

DIVISION 300

2018 AMENDED SECTION 304

ASPHALTIC CONCRETE PAVEMENT

304.01 Description.

The work specified under this section shall consist of one or more courses of bituminous mixture constructed on a prepared foundation and in reasonably close conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans or established by the Engineer. This article also addresses asphaltic concrete pavement repairs performed as part of the installation of some appurtenance.

304.02 Materials.

- A. General. The asphaltic pavement shall be hot mixed at a central plant. It shall consist of mineral aggregates, uniformly mixed with asphalt cement and laid upon the prepared base to the finished thickness shown on the typical cross-section on the plans or as directed by the Engineer. The composition of the combined mineral aggregate shall be crushed gravel.

- B. Crushed Gravel Gradation. Crushed gravel shall consist of clean, hard, durable, stone particles which have been crushed, screened, and otherwise processed to meet the following requirements. The thickness and grading type shall be as specified in the Special Provisions.

TABLE 1 – GRADATION REQUIREMENTS*

<u>Sieve</u>	<u>% Passing, Nominal Maximum Aggregate Size</u>		
	<u>3/4" (19 mm)</u>	<u>1/2" (12.5 mm)</u>	<u>3/8" (9.5 mm)</u>
<u>1 1/4" (31.5 mm)</u>	<u>-</u>	<u>-</u>	<u>-</u>
<u>1" (25 mm)</u>	<u>100</u>	<u>-</u>	<u>-</u>
<u>3/4" (19 mm)</u>	<u>90-100</u>	<u>100</u>	<u>-</u>
<u>1/2" (12.5 mm)</u>	<u>55-90</u>	<u>90-100</u>	<u>100</u>
<u>3/8" (9.5 mm)</u>	<u>45-85</u>	<u>55-90</u>	<u>90-100</u>
<u>No. 4 (4.75 mm)</u>	<u>30-65</u>	<u>35-70</u>	<u>45-85</u>
<u>No. 8 (2.36 mm)</u>	<u>20-50</u>	<u>20-55</u>	<u>30-65</u>
<u>No. 30 (600 μm)</u>	<u>5-30</u>	<u>5-35</u>	<u>10-40</u>
<u>N0. 200 (75 μm)</u>	<u>2-7</u>	<u>2-7</u>	<u>2-7</u>

*- The proposed combined grading shall fall within these limits

- C. General. Aggregate shall be composed of coarse and fine aggregates combined in the proper proportions to meet the grading requirements shown above. Aggregates shall be composed of clean, tough, durable fragments, free from an excess of flat, elongated, soft, or disintegrated pieces and free from fragments coated with dirt or other objectionable matter.

- D. Coarse Aggregate. Coarse aggregate shall be crushed stone or crushed gravel of such gradation that when combined with other required aggregate fractions and fillers in proper proportion, the resultant mixture shall meet the gradation required under the composition of mixture for the specific type under contract. The crushed aggregate shall have a percentage of wear of not more than 40 at 500 revolutions when tested in accordance with ASTM C131 and have a minimum 55% two fractured faces (ASTM D5821). The magnesium sulfate soundness loss shall not exceed 18% in accordance with ASTM C88, and the material shall be non-plastic.
- E. Fine Aggregate. Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. The fraction passing the No. 200 (75 μ m) sieve shall not be greater than two-thirds (2/3) of the fraction passing the No. 40 (425 μ m) sieve. The fraction passing the No. 40 (425 μ m) sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than three (3), except that when the plasticity index is non-plastic (NP), the liquid limit shall be not more than 30. The sand equivalent shall be a minimum of 40 (ASTM D2419). The fine aggregate angularity shall be a minimum of 40 (ASTM C1252).
- F. Reclaimed Asphalt Pavement (RAP). RAP in an amount not to exceed 10% by weight of dry aggregate may be used. RAP shall be crushed and screened such that 100% of the RAP used passes a 2" (50 mm) sieve. The RAP shall be stockpiled separately. The source of RAP shall be identified in the mix design submittal, and shall not be changed without written authorization from the City or their designated representative. Mix designs including RAP shall note the amount of virgin binder to be added. ***NOTE: The addition of RAP in excess of 10% shall constitute sufficient grounds for removal and replacement of all asphalt concrete placed on the project and prohibition of the use of RAP for the remainder of the project.***
- G. Performance-Graded Asphalt Binder (PGAB). For full-depth new construction, PG 64-28 binder shall be required unless otherwise specified in the Special Provisions. For construction of overlays over existing asphaltic concrete pavement, the binder shall be the Contractor's option of PG 64-22 or PG 64-28 unless otherwise specified in the Special Provisions. Performance-Graded binders with higher upper specification temperatures, decreased lower specification temperatures, or both, may be substituted upon written notice to the City or their designated representative. PGAB shall meet the requirements of Section 804.1, Performance Graded Asphalt Binder, of the current version of the Wyoming Department of Transportation Standard Specifications for Road and Bridge Construction.
- H. Warm Mix Asphalt (WMA). The use of Warm Mix Asphalt technology is allowed, subject to the submittal requirements herein. When warm mix additives are proposed, provide the following information in addition to the mix design information at least two (2) weeks prior to start of paving:
1. WMA technology and/or WMA additives information;
 2. WMA technology manufacturer's established recommendations for usage;
 3. WMA technology manufacturer's established target rate for water and additives and the acceptable variation for production; and

