

## SECTION 401 <sup>3</sup>/<sub>4</sub> ASPHALT 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. The Engineer reserves the right to reduce the size of the batch or rate of production when, in his judgment, the mixer will not operate effectively at the rated capacity. Operate the plant so that it produces a mixture within the specified properties, gradation tolerances, and asphalt binder tolerances.

When plants are in operation, the Department will require the following minimum computer equipment for submission of test data: one computer on the site of operations installed with, and capable of running, the following:

- 1) Microsoft Windows 95; and
- 2) Microsoft Excel, Version 7.0 or greater.

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.

The Engineer will accept a laboratory with a floor space less than 250 square feet if it was previously approved and is determined to be of adequate size.

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 solvent extractions are used for acceptance purposes, provide all additionally needed equipment, according to the applicable KM. 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.

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.

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

- C) Equipment for Handling Asphalt Binders.** Provide tanks for storage of asphalt binders equipped for heating the material to the temperature required in Subsection 401.03.01. 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 pugmill. 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 to prevent oversized material and to separate all aggregates so they may be recombined consistently within the specification limits for the asphalt mixture being produced.

- G) Bins.** Provide the plant, except for drum-mix plants, 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 audible 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. Equip continuous plants with an actuating device that prevents material from being drawn from all compartments when material is low in any one compartment.

- 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  $\pm 1.0$  percent when tested for accuracy. 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 and continuous mixing plants, calibrate the asphalt binder delivery system and metering device 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 recording and 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 recording and 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  $\pm 15$  °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 approved material 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 other approved types of scales for any 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.

Have the component batching scales 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 provide 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 401.02.05 A) and B).

- C) Bins.** For batch plants equipped with aggregate weighing devices 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 application of asphalt binder and the opening of the mixer gate.)

**401.02.03 Special Requirements for Automatic Batching.** Provide the systems 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 interrupt and stop the automatic cycling of the batching operations whenever the quantity of any ingredient falls outside the tolerance specified below:

<b>BATCH TOLERANCES</b>	
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.

When the automatic proportioning system becomes inoperative, the Engineer may allow the plant to operate semi-automatically until repairs can reasonably be expected to be made, provided the asphalt mixtures produced conform to specifications. The Department will not allow the plant to operate in this manner for more than 3 working days.

**401.02.04 Special Requirements for Continuous Plants.**

**A) Gradation Control Unit.** Provide a means to check the proportioning of each bin size of aggregate by weight.

Mount interlocked feeders under the bin compartments. Equip the interlocked feeders with a dust-proof revolution counter with maximum graduations of 0.1 of a revolution. Set the bin proportions based on pounds of each aggregate size per revolution.

Provide each bin with a feeder mechanism capable of controlling the rate of flow of aggregate from each bin. If a gate orifice feeder is used, ensure that it has at least one adjustable dimension. Provide calibrated gages with graduations of no more than 0.1 inch for each gate to establish the gate openings.

When using mineral filler, furnish a separate bin and feeder with its drive interlocked with the aggregate feeders.

**B) Weight Calibration of Asphalt Binder and Aggregate Feed.** Calibrate the gate openings and asphalt materials flow by means of test samples in pounds per revolution.

Use individual orifices to bypass the aggregate feed out of the bins into

suitable test boxes. Confine each individual material in individual test receptacles or compartments.

Supply accessories so the aggregate in each compartment may be weighed separately.

When equipped with aggregate weighing devices (belt scales), calibrate each cold feeder, along with the aggregate weighing devices, according to Subsection 401.02.05 A) and B).

- C) **Synchronization of Aggregate and Asphalt Binder Feed.** Provide positive interlocking or mechanical control between the flow of aggregate through the gates and the flow of asphalt binder through the proportioning device. Check the rate of flow of the asphalt binder by the scale weight per revolution.
- D) **Mixer Unit for Continuous Method.** Provide a continuous mixer of an approved twin pugmill type.

Provide paddles that are adjustable for angular position on the shafts and reversible to retard the flow of the mix.

Equip the hopper with dump gates that allow rapid and complete discharge of the asphalt mixture.

#### 401.02.05 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 the metering devices are accurate to within  $\pm 0.5$  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.

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 each cold feeder, along with the aggregate weigh bridge(s), 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 D).

- 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, there is a failure of the automatic electronic weighing system of the aggregate feed or the asphalt binder feed control occurs. Do not manually operate the proportioning controls.

