for all work required under this section.

SECTION 405 — ASPHALT SEAL COAT

405.01 DESCRIPTION. Construct an asphalt seal coat consisting of one or more applications each of asphalt material and cover aggregate.

405.02 MATERIALS AND EQUIPMENT.

405.02.01 Asphalt Material. Furnish RS-2 or HFRS-2 conforming to Section 806.

405.02.02 Aggregate. Conform to Section 804 or 805, as applicable.

405.02.03 Equipment. Provide, and keep on the project at all times, an accurate thermometer, hand brooms, and other small tools and equipment essential for completion of the work.

Provide equipment for heating the asphalt material and pressure distributors conforming to Subsection 406.02.05.

Provide a mechanical broom or sweeper for cleaning the existing surface and for sweeping the completed seal coat.

Provide an aggregate spreader equipped with a mechanical feed. Ensure that the spreader is capable of depositing aggregate from the transporting vehicle directly onto the fresh asphalt material at the rate specified, in smooth, uniform layers, independent of the forward speed. Ensure that the spreader is capable of being filled and moved without discharging aggregate.

Provide a pneumatic-tired roller for roadway surfaces. On slopes, the Department will allow a steel-wheel roller.

405.03 CONSTRUCTION.

405.03.01 Weather Limitations. Do not construct any seal coat when the ambient temperature is below 45 °F, nor when the ambient temperature within the preceding 24 hours has been 35 °F or lower, except with the Engineer's written permission.

405.03.02 Preparation of Surface. Sweep the road with a mechanical sweeper and with wire hand brooms, when necessary. Clean the edges of the surface so that the full width of the roadway to be treated is uniformly clean. Where any mud or earth exists, remove it in advance of the application of the asphalt material, and allow the surface to thoroughly dry.

If cracks cannot be adequately filled by the seal coat, fill them with asphalt material and apply cover aggregate before applying the seal coat.

405.03.03 Heating and Applying Asphalt Material. Heat and maintain the asphalt material between 125 and 175°F during application.

Apply asphalt material by means of a pressure distributor in a uniform, continuous spread over the section to be treated in the quantity per square yard specified in the Contract or as the Engineer directs.

Keep the nozzles of the spray bar clean at all times. Immediately make any streaked areas uniform by use of a hand hose equipped with a nozzle.

Treat areas over which it is impractical to operate a distributor by means of a hand hose equipped with a nozzle or by means of a pouring pot.

Do not apply the asphalt material farther in advance of the spreading of the aggregate than can be covered directly by the aggregate immediately available at the site of work.

When the seal coat treatment is constructed in half-widths, provide complete coverage by overlapping the 2 applications approximately 4 inches along the centerline.

Prevent spotting or discoloring curbs, headwalls, and other structures. When such discolorations occur, remove them at no expense to the Department.

Make joints utilizing an approved method.

405.03.04 Application of Cover Material. Provide the gradation specified in the Contract. Ensure that the aggregate for cover material is surface-dry when applied, unless damp aggregate is allowed or required due to the type of asphalt material being used. Spread the aggregate immediately following the application of the asphalt material. Spread the aggregate before the asphalt material breaks. Ensure that the spreading equipment does not contact the asphalt material before it is covered with aggregate. Apply the cover material at the rate designated in the Contract, with precautions taken not to exceed the designated rate by more than 5 percent. Use hand brooms to correct any irregularities.

When applied on the roadway lanes and shoulders, roll the entire surface width with pneumatic-tired rollers immediately following the spreading of the aggregate. Do not use steel-wheel rollers except as specified in Subsection 405.02.03. Operate the rollers parallel to the centerline, and cover the entire surface with at least 3 passes of the rollers, or more when the Engineer directs.

When applied on the roadway lanes and shoulders, after rolling, mechanically sweep the completed seal coat to remove all excess cover aggregate after the asphalt material has cured sufficiently to allow sweeping without dislodging the imbedded aggregate, when deemed necessary. If an asphalt surface course is to be applied over the seal coat, do not allow traffic on the seal coat before applying the surface course unless required by the traffic control plan or the Engineer.

405.04 MEASUREMENT. When an authorized adjustment is made, the Department will measure quantities up to 5 percent in excess of the designated application rate for payment. The Department will not measure quantities exceeding the designated application rate by more than 5 percent for payment.

405.04.01 Asphalt Material for Asphalt Seal Coat. The Department will measure the quantity in tons according to Section 109.

405.04.02 Asphalt Seal Aggregate. The Department will measure the quantity in tons according to Section 109.

405.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
00103	Asphalt Seal Coat	Ton
00100	Asphalt Seal Aggregate	Ton

The Department will consider payment as full compensation for all work required under this section.

SECTION 406 — ASPHALT CURING SEAL AND ASPHALT PRIME AND TACK COATS

406.01 DESCRIPTION. Prepare existing bases or surfaces, and apply asphalt material before placing covering courses of asphalt mixtures or treatments.

406.02 MATERIALS AND EQUIPMENT.

406.02.01 Tack Coat. Furnish SS-1 or SS-1h conforming to Section 806.

406.02.02 Prime Coat. Furnish SS-1h conforming to Section 806 unless the Contract allows another material.

406.02.03 Curing Seal. Furnish RS-2, SS-1, or SS-1h conforming to Section 806.

406.02.04 Water. Conform to Section 803.

406.02.05 Equipment. Provide hand brooms and other small tools and equipment essential to completing the work in addition to a mechanical broom or sweeper, asphalt heating equipment, and a pressure distributor. Provide a mechanical broom or sweeper that is adjustable to make uniform contact with the surface and that thoroughly cleans without cutting into the surface being swept.

Provide equipment for heating the asphalt material in tanks, railroad cars, trucks, and distributors that is capable of heating the material to the required temperature without introducing moisture, localized overheating, or otherwise changing the characteristics of the material.

Mount the pressure distributor on a self-propelled, motor vehicle equipped with pneumatic tires, and ensure that it has sufficient power to maintain a constant and uniform speed under all operating conditions. Use a distributor designed to apply the material uniformly at the rate required for the type of construction. Use a distributor conforming to the following requirements:

A) Tank. Use a tank with a capacity of at least 600 gallons and equipped with a removable manhole cover, an overflow pipe, and a dial gage for indicating the contents (mounted so as to be plainly visible to the operator). Carry an accurate measuring stick on the distributor at all times.

B) Heating System. Ensure that the heating system evenly heats and maintains the asphalt material within the required temperature range at all times. Provide a temperature measuring device that will quickly and accurately determine the temperature of the material.

C) Distributing System. Ensure that the pressure distributing system contains a separate power and pump unit of sufficient capacity to distribute the required quantity of asphalt material at a constant flow and uniform pressure. Mount a dial pressure gage plainly visible to the operator.

D) Spray Bar and Nozzles. Use a full-circulating spray bar that adjusts in length to conform to the width of the application being made without overlapping. Use a spray bar that swings laterally over a distance of 9 inches or more. Provide a positive and immediate cut-off and means to prevent material from dripping onto the road surface when the flow is shut off. Use individual nozzles that maintain an equal flow from all nozzles at the same time. To prevent clogging of the nozzles, provide screens for the circulating system, and keep the screens clean. Also, provide a hand spray bar and nozzle having an adequate length of flexible steel hose with packed couplings.

E) Tachometer or Synchronizer. Provide a tachometer visible to the truck operator to enable him to maintain the constant speed necessary for the application of the specified quantity of material. Furnish suitable charts showing the truck speeds

necessary for the correct application.

When using a synchronizer, the tachometer may be omitted. Use a synchronizer that delivers a specified quantity of asphalt material onto the road surface independent of the truck speed.

406.03 CONSTRUCTION. For the asphalt prime coat, apply liquid asphalt material to granular-type bases.

For the asphalt tack coat, apply liquid asphalt material to the surface of concrete or bases, and to existing asphalt surfaces and, when necessary, to newly constructed asphalt courses.

406.03.01 Weather Limitations. Conform to the temperature limitations specified for the asphalt mixture to be placed. Do not apply prime and tack coats to wet surfaces.

