

PART C ASPHALT CONSTRUCTION

SECTION 320 ASPHALT CONCRETE, GENERAL

320.1 DESCRIPTION

These requirements are applicable to all types of hot mixed asphalt pavements irrespective of class, type, asphalt material, or pavement use. Exceptions to the general requirements are in the specified requirements for each class.

The work consists of one or more courses of asphalt mixture constructed on a prepared foundation.

320.2 MATERIALS

- A. Composition of Mixtures:** The asphalt concrete shall be composed of a mixture of aggregate and asphalt. The several aggregate fractions shall be combined in such proportions that the resulting mixture meets the requirements of the job mix formula.

The operation of the plant shall not commence until the Engineer has established, in writing, a job mix formula meeting the **specifications and the** criteria for the class of asphalt concrete specified. The mixture shall conform within the range of tolerances established by the job mix formula for that class of asphalt concrete.

Should a change in sources of materials be proposed or when unsatisfactory results are obtained a new job mix formula shall be established.

- B. Aggregates:** Aggregates shall conform to Section 880.
- C. Asphalt:** Asphalt shall conform to Section 890.
- D. Shoulder Joint Sealant:** Joint sealant shall conform to Section 870.
- E. Granular Additives:** Granular additives (rock, filler, sand) shall conform to **Section 880.2 B or as otherwise specified**. Rock for mineral aggregate shall not be manufactured from material rejected or separated during the production of the mineral aggregate. If the Contractor elects to use the plans designated pit(s) for the production of the rock additive, he shall obtain his own option and pay all costs including royalty on rock and reject material.
- F. Hydrated Lime:** Hydrated lime shall conform to Section 760.

320.3 CONSTRUCTION REQUIREMENTS

- A. Weather and Seasonal Limitations:** Asphalt concrete shall not be placed when the underlying surface is wet or frozen. Asphalt concrete shall not be placed when weather conditions prevent proper handling, compaction, or finishing. The temperature and seasonal limitations are as follows:

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Minimum Air Temperatures & Seasonal Limitations (English)

Compacted Thickness	Surface Course		Subsurface Course & Shoulder Courses	
	Min. Temp	Seasonal Limits	Min. Temp	Seasonal
1" or less	45EF	May 1 to Oct 15 (incl)	45EF	None
over 1"	40EF	May 1 to Oct 15 (incl)	40EF	None

Minimum Air Temperatures & Seasonal Limitations (Metric)

Compacted Thickness	Surface Course		Subsurface Course & Shoulder Courses	
	Min. Temp.	Seasonal Limits	Min. Temp	Seasonal
25 mm or less	7EC	May 1 to Oct 15 (incl)	7EC	None
over 25 mm	4EC	May 1 to Oct 15 (incl)	4EC	None

For Class S asphalt concrete the following seasonal restrictions shall apply:

Construction will be permitted only between June 1 and September 15, inclusive, and when the air and surface temperatures are 60EF (16EC) or greater in the shade.

B. Equipment:

- 1. Requirements for All Plants:** The central plant for mixing the mineral aggregate and asphalt may be a batch, continuous, or drum mix type mixing plant.

Batch or continuous type shall have at least two storage bins, protected from the weather with sufficient capacity to furnish the quantity of mineral aggregate materials necessary to operate at the calibrated capacity of the plant. The bin capacity shall be proportioned to insure adequate storage of the hot, dried, and screened mineral aggregate. Each compartment shall have an overflow pipe that prevents diversion of material into other compartments. Vibrators shall be provided to prevent bridging or arching of the bin contents. Adequate and convenient facilities shall be provided to obtain representative aggregate samples from each bin.

When mineral filler, rock, sand, or hydrated lime additive is required, a separate bin and feed system shall be provided to store and accurately and uniformly proportion the required quantity into the mixture. All cold feed bins shall be equipped with

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dividers to prevent overflow of aggregate to adjacent bins.