**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.

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

<b>MIXING AND LAYING TEMPERATURES (°F)</b>			
Material		Minimum	Maximum
Aggregates		240	330
Aggregates used with Recycled Asphalt Pavement (RAP)		240	—
Asphalt Binders	PG 58-22 and PG 64-22	230	330
	PG 70-22	285	350
	PG 76-22	285	350
Asphalt Mixture at Plant (Measured in Truck)	PG 58-22 and PG 64-22	250	330
	PG 70-22	300	350
	PG 76-22	310	350
Asphalt Mixture at Project (Measured in Truck When Discharging)	PG 58-22 and PG 64-22	230	330
	PG 70-22	275	350
	PG 76-22	300	350

Maintain the temperature of the mixture at the plant to within  $\pm 15$  °F of the approved mixing temperature. The Engineer may accept batches outside this tolerance if they are within the temperature requirements listed in the above table.

**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 lengths of time as the dry-mixing time and asphalt binder introduction time.

- B) Continuous Plants.** Mix the aggregates and asphalt binder to produce a well coated mixture.
- C) 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.
- D) 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, maintain near full to provide a non-oxidizing condition. Maintain mixture temperatures to within those specified for Asphalt Mixtures at Plant according to Subsection 401.03 or 404.03 as applicable.

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 <sup>3</sup>/<sub>4</sub> CONTROL AND ACCEPTANCE OF ASPHALT MIXTURES

**402.01 DESCRIPTION.** Provide the process control and acceptance testing of all classes and types of asphalt mixtures.

### **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, and acceptance testing at the plant site.

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 Engineer of the intent to start a minimum of 36 hours before beginning production of each type of mixture. Furnish the facilities, equipment, personnel and all other resources needed to comply with KM 64-435 and KM 64-426. Provide a Quality Control Plan (QCP) and complete the setup duties of KM 64-421. Upon completing setup, prepare 2 duplicate maximum specific gravity ( $G_{mm}$ ) samples according to KM 64-411, and furnish them to the Engineer before the start of the second day of production. 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 Acceptance.**

- A) **General.** The Department will accept asphalt mixtures from the plant on a lot basis. A lot is 4,000 tons. A subplot is 1,000 tons. Monitor and evaluate the AC, air voids (AV), voids-in-mineral aggregate (VMA), density, and gradation. Document and report all acceptance tests 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. Excluding the first subplot of production, obtain all samples according to the random sampling procedures of KM 64-113. Randomly determine when to obtain the acceptance samples, and take one sample for each subplot. At the beginning of each production day, do not take any acceptance 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 subplot of production. Within the first 4 hours of project production or by the end of the first subplot, test to document that the mixture meets a 0.90 minimum pay value for AC, AV, and VMA. For mixtures with a total-project quantity between 500 and 1000 tons, perform a minimum of

one process control test for AC, AV, and VMA, 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 a copy of the random number chart established for the entire tonnages for the mixture specified. Develop the rolling pattern during the first subplot. When necessary during setup, adjust the AC up to  $\pm 0.3$  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.

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

- 1) AC. Perform one evaluation corresponding to each AV/VMA analysis per subplot. Test according to KM 64-405, KM 64-436, KM 64-437, KM 64-438, or AASHTO T 308.
- 2) AV. Prepare and analyze one set of 2 specimens per subplot. Test according to KM 64-435.
- 3) VMA. Analyze the set of 2 specimens corresponding to each AV analysis per subplot. Test according to KM 64-435.
- 4) Density. The Contract will state the compaction option to be used.

*Option A (Mainline Cores).* Furnish 4 cores per subplot to the nearest laboratory facility (Contractor or Department lab) for density determination by the Engineer. 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 3 inches to the pavement edge or joint.

*Option A (Joint Cores).* Furnish 2 cores per subplot to the nearest laboratory facility (Contractor or Department lab) for density determination by the Engineer. 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  $3.0 \pm 0.5$  inches of the longitudinal joint.

*Option A (All Cores).* The Department will not mark the core locations until compaction is complete. Obtain cores by the end of the following work day. Replace all cores the Engineer deems damaged. When directed by the Engineer, saw cores to the thickness actually placed. Fill each core hole with compacted asphalt mixture or non-shrink grout within 3 working days.

The Department will determine the density from the furnished cores according to KM 64-442. The Department will base values on the percent of solid density for that subplot's  $G_{mm}$  value. The Department will evaluate values regularly exceeding 95 percent to determine if the  $G_{mm}$  or target density values are invalid.