406.03.02 Preparation of Surface. Obtain the Engineer's approval of the prepared surface before applying the prime or tack coat.

A) Asphalt Prime Coat. Grade and shape the existing traffic bound base to the required grade and cross section before applying any asphalt material. Wet and roll salvable floater material into the existing traffic bound base.

B) Asphalt Tack Coat. Use mechanical sweepers to clean the application surfaces of all dirt and other foreign matter. Use wire hand brooms when necessary. Extend sweeping beyond the edges of the surface to ensure a thorough cleaning of the full width to be treated.

C) Asphalt Curing Seal. Ensure the roadbed surface is dense, free from loose extraneous material, and contains sufficient moisture to prevent penetration of the asphalt material.

406.03.03 Application. Provide necessary barricades, warning signs, and flaggers to prevent traffic from traveling over a freshly applied prime or tack coat. Also, provide for public convenience and safety as specified in Sections 104 and 107.

Prevent spotting or discoloring curbs, headwalls, and other structures. When discolorations occur, remove them at no expense to the Department.

Protect the exposed, treated surfaces from damage. Repair all damaged areas.

Maintain the material within the following temperature ranges during application:

SS-1, SS-1h	70-160 °F
RS-2	70-140 °F

A) Asphalt Prime Coat. Apply prime coats at the rate specified in the Contract, or as directed when conditions justify variations in the rates of application.

Apply the number of applications of the prime coat as directed. Apply the material under pressure. Do not use hand-pouring except for special conditions, and then only with the Engineer's approval.

Allow the prime coat to cure before placing the asphalt mixture course unless the Engineer approves otherwise.

B) Asphalt Tack Coat. Apply the tack coat with a spray bar that can be raised to a sufficient height so as to uniformly and completely coat the entire surface. When a uniform application, at the rate required, cannot be obtained from the spray bar, then apply the tack coat by fogging with a hand spray attachment. The Engineer will only accept complete and uniform coverage and will verify the application rate by gauge reading. If the application rate has not been achieved, reapply the tack coat to achieve the required application rate before placing asphalt mixture. Unless otherwise specified in the requirements for the asphalt mixture being placed, apply undiluted tack at a rate of 0.84 pounds (0.1 gallons) per square yard. Application rate will also be verified at the end of the production day by measurement according to section 109.

When furnishing SS-1 or SS-1h for tack, the Department will only allow undiluted application. On newly constructed base and binder courses, adjust the application rate as the Engineer directs.

When placing asphalt material adjacent to curbs, existing pavements, or other structures, first coat the contact surface of the existing structure with tack material. In addition place tack material on the longitudinal and transverse joints prior to placing asphalt materials. Ensure that the tack material overlaps onto the adjoining surface no more than 3 inches.

If the initial application of any tack material is not uniform, apply additional material as directed at no additional expense to the Department.

Remove asphalt material applied in excess of the requirements, or cover it with a blotter course of dry sand or stone chips as the Engineer directs.

On projects over which public traffic is being maintained, apply the tack coat over one-half of the pavement width, not to exceed one-half of the day's work, in advance of the construction of the asphalt cover course. Do not end the tack coat application at a location hazardous to traffic. Do not apply tack coat to a lane that requires overnight closure, unless the Engineer approves it in writing. Schedule the work so that, at the end of the day's production, all tack is covered with the asphalt mixture or a sand blotter course. At road intersections or other traffic crossings, the Engineer may require the application of a sand blotter course over the tack coat.

When Sand for Blotter is included in the Contract as a bid item, cover the tack coat with surface-dry, natural sand in a minimum quantity sufficient to prevent the tack coat from being picked up by traffic. Apply the sand uniformly at the rate the Engineer directs but not exceeding 5 pounds per square yard. The normal rate is 2 to 3 pounds per square yard.

C) Asphalt Curing Seal. Uniformly apply the curing seal at the rate of approximately 2 pounds per square yard. The Engineer will determine the actual rate and application temperature of asphalt material. Apply the curing seal in sufficient quantity to provide a continuous membrane over the roadbed. To avoid excessive runoff, apply the seal in 2 or more applications when directed or allowed, making each application as soon as possible after the previous application. If any damage occurs, immediately reseal the damaged area.

If the asphalt material is sticky, apply a sand blotter material at a rate of approximately 5 pounds per square yard, when the Engineer directs, to avoid damage to the seal or to avoid tracking material onto other facilities.

406.04 MEASUREMENT. The Department will not measure for payment the removal of discolorations, maintenance, and repair of the applied coating, or removal of excess material.

406.04.01 Asphalt Prime Coat. The Department will measure the quantity according to Section 109. The Department will not measure water used to prepare dry surfaces for payment.

406.04.02 Asphalt Material for Tack. The Department will measure the quantity according to Section 109.

406.04.03 Asphalt Curing Seal. The Department will measure the quantity according to Section 109. The Department will not measure water used to prepare dry surfaces for payment.

406.04.04 Sand for Blotter. When listed as a bid item, the Department will measure the quantity in tons according to Section 109. The Department will not measure sand for payment when used to treat excessive asphalt material application.

406.05 PAYMENT. The Department will make payment for the completed and accepted

quantities under the following:

Code	Pay Item	Pay Unit
00296	Asphalt Prime Coat	Ton
00358	Asphalt Curing Seal	Ton
02702	Sand for Blotter	Ton
00356	Asphalt Material for Tack	Ton

The Department will consider payment as full compensation for all work required under this section.

SECTION 407 — ASPHALT MIXTURE FOR PAVEMENT WEDGE

407.01 DESCRIPTION. Construct a pavement wedge composed of a hot-mixed or warm-mixed asphalt mixture. Prepare the area to be covered by the mixture when necessary.

407.02 MATERIALS AND EQUIPMENT.

407.02.01 Asphalt Binder. Furnish PG 64-22 conforming to Section 806.

407.02.02 Aggregate. Conform to Sections 804 and 805. Use a gradation within the requirements in the following table:

Sieve Size	Percent Passing
1 1/2 inch	100
3/4 inch	70-100
3/8 inch	45-80
No. 4	30-60
No. 8	20-45
No. 16	15-35
No. 50	5-20
No. 100	3-10

Test gradation according to KM 64-433 or KM 64-620.

Use an asphalt binder content (AC) between 4.5 and 6.0 percent by weight of the mixture. When using a porous aggregate, increase the AC as needed to compensate for asphalt absorption by the aggregate. Submit a JMF to the Engineer for approval according to KM 64-421. Maintain the approved AC within ± 0.5 percentage points as determined according to KM 64-405, KM 64-436, KM 64-437, KM 64-438, or AASHTO T 308.

407.03 CONSTRUCTION. Conform to Section 403 except as specified in this section and in the Contract.

Construct the wedge to the depth, width, and slope the Contract specifies where existing conditions permit. Remove the sod or perform trench excavation only when necessary to obtain the specified depth and width. Do not remove solid rock.

Compact the mixture with a roller weighing at least one ton.

407.04 MEASUREMENT. The Department will measure the quantity according to Subsection 402.04.

The Department will not measure trench excavation or sod removal performed as specified in this section for payment and will consider them incidental to this item of work.

407.05 PAYMENT. The Department will make payment for the completed and accepted quantities according to the Lot Pay Adjustment Schedule for Specialty Mixtures in Section 402 under the following:

Code	Pay Item	Pay Unit
00263	Asphalt Mixture for Pavement Wedge	Ton

The Department will consider payment as full compensation for all work required under this section.

SECTION 408 — ASPHALT PAVEMENT MILLING AND TEXTURING

408.01 DESCRIPTION. Remove existing pavement by milling and texturing.

408.02 MATERIALS AND EQUIPMENT. Provide a power-operated, self-propelled milling machine capable of:

1) removing asphalt pavement to the required depth, profile, cross slope, and surface texture;
2) accurately establishing profile grades by referencing from either the existing pavement or from an independent grade control;
3) controlling cross slope;
4) applying sufficient down-pressure to plane the milled surface; and
5) effectively removing cuttings from the pavement and preventing dust from escaping into the air.