The central mixing plant shall be equipped with a dust collector capable of eliminating or conserving the dust necessary to meet gradation limits and environmental standards.

The central mixing plant shall be equipped with a dryer or driers which continuously agitate the mineral aggregate during the heating and drying process. The driers shall be capable of preparing aggregates in sufficient quantity that the plant may operate at the calibrated capacity.

Burner fuel used for production of asphalt concrete shall be propane, butane, natural gas, and No. 1 or No. 2 fuel oils. **Number five burner fuel may only be used providing the number five burner fuel is properly preheated and efficiently burned.**

A pyrometer or other thermometric instrument shall be installed in the supply line between the storage tank and the discharge point in the plant to accurately measure the temperature of the asphalt. The mixing plant shall not operate unless the thermometric instruments are installed and working properly.

The plant shall be equipped with accurate weighing or volumetric measurement devices. The devices shall permit easy readjustment of any working part that gets out of adjustment.

Asphalt storage tanks shall be kept level. Accurate calibration charts which show the quantity of material contained in a tank at each one inch (25 mm) increment of depth and a suitable device to measure the depth of the material, shall be provided. Storage tanks shall uniformly heat the material, under effective and positive control, to the required temperature. Heating shall be accomplished by steam coils, electricity, or burners, provided the flame does not come in direct contact with the heating tank. The asphalt circulating system shall be of adequate size to insure proper and continuous circulation during the entire operating period.

The Engineer may require that an acceptable silicone be added to the asphalt cement in storage at the rate of one fluid ounce per five thousand gallons (1.6 mL per cubic meter) of asphalt cement. The cost of the silicone additive shall be considered incidental to other items, therefore, separate measurement and payment will not be made.

- 2. Continuous Type Mixing Plants:** The plant shall include a continuous mixer capable of heating and producing a uniform mixture. The discharge hopper shall be equipped with dump gates which permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and reversible to retard the flow of the mix. The clearance between the paddles and the mixer liner shall not exceed one inch (25 mm).

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The proportioning device (gradation unit) for mineral aggregate shall be equipped with accurately controlled gates or orifices for volumetrically measuring the material fed by conveyor into the mixer, and constructed so the flow of aggregates can be accurately determined and positively controlled. A cutoff system shall automatically stop the mixing operation when the level of the aggregate in any bin is less than 15 inches (375 mm) above the apron feeder. An accurate revolution counter, easily accessible for reading, shall be provided on a plant drive shaft which is interlocked with the conveyor to the mixer. Bypass gates for obtaining test samples shall be provided for calibration of gate openings. The proportioning device for the asphalt shall be a positive displacement metering pump with a satisfactory nozzle arrangement in the mixer. The operating speed of the pump shall be synchronized with the flow of mineral aggregate to the mixer by an automatic interlocking control. The device shall be equipped with an accurate meter and shall be easily and accurately adjustable to vary the rate of asphalt so the mixture will be uniformly proportioned.

A recording pyrometer shall be mounted in the discharge end of the mixer and daily charts of continuous mix temperature readings shall be submitted to the Engineer. The pyrometer shall be of a type that is easily read and at a location that is easily accessible.

3. **Batch Type Mixing Plants:** The batch mixer shall produce a uniform mixture. The mixer box shall prevent loss of dust. The clearance between the paddles and the mixer liner shall not exceed one inch (25 mm).

Batch plants shall be fully automatic, to the extent that the only manual operation required will be for the proportioning of one batch utilizing a single actuation switch or starter.

The automatic unit shall include a timer to automatically control the measuring, mixing and dumping processes through a central control.

The automatic unit shall be self-contained. If the unit is affected by vibration, it shall be set on the ground or mounted on a vibration free surface.

The automatic unit shall be capable of performing the following operations in the proper sequence and time interval:

- a. Automatically dumping preset weights of the materials into the pugmill or mixer in proper time sequences.
- b. A cutoff system shall automatically stop the weighing process until the quantity of material required for one batch is available or the automatic control unit may be equipped with an over-under weight control device which automatically stops the weighing process when the weight of a component in the batch varies from the preset weight by more than the following listed tolerances:

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Aggregate

Components±1.5% of total batch wt.