*Option B.* The Department will not require any cores.

- 5) Gradation. Control according to KM 64-407, KM 64-433, or KM 64-620 as needed.

Use the same field sample for tests 1) through 3). Use the same specimens for tests 2) and 3). Retain the AV/VMA specimens and one additional corresponding  $G_{mm}$  sample for 5 working days for verification testing by the Department. For Specialty Mixtures, retain a mixture sample for 5 working days for verification testing by the Department.

**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 acceptance testing.
- 2) Placed Separately. Perform tests 1), 2), and 3) of Part D) above.

**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 subplot. 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 RAP.** Furnish the grade of asphalt binder determined according to KM 64-427. Furnish a RAP sample and a minimum of 3 representative extracted gradation and determinations with the mixture design submittal. Perform one AC determination during setup. After setup, perform and document an AC determination and gradation for every 2 lots of mixture supplied.

**H) Unsatisfactory Work.**

- 1) Based on Lab Data. After the setup period, when the Contractor or Department determines any individual subplot pay value would be below 0.90 for AC or AV in any QC or QA test, make adjustments and immediately run tests again. If the second round of tests determines any individual subplot pay value would have been below 0.90 for AC or AV, 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 the Contractor or Department determines that the VMA is 1.1 to 1.5 percent below the specified minimum value from AASHTO MP2 for the nominal-maximum size of mixture in any QC or QA test, make adjustments and immediately run tests again. If the second round of tests determines that the VMA is again 1.1 to 1.5 percent below the specified minimum value from AASHTO MP2, cease all shipments to the project. Also, when the Contractor or Department determines that the VMA is more than 1.5 percent below the specified minimum value from AASHTO MP2 in any QC or QA test, cease all shipments to the project. Adjust procedures or mixture composition until they are acceptable. Document acceptable results and work before restarting operations.

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 402.03.04.

- 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 subplot 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 any property of the core is within the following thresholds, regardless of the subplot acceptance test results:

PROPERTY	THRESHOLD
AC	$\geq \pm 0.9\%$ deviation from JMF

Density	$\leq 89.0\%$ or $\geq 97.5\%$
---------	--------------------------------

**402.03.03 Verification.** For volumetric properties, the Department will perform a minimum of one verification test for AC, AV, and VMA for each lot according to the corresponding procedures as given in Subsection 402.03.02. 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 Department will obtain an independent sample at the same time the Contractor is obtaining the random sample. The Department may perform the verification test on the Contractor's equipment or on the Department's equipment. Provided the differences are within the tolerances listed below and the results compare favorably with the other sublots' results, 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 sublots. The Department's results will be used in the computation of the appropriate Lot Pay Adjustment. In the event that the Contractor's retained samples are not available, the Contractor shall provide additional samples, at his expense, as directed by the Engineer, to determine the acceptability of the lot in question.

COMPARISON OF DEPARTMENT AND CONTRACTOR TESTING	
Test	Tolerance (%)
AC	$\pm 0.5$
AV and VMA	$\pm 1.0$ (same equipment) $\pm 1.5$ (different equipment)
1/2 inch and larger	$\pm 5$
3/8 inch, No. 4, No. 8, and No. 16	$\pm 4$
No. 30, No. 50, and No. 100	$\pm 3$
No. 200	$\pm 2$

The Department will monitor the test results of the acceptance testing for each subplot 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 402.03.04.

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

**402.03.04 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 indented rumble strips for payment and will consider it 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 AASHTO T 84 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.

If the Engineer deems it necessary to check the thickness of the overlaid area by coring, the Department will deduct the cost of this additional coring from monies due, or to become due, the Contractor when deficient thickness is found.

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

## **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 subplot and average the subplot pay values to determine the pay value for each lot.

**402.05.02 Asphalt Mixtures and Mixtures With RAP.** 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 subplot and average the subplot pay values to determine the pay value for a given property for each lot.