Provide supplemental equipment as necessary to remove material adjacent to curbs, railroad crossings, and other areas that cannot be removed by the milling machine. Additionally, provide a mechanical sweeper and, when the Engineer deems necessary, a water truck to control dust.

408.03 CONSTRUCTION. The depth of cut indicated in the Contract is approximate only. The Engineer will specify the actual depth of cut.

When the Contract requires a bottom-of-rut cut, remove only the amount of material necessary to acceptably texture the bottom of the rut. Where there are no ruts, remove only the amount of material necessary to obtain an acceptable texture.

Remove the material in successive cuts of approximately 1 to 1 1/2 inches, measured at the edge of the cutting drum. Complete each cut over the entire length and width of the area. Do not begin the next cut until the Engineer examines the area and determines that additional cutting is necessary.

When maintaining public traffic is not necessary, the Department may allow deeper cuts, provided the final cut does not exceed 1 1/2 inches and satisfactory results are obtained.

Provide an average depth of 0.20 inch between the high and low points on the milled pavement.

After milling and texturing, ensure that the finished surface conforms to the required grade and cross section and provides a smooth riding surface free from gouges, ridges, oil film, and other imperfections of workmanship. Do not allow the elevation of the longitudinal edges of adjacent cuts to differ more than 1/8 inch. Unless the Engineer allows, do not leave vertical longitudinal faces during non-working hours in areas exposed to public traffic. Limit the vertical longitudinal faces to 1 1/2 inches in height, and taper them in a manner the Engineer approves to avoid creating a hazard for traffic.

When the Engineer deems necessary, apply water to control dust.

Remove excess millings and fines that have collected at the vertical longitudinal faces and thoroughly sweep up all millings. Load and haul away all materials swept up.

Repair pavement that is gouged, torn, or otherwise damaged during milling operations, and repair damage done to any other property of any kind including utility frames, grates, and covers.

408.03.01 Surface Tolerance. Ensure that the finished surface after the final cut does not deviate more than 1/8 inch from a 10-foot straightedge and that the cross slope does not deviate more than 3/8 inch in 10 feet. Correct all irregularities exceeding these limits.

408.03.02 Approaches and Tapers. Mill approaches and tapers as required by, and to the satisfaction of, the Engineer. The Engineer will determine the length, width, and depth of cut on approaches and tapers. Match the approaches and tapers to the finished cut

on the mainline, and transition them to the existing surface within 1/8 inch.

When the Engineer deems necessary, transition private entrances to provide a smooth approach to the roadway.

408.03.03 Pavement Marking. Apply and maintain pavement markings according to Section 112.

408.03.04 Adjusting Small Drainage Structures. Adjust small drainage structures, such as catch basins, as required to match the finished pavement, or to provide proper drainage, according to Subsection 710.03.03. When existing catch basin grates are below the finished grade, the Department will require no adjustments.

Keep all small drainage structures, utility valves, etc. free of cuttings and other debris during the milling operation.

408.03.05 Adjusting Manholes. Only when the Engineer directs, adjust manholes according to Subsection 710.03.03. Return manhole adjusting rings that are removed and not reused to the utility owner.

408.04 MEASUREMENT.

408.04.01 Asphalt Pavement Milling and Texturing. The Department will measure the quantity of material removed from the areas milled and textured in tons.

When the original Contract quantity is 2,000 tons or more, weigh the material according to Section 109, except that the Department will accept commercial or portable scales, certified by the Kentucky Department of Agriculture, Division of Weights and Measures, and approved by the Engineer.

When the original Contract quantity is less than 2,000 tons, arrange for 3 trucks of each capacity to be weighed to determine the average net weight per load. The Department will calculate the total quantity using the average weight per load and the load count for each size of truck. The Engineer may require additional weighing if excessive variation in loading is apparent. The Engineer may perform check-weighing.

The Department will not measure additional milling performed to correct deficiencies in the finished grade, cross section, or texture for material removed when the deficiencies are due to unsatisfactory workmanship.

The Department will not measure work to repair damage caused by the milling operations.

The Department will not measure water used to control dust for payment and will consider it incidental to this item of work.

408.04.02 Mobilization for Asphalt Pavement Milling and Texturing. The Department will measure the quantity by the lump sum. The Department will measure Mobilization for Asphalt Pavement Milling and Texturing for payment only once per Contract and will consider any additional mobilization operations for milling and texturing incidental to this item of work.

The Department will not measure Mobilization for Asphalt Pavement Milling and Texturing for payment when milling is performed to correct deficiencies in the finished grade, cross section, or texture for material removed when the deficiencies are due to unsatisfactory workmanship.

For group contracts, the Department will measure the quantity for each project (subsection) that has a bid item for Mobilization for Asphalt Pavement Milling and Texturing.

408.04.03 Adjusting Small Drainage Structures. The Department will measure the quantity according to Subsection 710.04.

408.04.04 Adjust Manhole. The Department will measure the quantity by each individual unit.

408.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

408.05.01 Asphalt Pavement Milling and Texturing. When Asphalt Pavement Milling and Texturing is a major item, the Department will use the supplemental formulas established in Subsection 104.02.02 for determining adjusted unit prices when either an underrun or an overrun of 25 percent occurs in the quantity of milling and texturing actually performed.

408.05.02 Adjust Manhole. In the event the Engineer directs the Contractor to adjust existing manholes and the Contract does not include a bid item for this work, the Department will make payment at an agreed unit price of $250.00 for each manhole acceptably adjusted by using the adjusting ring method, or an agreed unit price of $350.00 for each manhole acceptably adjusted by removing or adding masonry.

Code	Pay Item	Pay Unit
02677	Asphalt Pavement Milling and Texturing	Ton
02676	Mobilization for Milling and Texturing	Lump Sum
01709, 01719	Adjusting Small Drainage Structures, Type, Size	See Subsection 710.05
01791, 01792		
01791	Adjust Manhole Frame to Grade	Each

The Department will consider payment as full compensation for all work required under this section.

SECTION 409 — ASPHALT MIXTURES USING RECLAIMED MATERIALS

409.01 DESCRIPTION. Use reclaimed asphalt pavement (RAP) from Department projects or other approved sources in hot mix asphalt (HMA) or warm mix asphalt (WMA) provided mixture requirements are satisfied. For other sources to be approved, satisfactorily establish to the Engineer that the quality of the material is acceptable.

Use either pre-consumer (manufacturer waste or new) or post-consumer reclaimed asphalt shingles (RAS) that are processed such that all the material passes the 3/8-in. sieve. Ensure pre-consumer RAS is free of deleterious materials. Ensure post-consumer RAS does not contain more than 1.5 percent wood by mass or more than 3.0 percent deleterious materials by mass.

409.02 MATERIALS AND EQUIPMENT. Conform to the guidelines in Subsection 409.03.03 for the required grade of asphalt binder which is based on the percentage of effective binder content of the mixture.

409.03 CONSTRUCTION. Keep reclaimed material of different gradation, asphalt binder content, asphalt binder properties, and aggregate properties separate at all times, including when stockpiling and feeding. The Department may approve other methods and procedures provided that all characteristics of the reclaimed material remain uniform.

409.03.01 Polish-Resistant Aggregate. When electing to utilize polish-resistant aggregate in reclaimed material to satisfy a portion of the polish-resistant aggregate requirements for the mix, provide documentation to the Engineer's satisfaction that the reclaimed material consists of the specified amount of polish-resistant aggregate. Provide samples of the reclaimed material to the Engineer for verification testing.

409.03.02 Asphalt Binder Content Adjustment for RAS. Recognizing that not all asphalt binder in RAS is activated during the mixing operation to fully blend with the virgin materials, the Department will reduce the asphalt binder content determined by Kentucky Method 64-405 for RAS by 25 percent.

409.03.03 Preparation of Mixture.

A) Mix Requirements. Conform to the Contract requirements for each mixture produced using reclaimed material consisting of RAP, RAS, or a combination of RAP and RAS. Conform to the following table to select the appropriate grade of virgin asphalt binder to blend with the reclaimed material. Calculate the percentage of effective binder content as follows:

*Percentage of effective binder content = [(A*B) + (0.75*C*D)]/E*, where

A = Asphalt binder content of the RAP (%);
B = Percentage of RAP in the mix (%);
C = Asphalt binder content of the RAS (%);
D = Percentage of RAS in the mix (%); and
E = Effective binder content of the mix (%).