Mineral Filler ±0.5% of total batch wt.

Asphalt ±0.3% of total batch wt.

- c. Preventing discharge until the end of the preset mixing time.
- d. Preventing the introduction of mix ingredients into the mixer while the dump gate is open.
- e. Controlling the asphalt and aggregate measuring processes by separate sets of components contained within the automatic unit, and shall be capable of performing both processes simultaneously.
- f. Indicating by dial pointer the weight or volume of the asphalt introduced into the batch.
- g. Converting the control of the measuring and mixing processes from automatic to manual operation.

The automatic unit shall include a time lock device which is capable of controlling the operations of a complete mixing cycle. The weigh box gate shall lock after charging the mixer and remain locked until the completion of the cycle. The asphalt bucket or the volumetric control shall lock throughout the dry mixing period and the mixer gate shall lock throughout the dry and wet mixing periods. The dry mixing period shall be the interval of time between the opening of the weigh box gate and the start of the application of asphalt. The wet mix period shall start at the beginning of the application of asphalt and shall end when the mixer gate is opened.

The control of the timing shall be flexible and capable of being set at intervals of five seconds or less throughout a total cycle of not less than three minutes. A mechanical batch counter shall be installed as part of the timing device to register the release of the batch.

The setting of time intervals shall be in the presence of the Engineer.

Springless dial or beam scales, accurate to one-half of one percent of the net load, are required on all batch plants.

Scales shall be attached to the bucket in a manner that will accurately weigh the quantity of asphalt going into the mixer. A tilting bucket will not be permissible. Weighing or measuring equipment shall be sealed or locked.

A recording pyrometer shall be mounted in the discharge chute of the dryer. Daily charts of continuous aggregate temperature readings shall be submitted to the Engineer. The pyrometer shall be of a type that is easily read and at a location that

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is easily accessible.

4. **Drum Mix Plants:** The dryer drum shall uniformly heat, coat and mix the materials without burning affecting the mixture.
 - a. The component aggregates shall be processed, stockpiled and proportioned as provided in Section 320.3 C.
 - b. Materials and additives shall be fed simultaneously into the dryer. Recycled asphalt concrete may be fed at a separate point.
 - c. The aggregate feed system shall provide positive control of the aggregate feed that can be easily and accurately calibrated. The rate of feed shall be continuously monitored, by belt scale or other device, that is interlocked with the asphalt metering mechanism. Provisions for obtaining representative samples of the combined aggregate prior to introduction into the dryer shall be provided in such a manner that the Department may obtain samples at any time.
 - d. The asphalt metering device shall positively control the rate asphalt is introduced into the mixture and shall respond instantaneously to variation in the aggregate feed rate. The mechanism shall be easily and accurately adjustable.
 - e. The system shall be equipped with automatic burner controls regulated by temperature sensing of either the mixture at point of discharge from the dryer drum or the stack temperature.
 - f. Production shall be limited to the rate required to obtain uniform aggregate coating and a uniform mixture meeting job mix temperature requirements. The rate must be within manufacturers rated plant capacity.
 - g. The mixture shall be conveyed from the dryer discharge to a storage bin for loading into haul units. The storage bin shall be designed and charged in a manner which prevents segregation of the mix.
 - h. A recording pyrometer shall be mounted in the discharge end of the mixer for determining the temperature of the mix. Daily charts of continuous mix temperature readings shall be submitted to the Engineer.
5. **Pavers:** Self-propelled pavers shall be equipped with a hopper having a bottom conveyor, **a full width vibrating screed, heated if necessary, and capable of spreading and finishing the mix to the specified widths, typical section and thickness. Hydraulic extendable screeds may be used for variable width pavements. The paver shall have an auger that extends to within one foot (300 mm) from either edge of the vibrating screed.** The paver shall provide an accurate, smooth, uniform textured spread, and provide preliminary compaction.

