ITEM 401 ASPHALT CONCRETE PAVEMENTS—GENERAL

401.01 Description. This specification is applicable to all types of asphalt concrete pavements irrespective of gradation of aggregate, kind, and amount of asphalt binder, or pavement use. Deviations from these general requirements are covered in the specific requirements for each type according to the appropriate contract item or items.

Work consists of one or more courses of asphalt concrete constructed on a prepared foundation. The asphalt concrete consists of a mixture of uniformly graded aggregate and specified type and grade of asphalt binder.

The asphalt concrete pavement thickness shown on the plans or stated in the Proposal is for the exclusive use in calculating the weight required to be placed per unit of surface area.

401.02 Mix Design and Quality Control. The quality control and acceptance requirements of Item 403 apply.

If required to perform the mix design or quality control, provide a laboratory and personnel meeting the requirements of Supplement 1041 to perform mix design and quality control tests.

Calibrate asphalt content nuclear gauges according to Supplement 1043 using personnel with a Level 1 rating according to Supplement 1041. Mix and test the calibration verification sample with a Department employee present.

Provide and dispose of the solvent used for cleaning the asphalt content nuclear gauge pans.

401.03 Materials. Furnish materials conforming to:

Asphalt binder (asphalt concrete, 401.14, 401.15)	702.01
Asphalt material (401.14, 401.18)	702.01, 702.04, or 702.13
Aggregates (base courses)	703.04
Aggregates (intermediate and surface courses)	703.05
Mineral filler	703.07

Sample aggregate, asphalt binder, asphalt material, and mineral filler according to 106.01.

If 100 percent of coarse aggregate in an asphalt mix design is steel slag, the Contractor may include steel slag as a maximum of up to 50 percent of fine aggregate. If a steel slag source causes bulking (expansion resulting in flushing or material loss) in asphalt concrete courses, the Laboratory will place limits on the amount of steel slag allowed in a mix design. Bulking may occur when a large percentage of an asphalt mix design is steel slag aggregate. Bulking may be shown through testing, such as ASTM D 4792, or through field failure such as, but not limited to, flushing on newer pavement or apparent over-asphalting in production. The Department may require the steel slag processor at any time to perform additional testing to verify steel slag properties. Potential pavement performance problems due to poor control of steel slag aggregate include bulking, poor gradation and specific gravity control resulting in highly variable void properties, excess soft pieces resulting in pock marks, flushing, etc.

401.04 Reclaimed Asphalt Concrete Pavement. The Contractor may use a blend of new materials in combination with reclaimed asphalt concrete pavement obtained from either a Department or Ohio Turnpike Commission project. The Contractor may use a maximum of 10 percent of reclaimed asphalt concrete pavement without adjusting the JMF, except for surface courses with polymer modified asphalt binder. This percentage is based on the dry weight of all the materials used. Ensure that the combined mixture falls within the gradation limits of the contract item specified.

For surface courses with polymer modified asphalt binder, the Contractor may use a maximum of 10 percent reclaimed asphalt concrete pavement, if it is included in the JMF. Do not allow the amount of reclaimed asphalt concrete pavement in production to exceed 10 percent of the mix by dry weight.

Identify the reclaimed asphalt concrete pavement as to type, source, gradation, and asphalt binder content. Ensure that the stockpile is free of contamination and uniform in composition. Before stockpiling, clean, grade, and compact the proposed sites for storing the reclaimed asphalt concrete pavement to produce a firm, level base. Stockpiles are subject to approval by the DET before use. Do not add additional reclaimed asphalt concrete pavement to an approved stockpile, except if it is being reclaimed concurrently with the production of the asphalt concrete incorporating it.

Ensure that the reclaimed asphalt concrete pavement is the proper size to allow for complete breakdown in the plant. During production, place a 2-inch (50 mm) screen on the cold feed. If mixing is incomplete, place a smaller screen on the cold feed. Due to variations in the reclaimed asphalt concrete pavement gradation, the Department will tolerate a maximum of 5 percent oversize material in the completed mix, provided the Contractor can incorporate it into the work with satisfactory results. Process the reclaimed asphalt concrete pavement to be used in a surface course to a maximum size of 3/4 inch (19 mm) before incorporating the reclaimed asphalt concrete pavement into the mix.