B) Restrictions. For the following mixtures limit the maximum cold feed percentages to:

Surface mixtures with RAP only 20%
Base mixture with RAP only 30%
All mixtures with RAS only 5%
Surface mixtures with RAP and RAS combo 10% RAP, 3% RAS
Base mixtures with RAP and RAS combo 12% RAP, 4% RAS

No.4 A & No.4B Mixes….. Use of Recycled/Reclaimed Materials is Prohibited

ASPHALT MIXTURES WITH NOMINAL-MAXIMUM AGGREGATE SIZE OF 0.5 in., 0.38 in., and No. 4		
ASPHALT BINDER SPECIFIED IN MIXTURE BID ITEM	VIRGIN ASPHALT BINDER	
	RAP	
	≤ 17% Effective Binder Content	18-23 % Effective Binder Content
PG 64-22	PG 64-22	PG 58-28
PG 76-22	PG 76-22	-----
	RAS	
	≤ 10 % Effective Binder Content	11-15 % Effective Binder Content
PG 64-22	PG 64-22	PG 58-28
PG 76-22	-----	-----
	RAP and RAS	
	≤ 12 % Effective Binder Content	13-18% Effective Binder Content
PG 64-22	PG 64-22	PG 58-28
PG 76-22	-----	-----

ASPHALT MIXTURES WITH NOMINAL-MAXIMUM AGGREGATE SIZE OF 1.50 in., 1.00 in., and 0.75 in.		
ASPHALT BINDER SPECIFIED IN MIXTURE BID ITEM	VIRGIN ASPHALT BINDER	
	RAP	
	≤ 25 % Effective Binder Content	26-30 % Effective Binder Content
PG 64-22	PG 64-22	PG 58-28
PG 76-22	PG 76-22	-----
	RAS	
	≤ 12 % Effective Binder Content	13-20 % Effective Binder Content
PG 64-22	PG 64-22	PG 58-28
PG 76-22	-----	-----
	RAP and RAS	
	≤ 15% Effective Binder Content	16-25 % Effective Binder Content
PG 64-22	PG 64-22	PG 58-28
PG 76-22	-----	-----

C) Mixing. Obtain the Engineer's approval for the method of incorporating the reclaimed material into the mixture. Thoroughly mix the new and reclaimed materials into a uniform mass. Ensure that the final mixture conforms to all requirements of the Contract. Ensure that the moisture content of the final mixture

is not detrimental to the handling, hauling, placing, or compacting of the mixture.

409.04 MEASUREMENT. The Department will not measure reclaimed material separately but will include it in the measured quantities of asphalt mixture produced.

409.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the appropriate pay item for the asphalt mixture being produced.

The Department will not make separate payment for incorporating reclaimed material. The Department will not increase or decrease the Contract unit prices for any asphalt mixture on the project as a result of using, or not using, reclaimed material in the asphalt mixtures.

SECTION 410 — ASPHALT PAVEMENT RIDE QUALITY

410.01 DESCRIPTION. This section covers the requirements for the ride quality of completed asphalt pavements. Ride quality is a measurement of surface tolerance in terms of an International Roughness Index (IRI). The IRI is an index derived from controlled measurements of the longitudinal profile in the wheel tracks and correlated with panel ratings of ride quality. The Contract will specify when ride quality requirements apply.

410.02 MATERIALS AND EQUIPMENT. The Department will measure the longitudinal profile of the surface with an ASTM E 950, Class 1 device.

410.03 CONSTRUCTION.

410.03.01 Corrective Work. Submit corrective work procedure plans to the Engineer for approval before performing the work. Provide a final, corrected surface comparable to adjacent, acceptable pavement placed within the project limits with respect to texture, appearance and skid resistance.

410.03.02 Ride Quality.

A) Acceptance Testing. The Department will test the ride quality of the pavement for acceptance after the Contractor:

1) makes a request at least 2 weeks in advance; and
2) partially completes the paving and the Department deems it necessary; or
3) completes all mainline paving.

The Department will determine the IRI by applying a linear transform, determined by correlation, to the values (average of 2 wheel paths) determined by ASTM E 1926. Thoroughly clean the surface of all dirt and other foreign matter immediately before the Department performs the testing.

The Department will divide and test each traffic lane using 0.1-mile test sections starting at the beginning of the lane and proceeding in the direction of traffic. The Department will exclude discontinuities, such as bridges, in the pavement. When a test section at the end of a lane is less than 0.1 mile long, the Department will include that section with the adjacent section. When deemed necessary, the Department will retest the pavement after any corrective work is completed.

When the final riding surface is an open-graded friction course (OGFC), the Department will test the underlying pavement before the OGFC is placed and, when deemed necessary, test the OGFC after it is placed.

B) Requirements. The Department will specify if the ride quality requirements are Category A or Category B when ride quality is specified in the Contract. Categories B ride quality requirements shall apply when the Department fails to classify which ride quality requirement will apply to a Contract.

1) Category A. Achieve an IRI of 70 or lower for each 0.1-mile section. When the IRI is greater than 80 for a 0.1-mile section, perform corrective work, or remove and replace the pavement to achieve the specified IRI. At the Department's discretion, a pay deduction of $1200 per 0.1-lane-mile section may be applied in lieu of corrective work.

The Department's testing generates a computer file containing the measured longitudinal profile in terms of elevation values of each wheel track at 3-inch intervals. The Department will create a strip chart from the file showing the elevation and distance traveled when the IRI is greater than 70 or upon request for lower IRI values.

2) Category B. Achieve an IRI of 80 or lower for each 0.1-mile section. When the IRI is greater than 90 for a 0.1-mile section, perform corrective work, or remove and replace the pavement to achieve the specified IRI. At the Department's discretion, a pay deduction of $750 per 0.1-lane-mile section may be applied in lieu of corrective work.

The Department's testing generates a computer file containing the measured longitudinal profile in terms of elevation values of each wheel track at 3-inch intervals. The Department will create a strip chart from the file showing the elevation and distance traveled when the IRI is greater than 80 or upon request for lower IRI values.

410.04 MEASUREMENT. The Department will measure the ride quality in terms of the IRI according to Subsection 410.03. The Department will not measure the IRI as a separate pay unit but will use the IRI to calculate a Ride Quality Adjustment payment.

410.05 PAYMENT. The Department will apply a Ride Quality Adjustment for each 0.1-lane-mile section tested. The Department will determine the Ride Quality Adjustments for each 0.1-lane-mile section using the Ride Quality Adjustment Schedule below. The Department will not apply positive ride quality adjustments to 0.1-lane-mile sections when their associated sublot's density value is less than 0.95. The sum of the pay value adjustments for ride quality shall not exceed $0 for the project as a whole.

When requesting tests on partially completed pavement, the Department will perform one test at no charge. The Department will perform additional requested testing and retesting for corrective work or pavement replacement at a cost of $300.00 per lane-mile. The Department will deduct charges for additional requested testing and retesting for corrective work from monies due on the Contract.

RIDE QUALITY ADJUSTMENT SCHEDULES

CATEGORY "A" PROJECTS		CATEGORY "B" PROJECTS	
IRI	**Pay Value Adjustment**[(1)]	**IRI**	**Pay Value Adjustment**[(1)]
30 or less	$750	36 or less	$500
31	$630	37	$420
32	$520	38	$350
33	$420	39	$280
34	$330	40	$220
35	$250	41	$170
36	$180	42	$120
37	$120	43	$80
38	$70	44	$45
39	$30	45	$20
40 to 70	0	46 to 80	0
71	-$30	81	-$20
72	-$70	82	-$45
73	-$120	83	-$80
74	-$180	84	-$120
75	-$250	85	-$170
76	-$330	86	-$220
77	-$420	87	-$280
78	-$520	88	-$350
79	-$630	89	-$420
80	-$750	90	-$500
81 or higher	corrective work[(2)]	91 or higher	corrective work[(3)]

[(1)] *The Department will not apply a positive pay value for corrective work other than*

removal and replacement to achieve the IRI.