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An attachment shall be provided on the paver that will place a beveled edge on the mat as specified.

Pavers shall be equipped so that the height and transverse slope of the screed is automatically controlled using a fixed or traveling stringline on either or both sides of the paver. The system shall be capable of manually controlling the transverse slope and the screed height.

The stringline shall be nylon, wire, binder twine, or other material which remains taut after being tightened. **The stringline shall be provided by the Contractor.**

The traveling stringline shall have a minimum effective length of 28 feet (8.5 meters). The traveling stringline shall be attached and positioned on the paver to reference off the adjacent lane, with the sensor of the control system resting midway between the ends.

- 6. Rollers:** Rollers for compacting the asphalt concrete shall be of the self-propelled type, capable of producing a smooth surface finish. The number and weight of rollers furnished shall be sufficient to compact the mix to the required density. The rollers shall be capable of being reversed smoothly and there shall be no excessive free play in the steering mechanism.

Rollers shall be equipped to prevent "pickup" on the tires or drums. Moistening the drums or tires with water, a water detergent solution, or enclosing the roller to prevent heat loss from the tires may be required. The use of fuel oil or other petroleum solvents to prevent "pickup" will not be permitted. Measures shall be taken to prevent oil, grease, or fuels from being dropped on the mat.

C. Preparation of the Mineral Aggregate:

- 1. Stockpiling Aggregate:** The following requirements apply **unless the bid item for asphalt concrete composite is provided.**

Stockpiles of mineral aggregate for Asphalt Concrete shall be built in layers, completing each layer over the full area of the pile before the next layer is started. The height of each layer shall be controlled to minimize segregation. The maximum drop of the materials from the conveyor shall not exceed 10 feet (three meters). Coning shall not exceed 10 feet (three meters). The stockpile shall be leveled with rubber tired equipment between layers to maintain a level platform for the next layer. Dumping, casting, or pushing over the sides of the previous layers will not be permitted. Segregated piles will be rejected until corrected. The equipment operating on the pile shall be free of dirt, grease, oil, and other contaminants. The size of the equipment shall be limited to that which can be operated on the stockpile without degradation of the material. The leveling requirement will be waived for the fines stockpile when split on a 1/4 inch (6.3 mm) or smaller screen unless there is indication of segregation.

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2. **Stockpile Tests:** The following requirements apply unless the bid item for asphalt concrete composite is provided.

The Contractor shall run process control tests on the mineral aggregate when producing material. A gradation, PI, crushed and lightweight particles test shall be run for every 1500 tons (1500 metric tons) produced per pile. The Contractor shall also test the quality (abrasion and soundness) of the mineral aggregate. The quality shall be tested once per source. All sampling and testing shall be accomplished in accordance with the South Dakota Department of Transportation Materials Manual. The Engineer may vary the frequency of the stockpile tests depending on the quality and uniformity of the materials. Test results shall be recorded on forms furnished by the Department, and shall be immediately submitted to the Engineer.

3. **Mix Design Submittal:** The asphalt concrete mix designs shall be performed by the Department in the central office bituminous lab. 50 percent of the plan quantity, or 15,000 tons (15,000 metric tons), which ever is less, of the mineral aggregate shall be produced prior to submission for the mix design. The materials for the mix design shall be submitted a minimum of 15 working days prior to hot mix production. Mix designs will not be performed on samples that are not submitted through the Area Engineer and accompanied by the following:

- a. A properly filled out data sheet (DOT 1), including the legal description of all mineral aggregate sources.
- b. The mineral aggregate samples submitted shall be representative of the materials produced for the project.
- c. The average stockpile test results of each mineral aggregate stockpile produced along with the recommended bin splits of each material produced.
- d. A minimum of two 1 quart (two 1 Liter) samples of asphalt cement intended for use on the project.
- e. A temperature viscosity curve (chart) or required mixing temperature for the asphalt cement intended for use and the specific gravity of the asphalt cement.