- A) **First Sublot (Setup).** When the Engineer determines the first subplot's individual pay values are 0.90 or greater, the Department will use 1.00 pay values for all properties in the subplot. When the Engineer determines any of the first subplot'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 subplot 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 subplot 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 subplot, the Department will calculate payment for these properties using the test results from the previous subplot.
  - When the final subplot 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 subplot.
- C) **Conventional and RAP Mixtures Placed on Shoulders.**
  - 1) Placed Monolithically With The Mainline – The Department will pay as mainline mixture but use 1.00 for the Lane and Joint Density Pay Value for shoulder quantities.
  - 2) Placed Separately. The Department will use 1.00 for the Density Pay Value.
- D) **Conventional and RAP Mixtures Placed Monolithically as Asphalt Pavement Wedge.** The Department will pay as mainline mixture but use a 1.00 pay value for all properties.
- E) **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
	0.90	---
	0.85	3.5
	0.75	≥ 4.0
Fineness Modulus	1.00	0.0-0.30
	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 = (Unit Price) (Quantity) {[0.10 (AC Pay Value) + 0.25 (AV Pay Value) + 0.25 (VMA Pay Value) + 0.40 (Lane Density Pay Value)] - 1.00}

<b>WEIGHTED VALUES</b>				
	AC	AV	VMA	Lane Density
Weight (%)	10	25	25	40

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

<b>VMA</b>	
Pay Value	Deviation From Minimum
1.03	≥ min. VMA
1.00	0.1-0.5 below min.
0.95	0.6-1.0 below min.
0.90 <sup>(2)</sup>	1.1-1.5 below min.
<sup>(1)(2)</sup>	> 1.5 below min.

<b>AV</b>		
Pay Value	Test Result (%)	
	ESAL Class 1 or 2	ESAL Class 3 or 4
1.05	3.5-4.5	3.5-4.5
1.00 + 0.1 (AV-3.0)	1.5-3.4	2.0-3.4
1.00 + 0.1 (5.0-AV)	4.6-6.0	4.6-6.0
0.75	6.1-6.5	----
<sup>(1)</sup>	< 1.5 or > 6.5	< 2.0 or > 6.0

<b>LANE DENSITY</b>		
Pay Value	Test Result (%)	
	ESAL Class 1 or 2	ESAL Class 3 or 4
1.05	94.0-96.0	94.0-96.0
1.00	92.0-93.9	92.0-93.9
0.95	91.0-91.9 or 96.1-96.5	91.0-91.9 or 96.1-96.5
0.90	90.0-90.9 or 96.6-97.0	90.0-90.9 or 96.6-97.0
0.85	97.1-98.5	----
0.75	89.0-89.9	----
<sup>(1)</sup>	< 89.0 or > 98.5	< 90.0 or > 97.0



**LOT PAY ADJUSTMENT SCHEDULE  
COMPACTION OPTION A SURFACE MIXTURES**

Lot Pay Adjustment = (Unit Price) (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
<sup>(1)</sup>	≥ ± 0.8

VMA	
Pay Value	Deviation From Minimum
1.03	≥ min. VMA
1.00	0.1-0.5 below min.
0.95	0.6-1.0 below min.
0.90 <sup>(2)</sup>	1.1-1.5 below min.
<sup>(1)(2)</sup>	> 1.5 below min.

AV		
Pay Value	Test Result (%)	
	ESAL Class 1 or 2	ESAL Class 3 or 4
1.05	3.5-4.5	3.5-4.5
1.00 + 0.1 (AV-3.0)	1.5-3.4	2.0-3.4
1.00 + 0.1 (5.0-AV)	4.6-6.0	4.6-6.0
0.75	6.1-6.5	----
<sup>(1)</sup>	< 1.5 or > 6.5	< 2.0 or > 6.0

LANE DENSITY		
Pay Value	Test Result (%)	
	ESAL Class 1 or 2	ESAL Class 3 or 4
1.05	94.0-96.0	94.0-96.0
1.00	92.0-93.9	92.0-93.9
0.95	91.0-91.9 or 96.1-96.5	91.0-91.9 or 96.1-96.5
0.90	90.0-90.9 or 96.6-97.0	90.0-90.9 or 96.6-97.0
0.85	97.1-98.5	----
0.75	89.0-89.9	----
<sup>(1)</sup>	< 89.0 or > 98.5	< 90.0 or > 97.0

JOINT DENSITY	
Pay Value	Test Result (%)
1.05	91.0-96.0
1.00	89.0-90.9
0.95	88.0-88.9 or 96.1-96.5
0.90	87.0-87.9 or 96.6-97.0
0.75	< 87.0 or > 97.0

<sup>(1)</sup> 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 subplot, 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.

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, acceptance, 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 ESAL Class 1 or 2 mixtures; and
- 0.90 or greater for AV for ESAL Class 3 or 4 mixtures.

