

**410.06. BASIS OF PAYMENT.**

The accepted quantities, measured as provided above, shall be paid for at the contract unit price as follows:

- (A) EMULSIFIED ASPHALT ..... GALLON OR TON (LITER OR METRIC TON)
- (B) TYPE I AGGREGATE ..... TON (METRIC TON)
- (C) TYPE II AGGREGATE ..... TON (METRIC TON)
- (D) TYPE III AGGREGATE ..... TON (METRIC TON)

Such payment shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

**SECTION 411  
PLANT MIX ASPHALT CONCRETE PAVEMENT**

**411.01. DESCRIPTION.**

This work shall consist of the construction of one or more courses of bituminous mixture on the prepared foundation in accordance with these Specifications and the specific requirements of the type under contract, and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the Plans or established by the Engineer.

**411.02. MATERIALS.**

Materials shall meet the requirements of Section 708. Have ample material in the stockpiles at the plant site at the beginning of each day's operation to supply and be used for that day's operation as well as provide to the Department's representative results of quality control tests on a daily basis.

**411.03. EQUIPMENT.**

- (a) **Mixing Plants.** At all times, have available at the plant site 1) a legible copy of the manufacturer's specifications for the mixing plant and 2) any modifications made to the plant including the manufacturer's tolerances for points of wear affecting the production of bituminous mixtures. Mixing plants shall be inspected and shall be within the manufacturer's tolerances and in good working order; in addition, they shall be so coordinated and of sufficient capacity to adequately produce the required bituminous mixture. All plants used for preparation of bituminous concrete mixtures shall conform to the requirements of AASHTO M 156 for plants and meet the Department's certification requirements. Batch plants shall be equipped with a mechanical batch counter.

Develop and maintain calibration charts for each cold feed for the job aggregates or maintain other suitable evidence of compliance with the paving mixture Specifications.

Mixing plants used for the production of asphaltic concrete composed of reclaimed asphalt paving materials shall operate in a manner that the reclaimed asphalt material is not directly exposed to the burner flame and the very high temperature combustion gases. Plants that have been modified for production of asphalt concrete containing reclaimed asphalt materials shall meet the requirements of the plant manufacturer for the specific modifications.

- (b) **Scales.** The bituminous mixture shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. When an approved automatic printer system is used in conjunction with an automatic batching and mixing control system, the printed batch weights may be used in lieu of truck scales. Such weights shall be evidenced by a weigh ticket for each load. Scales shall be inspected and certified as often as the Engineer deems necessary to assure their accuracy but not less than once every six months.
- (c) **Bituminous Pavers.** Bituminous pavers shall be self-contained, power-propelled units, in good working order and provided with an activated heated screed; they shall also be equipped with an approved automatic control device for laying the mixture to the specified slope and grade, and be capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thicknesses shown on the Plans. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant mix material in widths shown on the Plans.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation and also with a distribution system to place the mixture uniformly in front of the screed.

The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture.

The Contractor may use an approved strike-off assembly, heated if necessary, provided the finished surface produces the required evenness and uniform texture without tearing, shoving, or gouging the mixture.

The paver shall be equipped with hoppers and distributing screws of the reversing type adequate to place the mixture evenly ahead of the screed for the full width being laid.

- (d) **Trucks and Transports** Trucks used for hauling bituminous mixtures shall comply with legal load limits and have tight, clean, smooth metal beds which have been thinly coated with a minimum amount of soap solution, lime solution, or other approved material to prevent the mixture from adhering to the beds. Antiadhesive solutions shall not be allowed to pond in the truck beds.

*NOTE: The use of solutions which contain diesel fuel or other contaminating solvents will not be allowed between daily truck deliveries.*

Each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather. When necessary, so that the mixture will be delivered on the road at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

Transports used for hauling liquid asphalt materials shall comply with Subsection 708.03(b). Keep a log or diary containing the delivery date, asphalt grade, source, quantity, invoice number, and the material hauled in the previous load. This information shall be furnished to the Engineer upon request.

- (e) **Sampling Device.** Provide an aggregate sampling device that can be safely operated by the Inspector and is capable of obtaining a representative sample of the combined aggregate from a flowing aggregate stream (belt or bin discharge)—in accordance with the requirements of AASHTO T-2—prior to entering the dryer drum or drum mixer and without stopping plant production. The sampling device shall be approved by the Engineer.
- (f) **Material Transfer Equipment.** Equipment to transfer mixture from the hauling units or the roadbed to the spreading and finishing machine will be allowed unless otherwise shown on the plans. A specific type of material transfer equipment shall be required when shown on the plans.