Two mix designs per type will be made by the Department without charge. Should the Contractor desire an additional mix design, or if additional mix designs are required due to the materials not meeting specifications, the costs involved shall be at the Contractor's expense.

4. **Proportioning of Aggregates:** If blending of aggregates is required, separate bins or stockpiles shall be provided. Materials shall be kept separated until they are delivered in their proper proportions onto the feeder leading to the dryer. Spreading or dumping filler, sand, or crushed rock over the tops of gravel pits, stockpiles or in hoppers at the crushing plants will not be permitted. Charging bins directly from

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pits, crusher, or screening plants will not be permitted.

The mineral aggregate exclusive of rock, sand, filler, or other additives shall be separated into at least two fractions dividing on the No. 4 sieve (4.75 mm) sieve, or other size agreed upon, and placed into separate compartments ready for proportioning and mixing.

In continuous plants and batch plants mineral filler shall be fed proportionately to the aggregate just prior to or during its introduction into the mixer and shall not pass through the gradation unit.

Hydrated lime shall be added to the aggregate on the primary feed-belt as a lime-water slurry, as dry lime to moistened aggregate or any lime and water combination satisfactory to the Engineer. Introduction directly into the drum-mix by blowing or augering will not be permitted.

The mixing of the aggregate, hydrated lime and water shall be accomplished with a pugmill, dow box or other means satisfactory to the Engineer prior to introduction into the dryer. Alternative methods for mixing must be approved by the Engineer.

Crushed rock screenings used as mineral filler shall be added separately to the cold feed into the dryer. Aggregates shall be uniformly dried and heated without unburned fuel or carbon residue on the aggregate when discharged from the dryer.

Stockpiles of the aggregate materials adequate for one days normal production, shall be maintained during mix production. The cold feed mechanism shall be charged uniformly from the stockpiles.

The resulting gradation of the combined aggregates shall meet specified gradation and job mix requirements. Failure to maintain production meeting these requirements will require immediate correction or suspension of the mode of control for aggregate proportioning.

Individual components required to make up the combined aggregate shall be fed on the conveyor into the dryer through a separate positive feed control that can be easily and accurately calibrated. Constant and uniform flow shall be maintained throughout the range of calibration.

- D. Preparation of the Mixture:** The mineral aggregate shall be satisfactorily mixed with the proper quantity of asphalt at the central mixing plant.

The mixing plant shall be operated using automatic controls. Manual operation will be permitted for the remainder of the day when automatic controls fail, provided specified results are obtained. The Contractor shall restore automatic operation prior to the next days production.

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The asphalt shall be added to the mix in the proportionate quantity and at the temperature established by the job mix formula. The temperature viscosity relationship of the asphalt furnished will be used as a guide for establishing the asphalt application temperature.

In batch plants, the mineral aggregate shall be mixed dry for a minimum of five seconds, after which hot asphalt shall be applied in a manner that will obtain uniform coating of particles.

After introducing the required aggregate and asphalt into the mixer the materials shall be continuously mixed until the aggregate is completely and uniformly coated and a thorough distribution of the asphalt throughout the aggregate is obtained. A wet mixing time for batch and continuous type plants and for each type of aggregate used will be determined by the Engineer and issued as a written order to the Contractor. Continuous mixing plants shall be operated at full calibrated capacity. Throttling back to reduce production rate will not be permitted.

When hot mix storage bins are used, storage of the mix shall be limited to a maximum of 15 hours.

- E. Transportation and Delivery of the Mixture:** The mixture shall be transported from the plant to the point of use in pneumatic tired vehicles. The vehicle boxes shall be tight, clean, and smooth. Boxes shall be cleaned only with lime water, soap, a detergent solution, or an approved commercial product. Oil, diesel fuel, or other petroleum solvents shall not be used. Excess solution in the box shall be disposed of before the vehicle is loaded.