(2) *When it is in the best interest of the Department, a minimum pay value deduction of $1200 per 0.1-lane-mile section may be applied in lieu of corrective work.*

(3) *When it is in the best interest of the Department, a minimum pay value deduction of $750 per 0.1-lane-mile section may be applied in lieu of corrective work.*

SECTION 411 — ASPHALT WEDGE CURBS AND MOUNTABLE MEDIANS

411.01 DESCRIPTION. Construct extruded asphalt sections of constant width with an extrusion-type machine. Construct asphalt sections of variable width by machine or hand.

411.02 MATERIALS AND EQUIPMENT.

411.02.01 Asphalt Materials. Conform to Section 806. For tack and paint coats, use SS-1 or SS-1h. For the asphalt mixture, use PG 64-22.

411.02.02 Aggregate. Conform to Sections 804 and 805. Use a gradation that conforms to the following table:

Sieve Size	Percent Passing
1/2 inch	100
No. 4	60-80
No. 8	45-65
No. 16	13-25
No. 200	6.0-12.0

Test gradation according to KM 64-433 or KM 64-620.

Use an asphalt binder content (AC) between 6 and 8 percent by weight of the mixture. When using a porous aggregate, increase the AC as needed to compensate for asphalt absorption by the aggregate. Submit a JMF to the Engineer for approval according to KM 64-421. Maintain the approved AC within ± 0.5 percentage points as determined according to KM 64-405, KM 64-436, KM 64-437, KM 64-438, or AASHTO T 308.

The Department may allow an alternate JMF. Submit alternates for the Engineer's approval. When the Engineer determines that the results from an alternate JMF are not satisfactory, repair or replace the defective work, and complete the remainder of the work using the JMF specified in this section.

411.02.03 Extrusion Equipment. Furnish a self-propelled machine for placing extruded asphalt sections. Ensure that it is equipped with a material hopper, a distributing screw, and adjustable forming devices; and capable of placing and compacting the asphalt mixture to the lines, grades, and cross section specified in a smooth, homogenous section free of honeycomb areas.

411.03 CONSTRUCTION. Conform to Section 403 except as specified in this section and in the Contract.

Thoroughly clean the surface where the extruded asphalt sections are to be placed, and apply tack at a rate to achieve an undiluted asphalt residue of 0.4 pounds (0.05 gallons) per square yard. Allow the tack material to cure before covering it.

For curbs and medians of constant width, extrude the asphalt sections at the locations and to the dimensions specified in the Contract.

In areas inaccessible to the machine and on variable-width medians, the Department will allow hand-placing. Ensure that the mixture is compacted and finished to a dense, uniform section comparable to the machine-placed mixture.

Apply an asphalt paint coat to the sections after construction. Prevent spotting or discoloring of concrete curbs, headwalls, and other structures, and remove any discolorations that occur.

411.04 MEASUREMENT.

411.04.01 Asphalt Wedge Curb. The Department will measure the quantity in linear feet along the top of the curb. The Department will not measure tack and paint coats for

payment and will consider them incidental to this item of work.

411.04.02 Mountable Medians. The Department will measure the quantity of each type in square yards. The Department will not measure tack and paint coats for payment and will consider them incidental to this item of work.

411.05 PAYMENT. When an alternate JMF is approved for use, the Department will not make any change to the Contract unit price for this item. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
01897	Asphalt Wedge Curb	Linear Foot
01935-01950	Mountable Median, Type	Square Yard

The Department will consider payment as full compensation for all work required under this section.

SECTION 412 — STONE-MATRIX ASPHALT (SMA)

412.01 DESCRIPTION. Construct one or more courses of a stone-matrix asphalt (SMA) upon the prepared foundation according to these specifications.

AASHTO R46 offers guidance for the design of SMA mixtures using the Superpave gyratory compactor (SGC).

For CL4 SMA BASE 1.00D PG76-22, conform to all requirements for CL4 ASPH BASE 1.00D PG76-22 unless specifically modified herein. For CL4 SMA SURF 0.50A PG76-22, conform to all requirements for CL4 ASPH SURF 0.50A PG76-22 unless specifically modified herein. For CL4 SMA SURF 0.38A PG76-22, conform to all requirements for CL4 ASPH SURF 0.38A PG76-22 unless specifically modified herein.

412.02 MATERIALS AND EQUIPMENT.

412.02.01 Fine Aggregate.

A) Polish Resistance. Contrary to Subsection 403.03.03, the Department will not require any of the fine aggregate to be polish-resistant.

B) Sand. Conform to the quality requirements of AASHTO M325. Contrary to AASHTO M325, conform to Subsection 804.04 for soundness.

C) Mineral Filler. Conform to the quality requirements of AASHTO M325. Do not use fly ash as the mineral filler component. Do not use collected baghouse fines or other airborne aggregate particles in lieu of mineral filler.

412.02.02 Coarse Aggregate.

A) All Aggregate Types Except Slag. Conform to the quality requirements of AASHTO M325. Contrary to AASHTO M325, conform to Subsection 805.03 for soundness.

B) Slag. Conform to AASHTO M325 for flat-and-elongated particles and crushed content. Conform to Section 805 for wear, absorption, and soundness.

412.02.03 Asphalt Binder. Provide a performance-graded (PG) 76-22 asphalt binder conforming to Section 806.

412.02.04 Reclaimed Materials. The use of reclaimed materials is prohibited in SMA mixtures.

412.02.05 Stabilizing Additive. Select and utilize either cellulose or mineral fiber in the SMA mixture. Conform to the dosage rates and quality requirements of AASHTO M325. Furnish the fiber manufacturer's certification to the Engineer stating that the material conforms to all requirements therein.

412.02.06 Fiber-Supply System. Use a separate feed system to accurately proportion the required quantity of fibers into the mixture in a manner that ensures uniform distribution. Interlock this proportioning device with the aggregate feed or weigh system to maintain the correct proportions for all rates of production and batch sizes. Add the fiber in such a manner to prevent the material from becoming entrained in the exhaust system of the drier or plant. Control the proportion of fibers to within ± 10 percent of the amount required. Provide flow indicators or sensing devices for the fiber system, interlocked with the plant controls, to interrupt mixture production if the introduction of fiber fails.

Prior to performing the trial demonstration specified in Subsection 412.03.04, calibrate the fiber-supply system. Provide the Engineer at least 2 days notice of the calibration date so that a Department representative may inspect the calibration process and verify that the system operates correctly.

For batch plants, add the fiber to the aggregate in the weigh hopper or as the Engineer directs. Increase the dry mixing time by 8 to 12 seconds, or as the Engineer directs, from the time the aggregate is completely emptied into the mixer. Ensure the fibers are uniformly distributed prior to the injection of asphalt binder into the mixer.

For continuous or drum plants, add the fiber to the aggregate, and ensure the fibers are uniformly dispersed, prior to the injection of asphalt binder.

412.02.07 Mineral Filler-Supply System. Use a totally enclosed, separate feed system to accurately proportion the mineral filler into the mixture in a manner that ensures uniform distribution. Do not introduce the mineral filler through the cold-feed system.

Prior to performing the trial demonstration specified in Subsection 412.03.04 of this note, calibrate the mineral filler-supply system to within 10 percent of the desired amount. Provide the Engineer at least 2 days notice of the calibration date so that a Department representative may inspect the calibration process and verify that the system operates correctly.

412.02.08 Rollers. Do not use pneumatic-tired rollers. Use vibratory rollers for breakdown rolling only.

412.02.09 Material Transfer Vehicle (MTV). Provide and utilize a MTV with the minimum characteristics outlined in section 403.02.10.

412.03. CONSTRUCTION.

412.03.01 Seasonal and Weather Limitations. Conform to the seasonal and weather limitations outlined in 403.03.01.

412.03.02 Preparation of Mixture. Conform to the following aggregate composition limits for the respective nominal-maximum size of SMA.