#### 411.04. CONSTRUCTION METHODS.

- (a) **Stockpiling Materials.** Deliver and stockpile aggregates in accordance with Subsection 106.09.
- (b) **Preparation of Materials**
  - (1) **Bituminous material and aggregate.** Heat bituminous material and aggregate to the temperature specified in Subsection 708.03 and in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature at all times.
  - (2) **Dried and heated aggregate.** Properly adjust flames used for drying and heating the aggregate to avoid damage to the aggregate and avoid soot on the aggregate.
  - (3) **Hot dry aggregates.** For plants controlling gradation of hot dry aggregates, screen the aggregate and store it in separate bins as follows: Mineral aggregate for use in Type C, D, or E mixtures shall be stored in not less than two bins and all other mixtures shall be stored in not fewer than three bins.
    - Bin No. 1 shall contain approved aggregate, 85 to 100 percent of which will pass a No. 10 (2.0 mm) sieve.
    - Bin No. 2 shall contain approved aggregate, 80 to 100 percent of which will be retained on a No. 10 (2.0 mm) sieve.
    - Other bins shall contain approved aggregate, 90 percent of which will be retained on the No. 4 (4.75 mm) sieve.

Correct continued variations in excess of these limitations by increasing the amount of screening area or reducing the rate of plant production.

- (c) **Plant Startup Requirements for New Construction and All Overlays.** Prior to placing any asphalt concrete, produce a sufficient amount of asphalt mix to properly calibrate the plant and procedures using the mix design approved for mainline construction. The asphalt concrete thus produced will be sampled and tested by the Engineer for the following:

VMA; asphalt cement content; gradation; air voids (Lab Molded); and Hveem stability.

No asphalt concrete from the startup operation that fails to meet specification requirements shall be placed on the mainline or the compaction test strips. Instead, continue to make adjustments until all of the requirements are met. Asphalt concrete not meeting the requirements may be used in the construction of temporary facilities, or if no temporary facilities are available, it shall become the property of the Contractor.

Costs of plant startup operations, including both labor and materials, will be included in the price bid for the mixture in place.

- (d) **Mixing.** Combine aggregates in the mixer in the amount of each fraction of aggregates required to meet the approved job-mix formula. Measure or gauge the bituminous material and introduce it into the mixer in the amount specified by the job-mix formula. The moisture content of the bituminous mixture at the point of discharge shall not exceed 0.75 percent. Uncoated or nonuniform mixtures will not be accepted.

During daily start-up or shutdown of plant operations, waste sufficient material to assure that all deliveries to the storage silo or roadway are in compliance with the Specification requirements for the type mixture specified. Do not change from one type of mixture to another until the plant has been emptied and the cold feed bins charged with the proper aggregates.

- (e) **Mat Irregularities.** The mat shall be free from segregation, nonuniform texture, bleeding or fat spots, and cracking.
- (f) **Tack Coat.** Tack coat, if required, shall be in accordance with Section 407.
- (g) **Weather Limitations.** The minimum surface temperature of the foundation course on which asphalt concrete may be laid shall be as shown in the following table:

COMPACTED LIFT THICKNESS	SURFACE TEMPERATURE (Minimum)
More than 3 inches ( 80mm)	40°F(4°C)
1 1/2 inches (40mm) to 3 inches (80mm)	45°F (7°C)
Less than 1 1/2 inches ( 40mm)	50°F (10°C)

Do not lay asphalt concrete when there is frost in the foundation course; and when conditions are such that the material becomes so chilled that it can't be properly leveled and thoroughly consolidated, stop operations. When rain begins, cease plant production; any material already in transit may be placed at the Contractor's risk, subject to all density and other requirements.

- (h) **Spreading and Finishing.** Lay the asphalt mixture with a paver that meets the requirements of Subsection 411.03(c) and upon an approved surface which is dry. Deliver the mixture on the job at an optimum workable temperature which will produce the density herein specified after final compaction. After the optimum workable temperature is determined, it shall not vary more than 25°F ( 14°C) above or below this temperature.

Establish the alignment of one edge of the asphalt mixture with a string or wire line in advance of the placing of the asphalt mixture.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, use hand tools to dump, spread, rake, and lute the mixture to the required compacted thickness.

Operate the spreading and finishing machine at a uniform forward speed consistent with the plant production rate, hauling capability, and roller train capacity to result in a continuous operation. The speed shall be slow enough that stopping between trucks is not ordinarily required. If, in the opinion of the Engineer, sporadic delivery of material is adversely affecting the mat, the Engineer may require paving operations to cease until acceptable methods are provided to minimize starting and stopping of the paver.

Spread the wearing course mixture uniformly high immediately adjacent to curbs, gutters, manholes, and other structures so that after compaction it will be approximately 1/4 inch (6 mm) above the edges of such structures. Before placing the mixture against contact surfaces of curbs, gutters, headers, manholes, etc., clean and paint them with a thin, uniform tack coat of a type specified herein.