Night operations in urban areas may be permitted, night operations in rural areas will not be permitted.

When directed by the Engineer each load shall be **satisfactorily covered**.

- F. Tacking, Spreading, and Compacting:** The surface, including all vertical contact faces, on which the asphalt concrete is to be placed, shall be tacked in accordance with Section 330. The tack coat shall be allowed a cure period, as determined by the Engineer, prior to asphalt concrete placement.

Asphalt concrete shall be placed by self-propelled pavers. Hand work is permissible in inaccessible or odd shaped areas.

Paver laid mix shall be spread using automatic transverse and longitudinal grade controls. If the automatic controls fail or malfunction, the Engineer may permit manual operation for the remainder of the day, provided the finished product meets the specifications. Frequent breakdowns shall constitute cause for suspension of the work until repair or replacement is made.

Following placement of the first pass using the traveling stringline for control, adjacent passes and succeeding lifts shall be placed using the traveling stringline riding on the

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previously laid material. A shoe attachment may be used to match the longitudinal joint(s) on the final paver pass(es) of the top lift unless otherwise directed by the Engineer.

A shoe attachment on the paver shall be used to automatically match the elevation of asphalt concrete shoulders with concrete pavements.

Automatic slope controls will be required on paving equipment for placing asphalt concrete on shoulders [8 feet (2.4 meters) or more in finished width] next to asphalt or concrete pavement.

The use of automatic controls for placing of asphalt concrete will not be required under the following conditions:

1. When placing the first lift on a surface that has been trimmed to grade and section by use of a stringline and electronically controlled fine grader or trimmer.
2. When placing the final lift on multilift construction, when the preceding lifts have been placed using automatic controls.

Asphalt concrete shall be placed directly on the roadbed in a uniform windrow and then fed into the paver by a paver feeder. The paver feeder shall pick up substantially all of the mix and feed it into the paver without segregation.

The size of the windrow shall be regulated so the the paver is fed a continuous and adequate supply of mix.

The "temperature of mixture on delivery to the road" shall be defined as the temperature of the mix just prior to placement or just prior to spreading by blade.

Spot leveling and repair of the existing surface with asphalt concrete shall be required prior to the paver laid courses at locations designated. Potholes and areas of localized disintegration shall be cleaned of loose material, squared, tacked, leveled with asphalt concrete, and satisfactorily compacted. Spot leveling may be blade laid in lifts not exceeding 3 inches (75 mm) of uncompacted depth. Compaction shall be by the specified roller coverage method, except a steel face roller will not be required.

On the final surfacing lift laydown operations shall commence at the farthest point and progress continuously toward the plant.

On rural projects, a partial width pass may be extended beyond the adjacent pass by as much as one days run. The paver shall be moved back the following working day to place the adjoining pass. Where a difference in elevation exists between two lanes carrying traffic in the same direction on rural multilane asphalt concrete construction, one of the effected lanes shall remain closed to traffic.

The plant production and availability of hauling vehicles shall be sufficient to provide a

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uniform and consistent quantity of asphalt concrete to the paver so laydown operations are continuous. Stops and starts shall be restricted to a minimum. Stopping normal laydown operations to surface an approach, thereby creating an unnecessary joint, will not be permitted.

Laydown operations shall proceed from the center to the shoulders of the roadbed surface. The center joints of succeeding lifts shall be offset approximately 6 inches (150 mm). The center joint of the top lift shall be located on centerline. Longitudinal joints other than at the lane lines will not be permitted in the top lift. In curb and gutter sections, laydown may proceed from the gutter line to the centerline.

Transverse joints of the final lift shall be formed by sawing back the previous run to expose the full depth of the course. The finished transverse joint of all lifts shall have a uniform texture and comply with the straightedge requirement. Waste material resulting from forming joints and temporary ramps shall be removed and disposed of.

Segregation or excessive pulling of the mix shall warrant suspension of operations.