401.05 Mixing Plants. The Department will approve mixing plants before preparation of the mixtures. General requirements for asphalt concrete mixing plants are specified in Item 402.

Set the asphalt binder controls for the computerized plant at the virgin asphalt binder content of the JMF at all times unless change is authorized by the Laboratory.

401.06 Weather Limitations. Place asphalt concrete only if the surface is dry and if weather conditions are such that proper handling, finishing, and compaction can be accomplished. Never place asphalt concrete if the surface temperature is below the minimum established in Table 401.06-1.

Table 401.06-1

Course Thickness	Minimum Surface Temperature	
3.0 inches (75 mm) and over	36 °F[1]	(2 °C[1])
1.5 to 2.9 inches (38 to 74 mm)	40 °F	(5 °C)
1.0 to 1.4 inches (25 to 37 mm)	50 °F	(10 °C)
Less than 1.0 inch (25 mm)	60 °F	(16 °C)
Variable Intermediate, 0 to 3.0 inches (0 to 75 mm)	40 °F	(5 °C)

[1] Instead of 36 °F (2 °C), use a minimum air temperature of 40 °F (5 °C) if paving on an aggregate base or subgrade.

In addition to the above surface temperature requirements, do not place surface courses if the air temperature is less than 40 °F (5 °C).

For Type 1H asphalt concrete or any surface course with a polymer modified asphalt binder, ensure that the surface of the existing pavement is at least 50 °F (10 °C) and the air temperature is at least 50 °F (10 °C).

Do not place any Type 1H asphalt concrete or any surface course with a polymer modified asphalt binder after November 1, regardless of pavement or air temperature.

401.07 Notification. Notify the Engineer at least 24 hours before starting paving on a project. After starting paving, if paving operations are stopped for 1 week or more, notify the Engineer at least 24 hours before resuming paving on a project.

401.08 Asphalt Binder Preparation. Heat the asphalt binder and deliver it to the mixer within the temperature range specified in Table 702.00-1. Do not use asphalt binder while it is foaming.

401.09 Aggregate Preparation. Feed aggregates in their proper proportions and at a rate to permit correct and uniform control of heating and drying. Remove all aggregates in the plant that will produce a mix outside the temperature limits or that contain excessive moisture or expanding gases causing foaming in the mixture, and return them to the proper stockpiles.

401.10 Mixing. Maintain the temperature of the mix at the plant within the range set by the Laboratory for the JMF. The Engineer will determine the required temperature of the mixture on arrival at the project site based on the temperature range set for the mix design and heat losses in transit.

For batch plants, after all of the aggregate is in the mixer, add the asphalt binder in an evenly spread sheet over the full length of the mixer. The mixing time is defined as the interval between the start of application of the asphalt binder and the opening of the mixer gate. Discharge all asphalt binder required for one batch in not more than 30 seconds. After the asphalt binder is added, the Laboratory will establish a minimum mixing time, which will not be less than 30 seconds.

401.11 Hauling. Use trucks for hauling asphalt concrete that have tight, clean, smooth metal beds from which the entire quantity of mixture is discharged smoothly into the spreading equipment.

Before loading, apply a thin coating of an approved release agent to the inside surfaces of the truck bed to prevent adhesion of mixture to the bed surfaces. The Laboratory maintains a list of approved release agents. Do not use fuel oil for this purpose. Drain truck beds before loading.

Provide a place off the project for cleaning trucks when hauling polymer modified asphalt binder mixes or when excessive sticking of material in truck beds occurs. If the Contractor does not resolve excessive sticking of material in truck beds in a reasonable time and the sticking is in areas of the truck that would indicate excessive cooling of the mix (front corners, bottom, etc.) due to a long haul, the Engineer will require an insulated bed. The Contractor may only make changes in policy regarding release agents for beds or other procedure changes for better mix handling at the discretion of the Laboratory.

Equip each truck with a securely fastened, waterproof cover of suitable material to adequately protect the mixture from wind and weather. At the request of the Engineer, remove covers before dumping into the paver.

If transporting hot asphalt concrete at prevailing air temperatures below 50 °F (10 °C) or if the length of haul exceeds 20 miles (32 km), insulate all truck beds to maintain workable mix temperature, and ensure that all covers are fastened to exclude the wind. Do not exceed a distance of 50 miles (80 km) from the asphalt concrete plant to the paving site except by specific permission of the Department.