The Department will also identify the most recent succeeding test (process control, acceptance, 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 subplot are as follows:

- less than 89.0 percent, or greater than 98.5 percent, of solid density for ESAL Class 1 or 2; or
- less than 90.0 percent, or greater than 97.0 percent, of solid density for ESAL Class 3 or 4.

The Department will require removal and replacement of the entire subplot 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 unit bid price for the asphalt mixture in question.

<sup>(2)</sup> See Subsection 402.03.02 H) for appropriate action.

**LOT PAY ADJUSTMENT SCHEDULE  
COMPACTION OPTION B MIXTURES**

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

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
<sup>(3)</sup>	≥ ± 0.8

VMA	
Pay Value	Deviation From Minimum
1.03	≥ min. VMA
1.00	0.1-0.5 below min.
0.95	0.6-1.0 below min.
0.90 <sup>(2)</sup>	1.1-1.5 below min.
<sup>(2) (3)</sup>	> 1.5 below min.

AV		
Pay Value	Test Result (%)	
	ESAL Class 1 or 2	ESAL Class 3 or 4
1.05	3.5-4.5	3.5-4.5
1.00 + 0.1 (AV-3.0)	1.5-3.4	2.0-3.4
1.00 + 0.1 (5.0-AV)	4.6-6.0	4.6-6.0
0.75	6.1-6.5	----
<sup>(3)</sup>	< 1.5 or > 6.5	< 2.0 or > 6.0

<sup>(2)</sup> See Subsection 402.03.02 H) for appropriate action.

<sup>(3)</sup> 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 subplot, 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, acceptance, 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 ESAL Class 1 or 2 mixtures; and
- 0.90 or greater for AV for ESAL Class 3 or 4 mixtures.

The Department will also identify the most recent succeeding test (process control, acceptance, 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 unit bid price for the asphalt mixture in question.

## **SECTION 403 <sup>3</sup>/<sub>4</sub> 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.

Construct one or more courses of asphalt mixture on the prepared foundation according to these Specifications and the specific 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. 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  $\pm 0.1$  percent; and
- 6) automatic feeder controls that properly adjust to maintain a uniform depth of material ahead of the screed.

**403.02.08 Rollers.** Provide self-propelled rollers that are capable of reversing smoothly. Equip steel-wheel rollers with adjustable scrapers 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.

### **403.03 CONSTRUCTION.**

**403.03.01 Seasonal and Weather Limitations.** 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 Engineer's written permission. Additionally, 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
Asphalt Mixture, Surface (one inch thick or less)	45
Asphalt Mixture, Surface (thicker than one inch)	40
Asphalt Mixture, Base and Binder	35
Leveling and Wedging	45
Asphalt Mixture for Pavement Wedge	40
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 710.05.

Only when the Engineer directs, adjust manholes according to Section 710. 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 ESAL class, provide a mixture of no more than one ESAL class higher than the specified asphalt mixture. Conform to the gradation requirements (control points) of AASHTO MP2 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.
- 2) Type B. 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.
  - 30 percent or more of the total combined aggregate is a combination of Class A and Class B polish-resistant fine aggregate.
- 3) Type C. Ensure that 40 percent or more of the total combined aggregate is polish-resistant; Class A coarse, Class A fine, or combination.
  - 4) Type D. No restriction on aggregate type.

**B) Moisture Content of Mix.** Determine the moisture content of the coated mixture according to KM 64-434. 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. The Engineer will determine the frequency of moisture content testing.

C) **Mix Design Criteria.** Conform to the gradation requirements (control points) of AASHTO MP2 for the Superpave mixture type the Contract specifies.

- 1) Preliminary Mix Design. Submit a preliminary mix design, completed using a Superpave gyratory compactor (SGC) conforming to AASHTO PP 35. Perform the volumetric mix design according to AASHTO PP28 and conforming to AASHTO MP2. The Department will require a dust-to-binder ratio range of 0.8 to 1.6. Complete the volumetric mix design at the appropriate number of gyrations as given in AASHTO PP28 for the number of ESAL's. The Department will define the relationship between ESAL classes, as given in the bid items for Superpave mixtures, and ESAL ranges as follows:

Class	ESAL's (millions)
1	< 0.3
2	0.3 to < 3.0
3	3.0 to < 30.0
4	≥ 30.0

- 2) Selection of Optimum AC. Normally, the Department will approve the AC at an air-void content of 4.0 percent. The Engineer may assign an AC corresponding to other air-void levels as deemed appropriate. Ensure the optimum AC is a minimum of 5.0 percent by weight of the total mixture for all 0.5-inch nominal surface mixtures and 5.3 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 SGC, and a target degree of saturation of the conditioned specimens of 65 ± 5 percent.