When an unsatisfactory asphalt course is being produced, immediately make the necessary corrections to obtain a satisfactory surface. If deemed necessary, the Engineer may terminate the laydown operation until such time as satisfactory performance can be obtained and require that the unsatisfactory material be removed as unacceptable work.

- (i) **Joints.** Stagger longitudinal and transverse joints on succeeding lifts approximately 6 inches (150 mm), and make them carefully.

Construct all longitudinal joints within 1 foot (300 mm) of the lane lines. The longitudinal joints in the top layer or in the layer upon which an open-graded friction course is to be placed shall be at lane lines.

Well bonded and sealed joints are required. When making joints between old and new pavements or between successive days' work, take care to make them in such a manner as to insure a thorough and continuous bond between the old and new surfaces. Cut back the transverse edge of the previously laid course to its full depth so as to expose a fresh surface; then paint the edge with a tack coat, and place the hot mixture in contact with it, raking it to a proper depth and grade.

- (j) **Compaction.**

(1) **General.** To compact and smooth, use self-propelled steel wheel and pneumatic tired compactors. Steel wheeled compactors shall weigh at least 10 tons (nine metric tons). Pneumatic tired compactors shall have at least seven pneumatic tires of equal size and diameter. They shall be constructed so that their total weights shall be varied to produce an operating weight of at least 3500 pounds (1588 kg) per tire. The tires shall be capable of being inflated to at least 110 psi (758 kPa) and be spaced so that the gaps between adjacent tires shall be covered by the following tires. Operating tire pressure (after one hour of operation) shall be maintained at 90 to 110 psi (620 to 758 kPa) with the range in pressure between tires not to exceed 10 psi (68 kPa).

Compactors shall be of adequate number, size, and weight and designed and properly maintained so that they are capable of accomplishing the required compaction. Operate them in accordance with the manufacturer's recommendations.

Use self-propelled pneumatic tired rollers on all lifts following the initial rolling with a steel wheel roller and before finishing with a steel wheel roller. A minimum of two coverages with the pneumatic tired roller is required on each lift.

During compaction, if there is any displacement as a result of the reversing of direction of compactor, or other causes, correct the surface at once by the use of rakes and addition of fresh mixture when required. Be careful in compacting not to displace the line and grade of the edges of the bituminous mixture. Take care that there is no damage caused by adhesion of the mixture to the compactors.

Use hot hand tampers, smoothing irons, or mechanical tampers to thoroughly compact the mixture along forms, curbs, headers, walls, and other places not accessible to the compaction equipment. To transmit compression to a depressed area, a trench compactor may be used when approved by the Engineer.

Remove any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, and replace it with fresh, hot mixture, compacting it to conform with the surrounding area.

*NOTE: Any area showing segregation or an excess or deficiency of bituminous material shall be removed and replaced at the expense of the Contractor as unacceptable work.*

Asphaltic concrete immediately behind the laydown machine shall be a minimum of 250°F (121°C). The target density of thicker lifts and optimum densities of thinner lifts shall be obtained before the mat temperature of the lifts under compaction drops below 180°F (82°C).

- (2) **Acceptance.** All lifts 1 1/2 inch (40 mm) or greater in nominal (Plan) thickness including both new construction and overlays will be accepted on the basis of density as specified in Subsection 2.1.

All lifts less than 1 1/2 inch (40 mm) in nominal thickness will be accepted on the basis of compactive effort as specified in Subsection 2.2.

Both new construction and overlays (all thicknesses) will be accepted on a lot-by-lot basis. Normally, a lot shall be considered to be 1000 tons (1000 metric tons); however, the Engineer may terminate a lot at any point and designate a new one when a materials or workmanship adjustment has been made which results in the desired correction.

- 2.1 *All lifts 1 1/2 inch (40 mm) or greater in nominal (Plan) thickness.* The target density of each lot shall be 94 percent of the Maximum Theoretical Specific Gravity at the Job Mix Formula (JMF) asphalt content determined by the most recent specific gravity of the bituminous paving mixture in accordance with AASHTO T 209.

The roadway density for each lot will be the average of tests of three separate specimens taken randomly within the limits of the area represented by the lot. Cut test specimens for each lot from the pavement by sawing or coring a specimen a minimum size of 6 inches (150 mm) on the cut side or diameter, at locations and times established by the Engineer. The cost of cutting specimens and satisfactorily placing and finishing new materials in areas where specimens have been taken will be included in the price bid for mixture in place. The tests may be on the specimens or through use of nuclear density gauges.