401.12 Spreading Equipment. Use self-contained spreading equipment of sufficient size, power, and stability to receive, distribute, and strike-off the asphalt concrete at rates and widths meeting the typical sections and other details shown on the plans. Use spreading equipment that has automatic control systems that maintain the screed in a constant position relative to profile and cross-slope references. These references shall be such that control of the screed position is reasonably independent of irregularities in the underlying surface and of the spreader operation. The Engineer will base approval of spreading equipment on the demonstrated capability of the equipment to place the mixture to the required cross-section, profile and alignment in an acceptable, finished condition ready for compaction.

Where the use of standard full-scale spreading equipment is impractical due to the size or irregularity of the area to be paved, use specialized equipment or hand methods approved by the Engineer to spread the asphalt concrete.

401.13 Rollers. Use only steel wheel and pneumatic tire types of rollers meeting the minimum requirements of the following tables. Conform to manufacturer's specifications for all ballasting.

Table 401.13-1 ROLLER CAPACITY

Roller Type	Maximum Capacity square yards per hour (m^2/hr)
Tandem	700 (600)
Three-Wheel	700 (600)
Trench	15 per inch width (13 per 25 mm width)
Pneumatic Tire, Type 1	1000 (850)
Pneumatic Tire, Type 2	700 (600)
Vibratory, Vibrating Roll	15 per inch width (13 per 25 mm width)
Vibratory, Static Roll (not vibrating)	3 per inch width (3 per 25 mm width)

Table 401.13-2 STEEL WHEEL ROLLERS

Roller Type	Three-Wheel	Tandem	Vibratory Static	Trench
Total weight, tons (metric tons)	10 (9)	8 to 12 (7 to 11)	8 to 12 (7 to 11)	
Compression rolls, pounds per inch width (kN/m), minimum	300 (53)	200 (35)	120 (21)	300 (53)

Table 401.13-3 PNEUMATIC TIRE ROLLERS

Type I	
Tire size, minimum	9.00 × 20 in (229 × 508

	mm)
Wheel load, minimum	5000 lb (2250 kg)
Average tire contact pressure, minimum	85 psi (590 kPa)
Type II	
Tire size, minimum	7.50 × 15 in (191 × 381 mm)
Wheel load, minimum	2000 lb (900 kg)
Average tire contact pressure, minimum	55 psi (380 kPa)

For pneumatic tire rollers, use self-propelled, reversible units with vertical oscillation on all wheels on at least one axle. Determine the tire inflation pressure necessary to meet the specified minimum contact area and contact pressure requirements. Furnish the tire manufacturer's charts or tabulations to the Engineer for verification of the required inflation pressure. Check tire inflation pressure as the Engineer directs and maintain it within 5 pounds per square inch (35 kPa) of the required pressure.

Provide rolls and wheels with the necessary accessories to prevent adhesion of the mixture, and keep them properly moistened with water, water containing a detergent, or water containing an approved additive. Do not use excess liquid.

401.14 Conditioning Existing Surface. Clean the surface on which the asphalt concrete is to be placed, and keep it free of accumulations of materials that would, in the judgment of the Engineer, contaminate the mixture, prevent bonding, or interfere with spreading operations. Where approved subgrade or pavement courses previously constructed under the Contract become loosened, rutted, or otherwise defective, correct the deficiency according to the contract item or items involved before the spreading of a subsequent pavement course.

If a quantity of asphalt concrete is specified for use in spot leveling or patching an existing pavement surface, spread and compact the material needed to effect the corrections as directed by the Engineer.

Paint contact surfaces of curbing, gutters, manholes, and other structures with a thin, uniform coating of asphalt material before placing the asphalt concrete against them.

If placing asphalt concrete against the vertical face of an existing pavement structure, clean the vertical face of foreign material and apply asphalt material that results in a coating of approximately 0.25 gallon per square yard (1 L/m^2).

Before placing a surface course onto an intermediate course, apply a tack coat to the intermediate course according to 407.06.

In areas where the surface is required to be feathered to meet an adjoining surface, coat the existing surface uniformly with a thin coat of asphalt binder.