**403.03.04 Transporting Material.** 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.

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.

**403.03.06 Thickness Tolerances.** Place asphalt mixtures at the lift thickness specified in the Contract. The Engineer may allow the base lifts to be adjusted to improve rideability provided the total base thickness remains the same.

- 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.** The Engineer will make thickness checks according to KM 64-420, as soon as practical after completion of all, or a major portion, of the asphalt base. When desired, supply the personnel and equipment, and core according to KM 64-420 under the Engineer's supervision. 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  $\pm 1/2$  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 or sand asphalt surface, consider all asphalt mixtures beneath that course as asphalt base for the purpose of determining compliance with thickness tolerances specified hereinafter.

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 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. 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.

#### **403.03.08 Rumble Strips.**

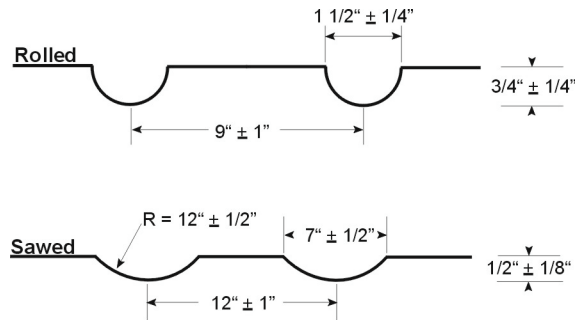
**A) Interstates and Parkways.** Construct sawed rumble strips on all mainline and ramp shoulders to the dimensions shown below.

**B) Other Roads.** When using a surface mixture instead of Asphalt Mixture for Pavement Wedge, or when the Engineer deems it appropriate to pave the driving lanes and the adjacent shoulder monolithically, provide rolled rumble strips. Construct strips on all mainline shoulders to the dimensions shown below. When furnishing Asphalt Mixture for Pavement Wedge, binder, or a base mixture for shoulders, the Department will not require rumble strips.

Time the rolling operation so indentations are at the specified size and depth without causing unacceptable displacement of the asphalt mat. Correct unacceptable rolled-in rumble strips by sawing.

On shoulders less than 3 feet, shorten the length and distance of the strips as the Engineer directs.

Provided the shoulder is thick enough, the Department may allow sawed rumble strips in place of rolled rumble strips. Obtain the Engineer's permission before making the substitution.



Distance from the edge of the mainline pavement to the end of the strip: 1 foot  
 Length of strips: Rolled 2 feet, Sawed 16 inches

#### 403.03.09 Leveling and Wedging, and Scratch Course.

- A) **Leveling and Wedging.** Conform to the gradation requirements (control points) for base, binder, or surface as applicable. 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 provided for 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 either a binder mixture or a surface mixture, or both.

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) 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. When the compaction option is not specified, compact by Option B.

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 with the specified mixture requirements.

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.

To prevent adhesion of the material to the roller wheels, 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 subplot.
- 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, use a pneumatic-tired roller. 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  $\pm 5$  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 the pneumatic-tired roller for 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. 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.

When using a 3-wheel roller, roll as directed. Do not use a 3-wheel roller to roll over a crown or over a warped section when the center axle is in the locked position.

The Engineer may allow a different rolling pattern. Submit the alternate rolling pattern for approval. Provide any demonstration or testing the Engineer requires. Obtain written approval from the Engineer before continuing with the alternate pattern.

**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.

#### **403.04 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. The Department will not measure rumble strips 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.

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

**403.05.01 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.

**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.

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
6600	Remove Pavement Marker Type V	Each
1791	Adjust Manhole Frame to Grade	Each

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

## **SECTION 404 <sup>3</sup>/<sub>4</sub> 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 not included in the Polish-Resistant Aggregate Sources section of the Department's List of Approved Materials 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 806.

**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.** In addition to the weather limitations specified in Subsection 403.03.01, do not place OGFC between September 15 and May 1, without obtaining the Engineer's written permission.