AGGREGATE COMPOSITION LIMITS			
Sieve Size	1.00-in. Base % Passing by Mass	0.50-in. Surface % Passing by Mass	0.38-in. Surface % Passing by Mass
1 1/2 inch	100	100	100
1 inch	85-100	100	100
3/4 inch	----	100	100
1/2 inch	50-70	85-100	100
No. 4	20-36	20-36	30-50
No. 8	15-25	12-25	20-30
No. 200	7.0-11.0	7.0-11.0	8.0-12.0

412.03.03 Mix Design Criteria. Using a compaction effort of N_{des} = 100 gyrations, submit a preliminary mix design conforming to the following mixture specifications.

MIX DESIGN CRITERIA	
Property	Requirement
% Air Voids (AV)	4.0
% Voids-in-Mineral Aggregate (VMA)	
CL4 SMA BASE 1.00D PG76-22	16.0 (minimum)
CL4 SMA SURF 0.50A PG76-22	17.0 (minimum)
CL4 SMA SURF 0.38A PG76-22	17.0 (minimum)
% Voids-in-Coarse Aggregate (VCA_{mix}) of Compacted Mixture[1]	< VCA of Dry Aggregate (VCA_{DRC})[1]
% Retained Tensile Strength (TSR)	80 (minimum)
% Draindown at Production Temperature[2]	0.30 (maximum)
% Asphalt Binder Content	
CL4 SMA SURF 0.50A PG76-22	6.0 (minimum)
CL4 SMA SURF 0.38A PG76-22	6.3 (minimum)

[1]*Determine according to AASHTO R46.*
[2]*Determine according to AASHTO T305.*

412.03.04 Trial Demonstrations. At least two days prior to beginning mainline paving, demonstrate that satisfactory production and placement of the SMA mixture is possible. Furnish at least 200 tons each of two or more different asphalt binder contents (AC's) for the trial demonstration. The Engineer will determine the site, outside of the driving lanes, and exact quantity of the trial placement and trial AC's. Perform a minimum of one volumetric analysis (two SGC specimens and two maximum-specific-gravity tests), one AC determination, and one gradation determination for each of the different AC's demonstrated. Document that the SMA mixture meets a 1.00 minimum pay value for AC, AV, and VMA prior to beginning mainline paving.

412.03.05 Optimum AC Selection. The Engineer will select the optimum AC based on the results of the trial demonstration(s). Contrary to Subsection 402.03.02, obtain the Engineer's approval prior to adjusting the AC during the setup period or thereafter.

412.03.06 Mixture Handling.

A) Mixing Temperatures. Maintain the temperature of the component materials for the SMA mixture according to the instructions of the respective manufacturer(s). However, do not exceed the maximum temperatures indicated in Subsection 401.03.01 for the PG binder specified.

B) Mixture Storage. Due to the possibility of binder draindown, do not store the SMA mixture overnight.

412.03.07 Placement and Compaction. Use a MTV when placing SMA mixture in the driving lanes. The MTV is not required on ramps and/or shoulders unless specified in the contract. When the Engineer determines the use of the MTV is not practical for a portion of the project, the Engineer may waive its requirement for that portion of pavement by a letter documenting the waiver.

Compact the SMA mixtures by Option A. Do not allow traffic on the compacted mixture until it has cooled sufficiently to withstand traffic without damage (normally about 140 °F). To expedite opening the pavement to construction equipment or traffic, the Department will allow the mat to be cooled by dousing it with water after compaction is complete.

412.04 MEASUREMENT.

412.04.01 Trial Demonstrations. The Department will measure up to 400 tons of mixture used in the Trial Demonstration. The Department will measure the quantity as CL4 SMA BASE 1.00D PG76-22, CL4 SMA SURF 0.50A PG76-22, or CL4 SMA SURF 0.38A

PG76-22, as appropriate. The Department will not measure quantities exceeding 400 tons for payment and will consider them incidental to the CL4 SMA BASE 1.00D PG76-22, CL4 SMA SURF 0.50A PG76-22, or CL4 SMA SURF 0.38A PG76-22.

412.04.02SMA Mixtures for Driving Lanes. The Department will measure CL4 SMA BASE 1.00D PG76-22, CL4 SMA SURF 0.50A PG76-22, and CL4 SMA SURF 0.38A PG76-22 by the ton.

412.04.03 Material Transfer Vehicle (MTV). The Department will not measure the MTV for payment and will consider its use incidental to the asphalt mixture.

412.05 PAYMENT.

412.05.01 Trial Demonstrations. The Department will pay for the measured quantities at the Contract unit bid price for CL4 SMA BASE 1.00D PG76-22, CL4 SMA SURF 0.50A PG76-22, or CL4 SMA SURF 0.38A PG76-22, as appropriate, with no adjustments.

412.05.02 CL4 SMA BASE 1.00D PG76-22. The Department will calculate payment by the Lot Pay Adjustment Schedule for Compaction Option A Base and Binder Mixtures in Subsection 402.05 except for the AV and Lane Density schedule. The Department will apply the following schedule for AV and Lane Density.

AV	
Pay Value	Test Result (%)
	AADTT Class 2,3, or 4
1.05	3.5-4.5
1.00 + 0.1 (AV-3.0)	2.0-3.4
1.00 + 0.1 (AV-5.0)	4.6-6.0
(2)	> 2.0 or >6.0

(2) Refer to section 402.05.02.

LANE DENSITY	
Pay Value	Test Result (%)
1.05	95.0-96.5
1.00	93.0-94.9
0.95	92.0-92.9 or 96.6-97.0
0.90	91.0-91.9 or 97.1-97.5
(1)	< 91.0 or > 97.5

(1) *The Department will require removal and replacement only when the results for all 4 cores in a sublot are less than 91.0 percent, or greater than 97.5 percent, of solid density. The Department will require removal and replacement of the entire sublot of material in this case. The Department will apply a 0.65 pay factor to individual cores with these results for sublots allowed to remain in place.*

412.05.03 CL4 SMA SURF 0.50A PG76-22 and CL4 SMA SURF 0.38A PG76-22. The Department will calculate payment by the Lot Pay Adjustment Schedule for Compaction Option A Surface Mixtures in Subsection 402.05 except for the AV, Lane Density and Joint Density schedules. The Department will calculate the Lot Pay Adjustment using all possible incentives and disincentives but will not allow the overall pay value for a lot to exceed 1.00. The Department will apply the following schedules for Lane Density and Joint Density.

DENSITY

Pay Value	Lane Density Test Result (%)	Joint Density Test Result (%)
1.05	95.0-96.5	92.0-96.0
1.00	93.0-94.9	90.0-91.9
0.95	92.0-92.9 or 96.6-97.0	89.0-89.9 or 96.1-96.5
0.90	91.0-91.9 or 97.1-97.5	88.0-88.9 or 96.6-97.0
0.75	----	< 88.0 or > 97.0
(1)	< 91.0 or > 97.5	----

(1) *The Department will require removal and replacement only when the results for all 4 cores in a sublot are less than 91.0 percent, or greater than 97.5 percent, of solid density. The Department will require removal and replacement of the entire sublot of material in this case. The Department will apply a 0.65 pay factor to individual cores with these results for sublots allowed to remain in place.*

AV	
Pay Value	Test Result (%)
	AADTT Class 2,3, or 4
1.05	3.5-4.5
1.00 + 0.1 (AV-3.0)	2.0-3.4
1.00 + 0.1 (AV-5.0)	4.6-6.0
(2)	< 2.0 or > 6.0

(2) Refer to section 402.05.02

412.05.04 Pay Items and Units. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
00395	CL4 SMA BASE 1.00D PG76-22	Ton
00396	CL4 SMA SURF 0.50A PG76-22	Ton
00397	CL4 SMA SURF 0.38A PG76-22	Ton

SECTION 413 - MICROSURFACING

413.01 DESCRIPTION. This work consists of constructing a cold-laid, polymer-modified, emulsified asphalt pavement course to fill ruts or provide an intermediate or surface course for existing pavements. The paving mixture is composed of a polymer-modified emulsified asphalt, crushed aggregate, mineral filler, water, and possibly other additives. Follow the requirements outlined in ASTM D 6372, Standard Practice for Design, Testing, and Construction of Microsurfacing, with modifications as found in this note. Apply this material according to the lines, grades, and typical cross-sections in the plans or as established by the Engineer.