Immediately after the mix has been placed and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling to the specified density requirements.

Rollers shall be operated at a slow uniform speed, not to exceed 5 miles per hour (eight kilometers per hour). Static steel faced rollers shall be operated with the drive wheel nearest the paver.

Rolling shall be longitudinal, commencing at the outer edges of the mat and progressing toward the center in straight, parallel strips, overlapping at least 6 inches (150 mm). On superelevated curves, rolling shall progress from the lower to the upper edge. The Contractor shall vary the points of reversal to prevent a transverse crease. The rollers shall not stand idle on any part of the mat which has not been completed and cooled sufficiently to resist deformation.

The beveled edge shall be satisfactorily compacted.

When abutting a previously laid lane, compaction of the longitudinal joint should be accomplished by rolling from the hot lane. The roller should overlap approximately six inches (150 mm) onto the cold lane.

The surface of each lift shall be free of waves and other irregularities. The final lift surface shall be checked with a 10 foot (three meter) straightedge. The variation of the surface from the straightedge between any two contact points shall not exceed 0.02 foot (6 mm). The crown, on all lifts, as indicated by checking with a 10 foot (three meter) straightedge, shall be within 0.04 foot (13 mm) of specified crown in any 10 foot (three meter) length.

Irregularities shall be corrected while the material is in a workable condition. Under no circumstances shall operations continue when it becomes evident final rolling is not

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producing a smooth, uniform, compacted surface free from roller marks and other irregularities.

The mix shall be compacted on the road by one of the following methods. Unless otherwise specified, the Specified Density Method shall be used.

- 3. Specified Density Method:** The mix shall be compacted to the density specified for the class of asphalt concrete designated. The percent of density shall be based on **the maximum specific gravity of the** test specimens prepared in the field in accordance with SD 312. The compacted density of asphalt concrete **shall be determined** according to SD 311.

Compaction rolling shall be completed before the temperature of the mix drops below 180E F (82EC). Vibratory rollers **may** be used **in the static mode** for finish rolling.

Compaction of mix placed on entrances to farms, residences, or businesses and intersecting road approaches shall be compacted by the specified roller coverage method.

- 4. Specified Roller Coverages:** The mix shall be compacted by at least four complete coverages with pneumatic tired rollers and at least one complete coverage with steel faced rollers, **or as approved by the Engineer.**

Breakdown rolling may be accomplished by steel faced rollers, only when approved by the Engineer.

Self-propelled pneumatic tired rollers shall cover an overall surface width of at least 60 inches (1500 mm) and furnish a minimum rolling weight (mass) of 250 pounds per inch (4.5 kilograms per millimeter) of roller width.

Self-propelled tandem smooth steel rollers (two steel drums operating in the same track) shall furnish a minimum rolling weight (mass) of 275 pounds per inch (4.9 kilograms per millimeter) of roller width.

Rolling shall proceed on the mat as soon as lay down is completed. Completion of rolling on any segment shall not lag behind the laydown more than 1000 feet (300 meters). During periods of cool weather this maximum distance between laydown and final rolling shall be reduced as directed.

Compaction to a specified density will not be required. However, additional roller coverages may be required in order to obtain a smooth surface finish.

When directed, the Contractor shall cool, saw and remove an undamaged, 6 inch (150 mm) square sample, or a 6 inch (150 mm) diameter round sample from an area designated and repair the hole to the satisfaction of the Engineer.

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- G. Maintenance:** The Contractor shall maintain the work during construction and until final acceptance. Maintenance shall include protection and repair of the prepared base course, tack coat, wearing surface mat, shoulders, and seal course. Rich or bleeding areas, breaks, raveled spots, or other nonconforming areas in the wearing surface or base shall be corrected.
- H. Traffic Control:** Hauling or allowing traffic on the roadway will not be permitted until the surface has been compacted and cooled sufficiently to resist marking or distortion.