Acceptance and pay adjustments will be based on tests by the Department and in accordance with the following schedule:

AVERAGE LOT DENSITY % OF MAXIMUM THEORETICAL DENSITY (ALD)	PAY ADJUSTMENT FACTOR (PAF)
Above 97	Unacceptable *
92 - 97	1.00
91 - 92	1.00-(0.07) (92-ALD)
88.1-91	0.93-(0.15) (91-ALD)
Below 88.1	Unacceptable *

Adjustment Payment = PAF x Contract Unit Price

\* Unless otherwise directed by the Engineer, products testing in this range are unacceptable and shall be removed and replaced at no additional cost to the Department.

2.2 *All lifts less than 1 1/2 inch (40 mm) in Nominal (Plan) Thickness.* Through the use of test strips and daily monitoring of asphalt placement, the Engineer will approve the rolling patterns necessary to obtain optimum compaction. While 94 percent of Maximum Theoretical Density shall be considered the target, acceptance will be based on the Contractor performing as approved by the Engineer to obtain optimum compaction.

Compaction test strips shall consist of approximately 500 square yards (500 m<sup>2</sup>) of pavement area and shall reasonably conform to the production that they are intended to represent as regards to asphaltic concrete characteristic, rate of production, temperatures, mat width, and thickness.

Construct a sufficient number of strips to determine the number, sizes, and weights of compactors to be used and the number of coverages in which the compactors shall be operated in order to obtain the acceptable density. The density of the test strip will be determined using nuclear density measurements.

A new compaction test strip shall be constructed either when ordered by the Engineer or requested by the Contractor under one or more of the following conditions:

- (a) There is a change in the material or mix design.
- (b) There is reason to believe that a compaction test strip density is not representative of the material being placed or that the underlying material has changed significantly.

Compaction shall be in accordance with the rolling pattern approved by the Engineer. The rolling sequence, the type of compactor to be used, and the maximum roller speed shall be as follows:

ROLLING SEQUENCE	TYPE OF COMPACTOR	MAX. ROLLER SPEED (MPH)
Initial or Pneumatic Tired	Steel Wheel	2 1/2 (4 km/h)
Intermediate	Pneumatic Tired	3 (5km/h)
Finish	Static Steel	3 (5km/h)

- (3) **Documentation.** Fully document all work performed under Subsection 2.2. Documentation shall include, but not be limited to, records of all directions given by the Engineer and the resulting actions by the Contractor. The records of the Contractor's actions shall, as a minimum, include detailed descriptions of the equipment used (including weight and tire pressure), the speed, and the number of coverages. Such records shall be signed daily by the roller operators and the Contractor's superintendent, or other responsible official, and shall be instantly available for inspection by the Engineer. They shall be furnished in total to the Engineer at the conclusion of work under Subsection 2.2.
- (k) **Tolerances.**
- (1) **Surface.** The surface tolerance shall be in conformity with Section 401.
- (2) **Width and Thickness.** The width shall be in reasonably close conformity with the dimensions shown on the Plans or established by the Engineer. The thickness of individual courses and the total thickness of the asphalt concrete pavement shall be in reasonably close conformity with the thicknesses shown on the Plans or established by the Engineer.
- (l) **Opening to Traffic.** Do not permit traffic on the asphalt concrete pavement until it has received its final rolling and has cooled to a temperature such that traffic will not mar the surface or alter the surface texture. Water or other artificial means may be used to assist in cooling.

#### 411.05. METHOD OF MEASUREMENT.

*Plant mix asphalt concrete pavement* including the aggregate, liquid asphalt and other ingredients as specified in the job-mix formula—shall be measured by the ton ( metric ton) of combined mixture.

*Tack coat* will be measured and paid for in accordance with Section 407.

#### 411.06. BASIS OF PAYMENT.

Accepted quantities for plant mix asphalt concrete pavement, measured as provided above, shall be paid for at the contract unit price as follows:

(A)	ASPHALT CONCRETE, TYPE A .....	TON (METRIC TON)
(B)	ASPHALT CONCRETE, TYPE B .....	TON (METRIC TON)
(C)	ASPHALT CONCRETE, TYPE C .....	TON (METRIC TON)
(D)	ASPHALT CONCRETE, TYPE D .....	TON (METRIC TON)
(E)	ASPHALT CONCRETE, TYPE E .....	TON (METRIC TON)
(A1)	ASPHALT CONCRETE, TYPE A (POL. MOD.) .....	TON (METRIC TON)
(B1)	ASPHALT CONCRETE, TYPE B (POL. MOD.) .....	TON (METRIC TON)
(C1)	ASPHALT CONCRETE, TYPE C (POL. MOD.) .....	TON (METRIC TON)
(D1)	ASPHALT CONCRETE, TYPE D (POL. MOD.) .....	TON (METRIC TON)
(E1)	ASPHALT CONCRETE, TYPE E (POL. MOD.) .....	TON (METRIC TON)

Such payment shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.