401.15 Spreading and Finishing. Spread the mixture at a rate calculated using the specified thickness and the compacted width of the pavement course being placed, and the weight-to-volume conversion factors established in 401.21. Maintain the actual rate of spreading the mixture equal to the required calculated rate within the tolerance specified in 401.19. For pavement courses specified for leveling an existing pavement surface, the actual rate of spreading the mixture may vary from the required calculated rate as approved by the Engineer to accomplish the intended purpose.

For intermediate courses, make the maximum compacted depth of any one layer 3 inches (75 mm).

Spread and finish the mixture using approved equipment or methods such that compaction can follow immediately. Preheat screeds before placing any asphalt concrete. Use side plates sufficient to contain the mixture laterally during spreading. If paving in excess of the nominal paver width, use only a permanent extension or an adjustable extension with full auger extensions when matching a previously placed pavement course. Use extensions that have the ability to heat. The Contractor may use strike-off plates on adjacent berm areas. Perform supplemental hand forming and tamping where irregularities develop and where placing the mixture by hand methods.

Ensure that the mixture as spread and finished is uniform in composition and surface texture. Correct conditions causing objectionable segregation of the mixture components or irregularities in surface texture in a manner satisfactory to the Engineer. Remove and replace, or otherwise correct, any portion of the pavement course found to be defective in surface texture or composition before or after compaction in a manner satisfactory to the Engineer. Coordinate the spreading operation with the rate of production and delivery of the mixture to attain uniform, continuous progress. Avoid erratic spreader operation due to irregular contact with the hauling vehicle, surging in the feed and distribution of the mixture, or other cause. Maintain sufficient control of the spreading equipment with regard to line and grade references so that the pavement course, when compacted as specified, is in reasonable conformance with the Contract Documents.

Do not displace or damage bridge deck waterproofing membranes during spreading operations on the membranes.

Do not allow traffic on the compacted mixture until it has cooled sufficiently to prevent glazing as determined by the Engineer.

After completion of the surface course, seal gutters with asphalt binder as directed by the Engineer. Apply the material at a uniform width of approximately 4 inches (100 mm) and at a rate just sufficient to fill surface voids.

401.16 Compaction. Immediately after spreading the asphalt concrete and adjusting any surface irregularities, compact the mixture uniformly using rollers conforming to 401.13. Do not use a spreading rate that exceeds the total of the specified capacities of the rollers in use; however, if compacting a mixture spread as an intermediate or pre-leveling course less than 1

inch (25 mm) thick, do not use a spreading rate that exceeds twice the total capacity of the rollers in use.

Coordinate the spreading of the mixture with the required roller coverage, considering the rate of cooling of the mixture as affected by lift thickness and environmental conditions. Complete the required roller coverage during the period of time in which the temperature of the mixture is sufficient for the roller coverage to be effective in compacting the mixture.

Compact base mixtures using a combination of both steel and Type I pneumatic tire rollers; however, in small areas, compact these mixtures as approved by the Engineer using any of the rollers specified in 401.13.

Compact intermediate and surface mixtures using a three-wheel roller in the breakdown position (roller immediately behind the paver) of the roller train; however, in small areas, compact these mixtures as approved by the Engineer using any of the roller types specified in 401.13.

Compact variable depth courses using a combination of both steel and pneumatic tire rollers; however, in small areas, compact these mixtures as the Engineer approves using any of the roller types specified in 401.13.

For Type 1H asphalt concrete or mixes using a polymer modified asphalt binder, give a copy of the JMF approval letter containing the design compaction temperature to the Engineer before any mix is placed. Ensure that the mix temperature immediately before rolling is not less than 290 °F (145 °C). Pneumatic tire rollers are not recommended for polymer asphalt concrete because of excessive pick up.

Do not use vibratory rollers on courses with a thickness under 1 1/2 inches (38 mm).

If using vibratory rollers, supplement them with three-wheel or pneumatic tire rollers.

Unless otherwise directed, begin rolling at the sides and proceed longitudinally parallel to the centerline at a slow, uniform speed. After each coverage or complete round trip, move the roller towards the crown of the road to begin its next pass, overlapping the previous pass by at least one-half the width of the previous pass. On superelevated curves, begin rolling at the low side and progress toward the high side. Where a longitudinal joint is being made, roll the joint then follow the applicable rolling procedure.