Where traffic is to be maintained by means of part width construction, the Contractor shall control all traffic by identified pilot cars and flaggers. The Contractor shall schedule work so traffic will not be greatly inconvenienced with long one-way lanes.

- I. Shoulder Joints:** When specified a continuous groove shall be constructed by forming, sawing, or routing the joint between the Portland cement concrete pavement and the asphalt concrete shoulder.

Sawing may be done with either diamond or water cooled abrasive blades.

If a router is used it must be capable of cutting a groove to the required dimensions. Equipment designed to plow the groove to dimension will not be permitted. The walls of the finished groove shall be vertical and the groove bottom shall be flat.

The groove shall be thoroughly cleaned immediately after forming, sawing, or routing. Dry sawed joints shall be cleaned with high pressure air. Wet sawed joints shall be cleaned with high pressure water followed by high pressure air. The air compressor shall produce a minimum of 125 CFM (0.06 cubic meters per second) output and shall be equipped with a maximum 3/4 inch (20 mm) nozzle. The groove (including the sides) shall be free of dirt, dust, water, oil, grease, and loose material immediately prior to sealing. The Portland cement concrete surface shall be free of asphalt and any curing compound that would prevent bonding. The groove shall be completely dry and filled level with joint sealer by a sealing device which will not entrap air in the sealed joint.

320.4 METHOD OF MEASUREMENT

- A. Asphalt Cement:** Asphalt cement will be measured to the nearest 0.1 ton (0.1 metric ton).
- B. Asphalt Concrete:** Asphalt concrete will be measured to the nearest 0.1 ton (0.1 metric ton) for the class specified. The mixture of mineral aggregate and asphalt cement will be weighed after mixing. No deduction will be made for the weight of the asphalt cement included in the mixture.

Deduction will not be made for material removed from temporary approaches.

- C. Compaction Samples:** Samples will be measured by actual count of samples ordered and accepted by the Engineer.

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- D. Sawing and Sealing Shoulder Joints:** Field measurement for this work will not be required. Plan quantity will be the basis of payment. If changes are ordered by the Engineer, the length will be measured and the quantity adjusted.
- E. Hydrated Lime:** Hydrated lime, when provided as an additive to the asphalt concrete mixture, will be measured to the nearest 0.1 ton (0.1 metric ton).
- F. Stockpile Tests:** Stockpile tests will not be measured for payment.
- G. Granular Additives:** Granular additives (sand, filler, rock) shall be measured to the nearest 0.1 ton (0.1 metric ton) based on the calibrated percentage of granular additives actually added to the plant on construction.

320.5 BASIS OF PAYMENT

- A. Asphalt Cement:** The accepted quantities of asphalt cement will be paid for at the contract unit price per ton (metric ton). The amount bid for this item shall be at least the cost of the asphalt cement furnished and delivered to the project site.
- B. Asphalt Concrete:** The accepted quantities of asphalt concrete, will be paid for at the contract unit price per ton (metric ton) complete in place.
- C. Compaction Samples:** Compaction samples will be paid for at the contract unit price per each.
- D. Sawing and Sealing Shoulder Joints:** Sawing and sealing shoulder joints will be paid for at the contract unit price per linear foot (meter).
- E. Hydrated Lime:** Hydrated lime will be paid for at the contract unit price per ton (metric ton) complete in place.
- F. Stockpile Tests:** There will be no direct payment for the stockpile testing and related requirements. All costs related to the testing for labor, test equipment, laboratory, tools and all incidentals required to satisfactorily perform the required work shall be incidental to the asphalt concrete pavement items.
- G. Granular Additives:** Granular additives will be paid for at the contract unit price per ton (metric ton) or as specified by plan note.

If rock additive is specified and the Contractor elects to obtain mineral aggregate from a different source than provided in the plans, payment for rock additive shall not exceed plans quantity, although a greater quantity may be required to meet specifications. If ledge rock is substituted for mineral aggregate, payment for rock additive shall be for plan quantity unless ledge rock is shown as an alternate source for mineral aggregate.