Unless otherwise noted, Section references herein are to the Department's Standard Specifications for Road and Bridge Construction.

413.02 MATERIALS AND EQUIPMENT.

413.02.01 Mineral Filler. Use Portland Cement, Type I, conforming to Section 801.

413.02.02 Aggregate. Provide 100-percent crushed aggregate conforming to Sections 804 and 805. Contrary to Subsection 403.03.03, provide polish-resistant aggregate in the asphalt mixture conforming to one of the following requirements:

Microsurfacing Type A

- 100 percent of total combined aggregate is Class A polish-resistant aggregate.

Microsurfacing Type B

- 100 percent of total combined aggregate is Class B or Class A polish-resistant aggregate.

Microsurfacing Type D

- No polish-resistant aggregate requirements

Contrary to ASTM D 6372, test sand equivalent according to AASHTO T 176, soundness according to Kentucky Method (KM) 64-610, and LA abrasion according to AASHTO T 96. Ensure all aggregates satisfy ASTM D 6372 for sand equivalent, soundness, and LA abrasion.

Do not use mineral aggregates that are inherently porous, such as blast-furnace slag, expanded shale, porous limestone, and lightweight aggregates, in this mixture.

413.02.03 Water. Conform to Section 803.

413.02.04 Emulsified Asphalt. The polymer-modified emulsion will be a CQS-1hP conforming to AASHTO M 316 and tested according to T59. Distill sample at 350 ˚F. In addition, ensure that the emulsified asphalt conforms to the following criteria:

Test	Criteria
Ductility at 77 °F (AASHTO T 51)	40 cm (min)

Ensure the asphalt supplied is on the List of Approved Materials.

413.02.05 Equipment. All equipment necessary for the satisfactory performance of the work shall be on hand and approved before the work is permitted to begin. All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working condition.

All trucks shall be covered immediately after loading with a cover of canvas or other suitable material. The cover shall lap down along the sides and rear of the truck bed a minimum of 6 in. and be secured by tie downs at a maximum of 5 ft. spacing along the sides and rear of the truck bed. All trucks must be equipped to meet the above requirements prior to commencing hauling operations.

413.02.06 Mixing Equipment. Produce the mixture in a self-propelled, front-feed, continuous-loading machine equipped with a conveyer-belt aggregate-delivery system and an interconnected, positive-displacement, water-jacketed gear pump and/or a variable displacement computerized rate control pump, to accurately proportion the aggregate and asphalt emulsion. Locate the mineral filler feed so the appropriate amount of mineral filler is added to the aggregate before discharge into the pug mill. Provide a spray bar to completely pre-wet the aggregate dropping into the pug mill with additive and water before the introduction of the asphalt emulsion. Provide a twin-shaft, continuous-flow, multi-blade pug mill that is a minimum of 49 inches long. Ensure that the blade size and side clearances meet the equipment manufacturer's recommendations. Introduce the emulsion within the first one-third of the mixer length to ensure proper mixing of all materials before exiting the pug mill.

Equip the machine with opposite-side driving stations to allow full control of the machine from either side. Equip the mixer with a remote, forward-speed control at the rear mixing platform so the rear operator can control the forward speed and level of mixture in the paving or rut box. Provide material control devices that are readily accessible and positioned so the amount of each material used can be determined at any time.

Equip the mixing machine with a water pressure system and nozzle-type spray bar to provide a water spray ahead of and outside the spreader box, when required. Apply water at a rate that will dampen the surface but not create free-flowing water ahead of the spreader box.

The mixer shall be equipped with a computerized material monitoring system with integrated material control devices that are readily accessible and positioned so the amount of each component material used can be determined at any time. The mixer shall be equipped with a back-up electronic materials counter that is capable of recording running count totals for each component material being monitored. The mixer shall include an attached radar ground measuring device or comparable device. All material control devices shall be calibrated prior to each mix application and at the discretion of the Engineer. The computer system shall have the capability to record, display, and print the following information:

- Individual sensor counts for emulsion, aggregate, cement, water and additive
- Aggregate, emulsion, and cement output in pounds per minute
- Ground travel distance
- Spread rate in pounds per square yard

- Percentages of emulsion, cement, water and additive
- Cumulative totals of aggregate, emulsion, cement, water and additive
- Scale factor for all materials

The computer system shall be functional at all times throughout the entire work operation.

413.02.07 Aggregate Equipment. Aggregate shall be weighed when removed from the stockpile and screened directly into the trucks. The inspector shall view the screen for oversized aggregate. If the screen is found to have gaps, it shall be repaired or replaced before the continuing the placement of material.

413.02.08 Spreading Equipment. If a leveling or surface course is specified, apply the mixture uniformly by means of a conventional spreader box.

If a rut-fill course is specified, apply the mixture with a 5-6 ft. top width, "V-shaped" rut-filling spreader box. Equip the rut-filling spreader box with a steel strike-off device.

Attach either type of spreader box to the mixer, and equip it with augers mounted on an adjustable shaft to continually agitate and distribute the materials throughout the box. Ensure that the equipment provides sufficient turbulence to prevent the mix from setting in the box or causing excessive build-up or lumps. To prevent loss of the mixture from the box, attach flexible seals, front and rear, in contact with the road. Operate the spreading equipment in such a manner as to prevent the loss of the mixture on super-elevated curves.

For surface courses, attach a secondary strike-off device to the spreader. Use neoprene rubber drags to obtain the desired finish. Replace drags having excessive buildup. Do NOT use burlap drags.

413.02.09 Calibration Equipment. Supply all of the equipment, materials, and scales necessary to perform the calibration according to Section 3.5 of this note.

413.03 CONSTRUCTION.

413.03.01 Preparation and Proportioning of Mixture. Submit a complete mix design to the Section Engineer and to the KYTC, Division of Materials, Asphalt Branch and Aggregate Section. Mix design shall be prepared by an approved laboratory, to verify the compatibility of the aggregate, asphalt emulsion, mineral filler, and other additives. Perform the mix design with the same materials that will be used on the project.

Ensure the mix design has a residual asphalt content, by dry weight of aggregate, of 7.0 to 8.5 percent for leveling and surface courses and 6.5 to 8.0 percent for rut-filling mixes. Also ensure the mixture contains no reclaimed materials and a mineral filler content between 0.25 and 2.0 percent by dry weight of aggregate.

In addition to the mix design information required by KM 64-421, provide the following (all percentages are based on the dry weight of aggregate):

- minimum and maximum percentage of water; and
- percentage of mix-set additives~~,~~

Provide test results from an accredited laboratory that conform to ASTM D 6372.

For testing and approval purposes, Submit the mix design and two full 5-gallon buckets of the aggregate blend for the mixture to the Division of Materials for verification according to Subsection 402.03 a minimum of four weeks prior to initial use.

The Contractor shall calculate the percent asphalt content of the mixture from the equipment computer display readings randomly, a minimum of 3 times a day. The engineer may request additional calculations of the % asphalt content of the mixture readings. The quality control tolerances from the mix design is ± 0.5%.

413.03.02 Mixture Gradation. Conform to the Type II requirements from ASTM D 6372 for surface courses and Type III requirements from ASTM D 6372 for leveling and rut-fill courses.

413.03.03 Weather Limitations. In addition to the applicable requirements in ASTM D 6372, apply the mixture only when rain is not imminent, and the existing pavement surface temperature is at least 50 °F. The ambient temperature shall be at least 45 °F and rising and no forecasted temperatures shall be below 32 °F within a 24 hour period after placement. Do not place the material between November 1 and May 1.

413.03.04 Surface Preparation.

Before applying mixture, ensure the surface is clean and free from any debris. Remove pavement markers, existing thermoplastic and/or excessive paint markings prior to application.

Prior to application, fill depressions with microsurface material, asphalt material, or other approved material meeting the engineer's specifications.

Contrary to Section 406, apply an approved tack coat material at rate of 0.03 to 0.06 gal/yd^2. Application rate shall be adjusted based on the surface texture and/or porosity. Do not apply tack coat on top of a rut fill or leveling course prior to placing surface course. Apply tack coat only to surfaces that will be covered by the application in the same day.