Continue rolling until full coverage of the course is complete and all roller marks are eliminated. Take care to prevent displacement of the edgeline and grade. Where displacement occurs, correct the area immediately in a manner satisfactory to the Engineer.

Along curbs, headers, walls, and in other areas not accessible to rollers, thoroughly compact the mixture with hot, hand tampers or with mechanical tampers. On depressed areas, the Contractor may use trench rollers or rollers fitted with compression strips.

Replace mixture that becomes loose, broken, contaminated, or otherwise defective with fresh, hot mixture. Compact it to match with the surrounding area.

401.17 Joints. Place the asphalt concrete mixture as continuous as possible. Set up joints at the proper height above the adjacent construction to receive maximum compaction. Where the edge of the new surface has been significantly rounded by the action of traffic, trim it to a vertical face before placing the adjacent pavement. On projects where traffic is allowed to cross the edge of the new pavement lane, complete the longitudinal joint of the adjacent lane or berm within 24 hours.

Form hot longitudinal joints using pavers operating in contiguous lanes, one just ahead of the other. Maintain the distance between pavers in adjacent lanes such that it does not exceed the distance that a normal size load of mixture will cover. Alternate loads of mixture between the pavers. Do not allow rollers performing the initial rolling operation in one lane closer than 12 inches (0.3 m) to the longitudinal joint until the adjacent lane is placed.

Instead of hot joint construction using multiple pavers, the Contractor may use full width construction with a single unit paver.

Compact all cold longitudinal joints on intermediate and surface courses using a three-wheel roller.

For surface courses, form or cut all transverse construction joints to a vertical.

Seal all cold longitudinal and transverse construction joints on surface courses, and any asphalt concrete course that is open to traffic for more than 30 days, by coating the vertical face of the cold joint with asphalt material, applied at a rate of 0.25 gallon per square yard (1 L/m^2).

401.18 Asphalt Binder Compatibility. If excess fat spots, regular random areas of flushing, or excess drain down occur on a project that are not attributable to over rolling, plant operation, or mix quality compared to the JMF, the Department will consider the asphalt binder incompatible. The Department will reject any on-hand asphalt binder because of incompatibility. The Department may use its discretion in determining if problem areas can be corrected, but if an unsafe condition exists, remove and replace the area in question. Demonstrate to the Laboratory through reporting actual testing analysis the compatibility of another asphalt binder and that proper equipment is in place in order to be allowed to resume.

401.19 Spreading and Surface Tolerances. If a uniform course is specified, make checks and adjustments to maintain the rate of spreading within a tolerance of ±5 percent of the required calculated weight per unit of area.

If a variable depth course is specified, place the mixture as shown on the plans.

If a longitudinal profile is specified by elevations on the plans, the longitudinal profile of the completed pavement surface shall not deviate from parallel with the specified profile by more than 7/8 inch in 50 feet (21 mm in 15 m). Before placing the surface course, check the profile of

the preceding course at 50-foot (15 m) intervals along the outside edge of each traffic lane and along any additional line described in superelevation tables, and submit a tabulation of the results to the Engineer for approval. Perform corrective work necessary for compliance with the profile tolerance before placing the surface course. The requirements of this paragraph do not apply to small incidental areas of pavement less than 500 feet (150 m) in length.

Do not vary the transverse slope of the surface of the completed course from the specified slope by more than 3/8 inch in 10 feet (10 mm in 3 m).

Do not vary the surface of each completed intermediate or surface course from the testing edge of a 10-foot (3 m) straightedge by more than 1/4 inch (6 mm). Furnish straightedges and straightedges equipped with levels or other devices satisfactory to the Engineer. The Engineer will check the surface course for variations in slope or surface.

Correct variations in excess of slope or surface tolerance by removing mixture to neat lines and replacing, or by surface grinding in a manner satisfactory to the Engineer.

401.20 Asphalt Binder Price Adjustment. Any contract item specifying asphalt concrete is eligible for a price adjustment, if the Department's asphalt binder index shows the price for asphalt binders has increased or decreased in excess of 5 percent and the adjustment is more than $100 for any individual item.