**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, RS-1, 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 70-22	285	350
	PG 76-22	285	350
Asphalt Mixtures at Plant (Measured in Truck)	PG 64-22	230	265
	PG 70-22	265	310
	PG 76-22	275	320
Asphalt Mixtures at Project (Measured in Truck When Discharging)	PG 64-22	175	265
	PG 70-22	230	310
	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 with a steel-wheel, 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 high side of the JMF, the Engineer will evaluate each occurrence and determine if it is detrimental to the pavement performance and whether the mixture is acceptable at no deduction, at some deduction, or must be removed and replaced.

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:

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
0266-0268	Asphalt Surface, Open-Graded, Grade	Ton

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

## SECTION 405 <sup>3</sup>/<sub>4</sub> 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 the type and grade specified in the Contract 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 406.02.04.

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

Provide an aggregate spreader of an approved type 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 within the following temperature ranges during application:

RS-1	70 - 140 °F
RS-2, CRS-2, HFRS-2	125 - 175 °F

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 uniform any streaked areas 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. 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:

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
----	Asphalt Material for Asphalt Seal Coat	Ton
0100	Asphalt Seal Aggregate	Ton

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

## SECTION 406 <sup>3</sup>/<sub>4</sub> ASPHALT CURING SEAL AND ASPHALT PRIME AND TACK COATS

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

### **406.02 MATERIALS AND EQUIPMENT.**

**406.02.01 Tack Coat.** Furnish any of the following asphalt materials conforming to Section 806: SS-1, SS-1h, or RS-1.

**406.02.02 Prime Coat.** Furnish Primer-L conforming to Section 806 unless the Contract allows another material.

**406.02.03 Curing Seal.** Furnish any of the following asphalt materials conforming to Section 806: RS-1, RS-2, SS-1, SS-1h, or Primer L.

**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.** Have 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 brick pavements and bases, 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:

Primer-L	60-120 °F
SS-1, SS-1h	70-160 °F
RS-1, 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 a spray bar, then apply the tack coat by fogging with a hand spray attachment. The Engineer will only accept complete and uniform coverage. Unless otherwise specified in the requirements for the asphalt mixture being placed, apply tack at a rate to achieve an undiluted residue of 0.4 pounds (0.05 gallons) per square yard.

When furnishing RS-1 for tack, apply it undiluted.

When furnishing SS-1 or SS-1h for tack, the Department will allow diluted or undiluted application provided uniform and complete coverage is achieved. When applying tack in a diluted form, apply it a sufficient time in advance to ensure that all water has evaporated before placing the asphalt mixture.

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.

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 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 mat 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 2.0 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 Cutback Asphalt Emulsion Primer-L.** 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 not measure tack for payment and will consider it incidental to the asphalt courses.

**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:

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
0296	Primer-L	Ton
0358	Asphalt Curing Seal	Ton
2702	Sand for Blotter	Ton

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

## SECTION 407 <sup>3</sup>/<sub>4</sub> ASPHALT MIXTURE FOR PAVEMENT WEDGE

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

**407.02 MATERIALS AND EQUIPMENT.**

**407.02.01 Asphalt Binder.** Furnish either PG 58-22 or 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:

<u>Sieve Size</u>	<u>Percent Passing</u>
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 AC 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:

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
0263	Asphalt Mixture for Pavement Wedge	Ton

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



## **SECTION 408 <sup>3</sup>/<sub>4</sub> 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.

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 to 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.

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
2677	Asphalt Pavement Milling and Texturing	Ton
2676	Mobilization for Milling and Texturing	Lump Sum
1709, 1719 1791, 1792	Adjusting Small Drainage Structures, Type, Size	See Subsection 710.05
1791	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 asphalt mixtures, provided mixture requirements are satisfied. For other sources to be approved, satisfactorily establish to the Engineer that the quality of the material is acceptable.

**409.02 MATERIALS AND EQUIPMENT.** Conform to the guidelines in Subsection 409.03.02 for the required grade of asphalt binder which is based on the percentage of RAP in the mixture.

**409.03 CONSTRUCTION.** Keep RAP of different gradation, asphalt binder percentage, 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 material remain uniform.

**409.03.01 Restrictions.** Do not use reclaimed materials in open-graded friction courses.

Before using RAP in asphalt mixtures requiring polish-resistant aggregate, provide documentation to the Engineer's satisfaction that the reclaimed material consists of a given portion of polish-resistant aggregate.

When the mixture's bid item specifies PG 76-22, limit RAP content to 20 percent or less.