413.03.05 Calibration. Before mix production, calibrate the mixing equipment in the presence of the Engineer. Generate documentation for the Engineer, including individual calibrations of each material at various settings. Perform a new calibration if there is any change in the mix design. Following calibration and adjustments for changes in the mix design, do not make any further calibration adjustments to the mixing equipment without the Engineer's approval.

413.03.06 Application. Apply the paving mixture in a manner to fill minor surface irregularities and achieve a uniform surface without causing streaking, drag marks, skips, lumps, or tears. Carry a sufficient amount of material in the spreader box at all times to ensure complete and uniform coverage. Avoid overloading the spreader box. Do not allow lumping, balling, or unmixed aggregate in the spreader box.

If a rut-fill course is specified, apply enough material to fill the wheel paths without excess crowning (overfilling). An excess crown is defined as 1/8 in. after 24 hours of traffic compaction. Apply rut-fill courses in widths from 5 to 6 ft for each wheel path. If rut depth exceeds 1.0 inches, apply rut fill course in multiple layers. Provide a smooth, neat seam where two rut-fill passes meet. Restore the design profile of the pavement cross-section. Feather the edges of the rut-fill course to minimize the

use of excess material. Rut fill courses shall not exhibit drag marks or tears greater than 1 inch wide, ½ inch in depth and greater than 12 inches in length. Rut fill courses shall not exhibit excessive flushing or excessive roughness.

If a leveling course is specified, ensure the material covers the entire surface area. The leveling course may exhibit minor raveling upon opening to traffic but shall not exhibit any continued raveling after the first four hours of being opened to traffic. Leveling course shall not exhibit drag marks or tears greater than ½ inch wide, ¼ inch in depth and greater than 12 inches in length. Leveling course shall not exhibit flushing or excessive roughness.

If a leveling course is specified, apply the paving mixture at a dry aggregate rate of 18± 2 lb/yd$^{2.}$ If a surface course is specified over a leveling or rut-fill course, apply the paving mixture at a dry aggregate rate of 18 ± 2 lb/yd^2. If a surface course only is specified, apply the paving mixture at a dry aggregate rate of 24 ± 2 lb/yd^2. For leveling course provide an even layer creating a neat center seam with no overlap where two passes meet. For surface courses, provide a smooth, neat center seam with a maximum overlap of 2 inches where two passes meet.

Construct surface courses wide enough to cover the outside edges of rut-fill and leveling courses. Maintain straight edge lines along curbs and shoulders. Do not allow runoff in these areas. Ensure that lines at the intersections are straight. Immediately remove excess material from the ends of each run.

Use squeegees and lutes to spread the mixture in areas inaccessible to the spreader box and areas requiring hand-spreading. With the Engineer's approval, adjust the mix-set additive to provide a slower setting time if hand-spreading is needed. Do not adjust the water content. If hand-spreading, pour the mixture in a small windrow along one edge of the surface to be covered, and spread it uniformly by a hand squeegee or lute.

Ensure the material cures at a rate that will permit traffic on the pavement within one hour of placement or a period of time specified by the engineer.

If the final surface is not uniform in texture, free from streaks, drag marks, lumps, or tears, stop applying mixture and correct the problem. Do not resume work until the engineer is satisfied the problem has been corrected. If surface correction is necessary, due to traffic, rain, or other causes during construction of the project, repair areas of the surface.

413.03.07 Acceptance and Verification.

A) Proportion and Spread Rate. Maintain continuous control of the emulsified asphalt-to-dry aggregate proportion to conform to the approved mix design within a tolerance of ±2 gal/ton. Ensure the spread rate satisfies the specified quantity of aggregate per square yard on a dry-weight basis.

The Contractor shall calculate the yield of the course being placed from the equipment computer display readings randomly, a minimum of 3 times a day. The

engineer may request additional calculations of the yield of the course being placed. The quality control tolerance from the specified application rate is ± 2 lbs/sy.

The Department will base acceptance of the emulsified asphalt-to-dry aggregate proportion and the spread rate on the Engineer's summary of daily quantities. The Department will accept a day's application of Microsurfacing provided the Engineer's summary indicates conformance with the requirements for proportion and spread rate.

B) Emulsified Asphalt. Submit samples of the polymer-modified emulsion to the Division of Materials for testing at a frequency of one sample per lot.

C) Mixture Gradation. Perform combined-gradation determinations on the aggregates used in the Microsurfacing at a frequency of one per day of production. The Department will allow the tested gradation to vary within the tolerances given in ASTM D 6372 provided the percent passing any sieve remains within the master gradation limits from ASTM D 6372.

The Department will perform combined-gradation determinations on the aggregates used in the Microsurfacing at a frequency of one determination every four days of production and compare those results with the contractor's combined-gradation results according to Subsection 402.03.03.

413.03.08 Documentation. The Contractor shall maintain a daily report including the following information:

- Aggregate used, ton (dry)
- Microsurfacing emulsion used, ton
- Bituminous Materials for Tack Coat, ton
- Cement used, ton
- Water used in mixture, gallons
- Additive used in mixture, gallons

413.03.09 Test Strip Construction. Prior to production application, the Contractor shall place a test section 1,000 ft. in length and one lane wide. The test strip shall demonstrate the mix and set time of the material and the ability to perform under traffic. If handwork will be required on the project, include handwork in the test strip. The test strip shall be placed at the same general time of day as paving is to take place (night or day), and under similar ambient conditions. The test strip shall be able to carry normal traffic within 60 minutes. If normal traffic cannot be carried, the emulsion or mixture must be adjusted and another test strip will be required. Upon approval of the test strip, the Contractor can begin application. Payment will only be made for the first test strip.

413.04 MEASUREMENT. The Department will pay for surface and leveling Microsurfacing courses by the number of square yards, complete and accepted in place. The Department will pay for Microsurfacing rut-fill course by the number of tons of dry aggregate used, complete and accepted in place. The weight of the dry aggregate used will be based on the calibrated weight of aggregate provided by the paving machine. The Department will base the width of the pavement course on the width shown on the plans or as directed by the Engineer. The Department will measure the length along the centerline of each roadway or ramp.

The Department will not measure the surface preparation for payment and will consider it incidental to the Microsurfacing.

The Department will measure asphalt material for tack according to section 109.

413.05 PAYMENT. The Department will consider the unit bid price per square yard to include all labor, materials, and equipment necessary to complete the work. The Department will make payment for the completed and accepted quantities according to the following:

Emulsified Asphalt Price Adjustment Schedule

Test	Specification	100% Pay	90% Pay	80% Pay	50% Pay	0% Pay
CQS-1hP						
Viscosity, 77 º F (SFS) AASHTO T 59	20 - 100	18 - 110	15 - 17 111 - 120	12 – 14 121 - 130	9 - 11 131 - 140	≤8 ≥ 141
Residue Penetration, 77 ˚F AASHTO T 59	40 - 90	37 - 98	34 - 36 99 - 108	31 - 33 109 - 120	28 - 30 121 - 130	≤ 27 ≥ 131
Softening Point, AASHTO T 53	≥ 135	≥ 130	127 - 134	128 - 129	126 - 127	≤ 125
Distillation Residue, % AASHTO T 59, 350˚F	≥ 62.0	≥ 60.0	59.5	59.0	58.5	≤ 58.4
Sieve, % AASHTO T 59	≤ 0.1	≤ 0.3	0.31 – 0.45	0.46 – 0.60	0.61 – 0.75	≥ 0.76
Residue Elastic Recovery @ 50 º F, % AASHTO T 301	≥ 60.0	≥ 58.0	57.0	56.0	55.0	≤ 54.9
Residue Ductility @ 77 ˚ F, cm	≥ 40	≥ 38	37	36	35	≥ 34

Code	**Pay Item**	**Pay Unit**
20814EC, 24957EC, 24958EC	MicroSurfacing-Surface Course – Type	Square Yard
21652EN	MicroSurfacing-Leveling Course	Square Yard
24515EC	MicroSurfacing-Rut Fill Course	Ton
00356	Asphalt Material For Tack	Ton