If the ratio of the placing index (*PI*) to the bidding index (*BI*) is greater than 1.05 or less than 0.95, the Department will adjust compensation the Contractor receives for work done each month under contract items specifying asphalt concrete. The adjustment will apply to the price for asphalt binder used in those contract items according to the following formula:

Where:

PA = price adjustment

C = *BI* × percent virgin asphalt binder / 100

PI = placing index *

Q = quantity of asphalt concrete in tons (metric tons)

BI = bidding index *

* Use the PG Binder grade for the asphalt binder used.

The *PI* is the average F.O.B. price for the PG Binder grade specified, as quoted by a majority of Ohio suppliers for the month the asphalt concrete is placed. The Department will secure the prices on the first business day of each month and will post the *PI* for each PG Binder grade in the Office of Contracts. The Department will use the Metric Placing Index if the project is in metric units; otherwise, the Department will use the English Placing Index. Only the calculated average prices will be available. If the price is not available from a majority of the Ohio suppliers, then the Director's determination will be final.

The *BI* is equal to the *PI* for each PG Binder Grade for the month immediately before the month the project is bid. The Department will use the Metric Placing Index if the project is in metric units; otherwise, the Department will use the English Placing Index.

The percent of virgin asphalt binder used to calculate *C* is determined from the approved JMF.

The quantity of asphalt concrete items (*Q*) is the authorized constructed quantity in tons (metric tons) placed in the month being considered. If the contract item is in cubic yards (cubic meters), the Department will convert the volume into tons (metric tons) using the conversion factor established according to 401.21.

If contract items specifying asphalt concrete are placed beyond an approved Contract Completion Date and liquidated damages are applied for completion of the contracts, the Department will base price adjustments on either the *PI* for the last month before liquidated damages were applicable or the *PI* for the actual month of placing, whichever is less.

At a minimum, the Department will calculate and apply price adjustments at the end of each construction season and as soon as practical after the completion of the project.

401.21 Method of Measurement. The Contractor is responsible for recording the net weight of each truckload of mixture to the nearest 100 pounds (50 kg) in triplicate on plant ticket forms approved by the Department. If the pay quantities are established by platform scales, the Contractor shall provide a tare weight for each truck at the beginning of each day's operation and a minimum of every 4 hours of operation each day. The Engineer may require additional tare weight measurements at any time. The Engineer will have the right to monitor all weighing operations and may require reweighing trucks at any time or location. The Contractor shall correct any discrepancies immediately. Continued non-compliance will result in the Department taking necessary and appropriate action, such as, but not limited to, assigning a Department ticket writer to the plant. The Contractor shall send one copy of the plant ticket with each load delivered to the paver and shall present it to the Engineer.

The Engineer will convert the total of the weights recorded on the plant tickets representing mixture finished according to contract requirements to cubic yards (cubic meters) using a conversion factor established by the Laboratory. The Laboratory will establish this conversion factor from the approved JMF. However, if a mix design is not available, the Laboratory will use the conversion factors in Table 401.21. If a uniform course is specified, the Department will not pay for a number of cubic yards (cubic meters) that exceeds the quantity calculated from plan lines and dimensions.

Table 401.21

Aggregate	lb/yd^3	(kg/m^3)
Gravel and stone	4000	(2370)
Slag, less than 90 lb/yd^3 (less than 1450 kg/m^3)[1]	3600	(2135)
Slag, 90 to 100 lb/yd^3 (1450 to 1600 kg/m^3)[1]	4000	(2370)
Slag, more than 100 lb/yd^3 (more than 1600 kg/m^3)[1]	4300	(2550)

[1] Based on average dry rodded weight at the Laboratory.

401.22 Basis of Payment. The Department will pay for all work performed and measured as specified above according to the appropriate contract items for each type.

For asphalt material used to seal the cold longitudinal joint according to 401.17, the Department will pay for accepted quantities at the unit bid price for Item 407 Tack Coat. If the Contract does not include the pay item 407 Tack Coat, the cost of sealing the joints is included in the unit price bid for the asphalt concrete.

The Department will assess all costs against the Contractor that it incurs as a result of taking necessary and appropriate action due to the Contractor's continued non-compliance.

If an unsafe condition exists, the Department will not pay for removing and replacing incompatible asphalt binder areas.