### 409.03.02 Preparation of Mixture.

- A) **Mix Requirements.** Conform to the Contract requirements for each mixture produced using RAP. If mixtures produced using RAP do not conform to the requirements for that mixture, complete the project using all virgin materials at no additional expense to the Department. Conform to the following table to select the appropriate grade of virgin asphalt binder to blend with the RAP:

Mixture's Bid Item	Appropriate Virgin Asphalt Binder		
	0-20% RAP	21-30% RAP	>30% RAP
PG 76-22	PG 76-22	-	-
PG 70-22	PG 70-22	PG 64-22	*
PG 64-22	PG 64-22	PG 64-22	*

\*Select according to KM 64-427.

- B) **JMF.** Develop the JMF, and submit it according to KM 64-421 to the Department for approval according to KM 64-427.
- C) **Mixing.** Obtain the Engineer's approval for the method of incorporating RAP 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.

The Engineer may require a longer mixing time for the new aggregate and reclaimed material, before and after the addition of virgin asphalt binder, than is normally specified.

**409.04 MEASUREMENT.** The Department will not measure RAP 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 RAP. 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 <sup>3</sup>/<sub>4</sub> ASPHALT PAVEMENT RIDE QUALITY

**410.01 DESCRIPTION.** This section covers the requirements for the ride quality of completed asphalt pavements. Included are provisions for incentive payments for outstanding work and deductions for acceptable, but lesser quality, work. Ride quality is a measurement of surface tolerance in terms of a 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 Lift Thickness.** When the Engineer approves, the thickness of individual lifts of asphalt base may be adjusted to improve ride quality. Conform to Subsection 403.03.06.

**410.03.02 Corrective Work.** Submit corrective work procedure plans to the Engineer for approval before performing the work. Provide a final surface comparable to adjacent pavement that does not require corrective work in respect to texture, appearance, and skid resistance.

#### **410.03.03 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;
  - 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 one-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 one 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 it before the OGFC is placed and, when deemed necessary, after it is placed.

#### **B) Requirements.**

- 1) **Roads Posted Over 45 MPH.** Achieve an IRI of 76 or lower for each one-mile section. When the IRI is greater than 76, perform corrective work, or remove and replace the pavement to achieve the specified IRI. The Department's testing generates a computer file containing the measured longitudinal profile in terms of elevation values of each wheel track at 6-inch intervals. The Department will create a strip chart from the file showing the elevation and distance traveled when the IRI is greater than 66 or upon

- request for lower IRI values.
- 2) Roads Posted Below 45 MPH. Achieve an IRI of 85 or lower for each one-mile section. When the IRI is greater than 85, perform corrective work, or remove and replace the pavement to achieve the specified IRI. The Department's testing generates a computer file containing the measured longitudinal profile in terms of elevation values of each wheel track at 6-inch intervals. The Department will create a strip chart from the file showing the elevation and distance traveled when the IRI is greater than 85 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 one-mile section tested. The Department will calculate the Ride Quality Adjustments by multiplying the asphalt surface mixture payment for each one-mile test section by its appropriate ride quality pay value found in the Ride Quality Adjustment Schedule below.

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 \$150.00 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 SCHEDULE  
FOR ROADS POSTED GREATER THAN 45 MPH**

<u>IRI</u>	<u>Pay Value Adjustment<sup>(1)</sup></u>
36 or lower	+0.15
37 to 46	= 0.015 x (47-IRI)
47 to 66	0.00
67 to 76	= 0.015 x (67-IRI)
77 or higher	Corrective work or replacement required

**RIDE QUALITY ADJUSTMENT SCHEDULE  
FOR ROADS POSTED 45 MPH OR LESS**

<u>IRI</u>	<u>Pay Value Adjustment<sup>(1)</sup></u>
36 or lower	+0.15
37 to 46	= 0.015 x (47-IRI)
47 to 85	0.00
86 or higher	Corrective work or replacement required

<sup>(1)</sup> The Department will not apply a positive pay value for corrective work other than removal and replacement to achieve the IRI.

## SECTION 411 <sup>3</sup>/<sub>4</sub> 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, SS-1h, or RS-1. 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:

<u>Sieve Size</u>	<u>Percent Passing</u>
1/2 inch	100
No. 4	60-80
No. 8	45-65
No. 16	13-25
No. 200	6-12

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 AC approval according to KM 64-421. Maintain the approved AC within  $\pm 0.5$  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 do 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:

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
1897	Asphalt Wedge Curb	Linear Foot
1935-1950	Mountable Median, Type	Square Yard

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