4. WMA technology material safety data sheets (MSDS) or safety data sheets (SDS); For mixtures to be produced with plant foaming equipment, provide the equipment manufacturer and model, the manufacturer's recommendations for rate of water addition and recommended operation parameters, and calibration information. For all WMA technology, provide:

1. Temperature range for field mixing; and
2. Temperature range for field compacting;
3. Allowable ambient temperatures;
4. Any necessary adjustments to curing or aging times for QC/QA testing.

Use equipment and WMA technologies capable of producing an asphalt mixture to meet the requirements specified herein and in the Special Provisions that is workable at the proposed mixing and compaction temperatures. The use of WMA technology in no way relieves the Contractor of the responsibility for meeting all other requirements.

- I. Certificates of Compliance. Certificates of compliance for each consignment of PGAB shall be furnished by the Contractor to the City or their designated representative in accordance with the requirements of Division 400, Section 403.06 of the specifications.

304.02 Paving Plant Requirements.

A. General Requirements.

1. Uniformity. The plant shall be so designed and operated as to produce a job mixture whose permissible variance from the mix design shall be as follows:

Amount passing on the No. 4 (4.75mm) sieve and larger +/- 7%
Amount passing on the No. 8 (2.36mm) to No. 100 (150um) sieves +/- 5%
Amount passing on the No. 200 (75um) sieve +/- 2.0%
Asphalt Cement +/- 0.5%
Laboratory air void content +/- 1.5%

1. Paving Plant Inspection. For verification of weights or proportions, including RAP content, and character of materials, and determination of temperatures used in the preparation of mixture, the City or their designated representative(s), shall have access at any time to all parts of the paving plant and shall, upon request, receive copies of production records including the proportions and/or quantities of materials used.
 2. Composition of Mixtures. Mixing temperatures for bituminous mixes shall be determined by the submitted and approved mix design and recommendations of the binder supplier.
- B. Asphaltic Pavement Mixture Design Criteria. The proposed mixture may be designed using either the Marshall or Superpave method in accordance with the criteria listed below.

Property	Marshall	Superpave
Number of blows	50	-
Marshall Stability (lbs (N)) – minimum	1500 (6700)	1500 (6700) ¹
Marshall Flow (0.01 in (0.25 mm))	8-16 (8-16)	8-16 (8-16) ¹
Number of gyrations	-	50
Air Voids – mix design target (%)	4.0	4.0
Air Voids – production target (%)	3.0	3.0
Air Voids – at N _{initial} = 6 gyrations - minimum (%)	-	8.0
Air Voids – at N _{max} = 75 gyrations - minimum (%)	-	2.0
Tensile Strength Ratio (TSR-ASTM D1075) – min ²	75	75
Voids Filled with Asphalt Binder	65-78	65-78

¹Marshall Stability and Flow shall be determined for Superpave mixes. Either gyratory or Marshall compaction may be used to compact the Marshall Stability specimens.

²if an antistripping agent is used, the agent and rate of application shall be noted in the mix design.

Percent Voids in Mineral Aggregate (VMA).

Nominal Maximum Aggregate Size and Range of Required VMA		
¾” (19 mm)	½” (12.5 mm)	3/8” (9.5 mm)
13.0-16.0	14.0-17.0	14.0-17.0

304.04 Construction.

A. General Conditions.

1. Proofrolling. Prior to the placing of any hard surfacing material upon the subgrade/subbase/base, such subgrade/subbase/base shall be proofrolled. Notice of proofrolling shall be provided to the City or their designated representative sufficiently in advance of the operation to allow the City or their designated representative to observe the proofrolling. The proofrolling shall be done by a pneumatic-tired roller with tires having a ground contact pressure of 85-90 psi. (585-621 kPa) or a fully-loaded 4,000-gallon, three-axle water truck. The entire area upon which hard surfacing is to be placed must be rolled. When proofrolling shows an area to be unstable, such area shall be brought to satisfactory stability by additional compaction, reworking, or removal of unsuitable material and replacement with acceptable material. If paving operations have not begun within twenty-four (24) hours after approval, a repeat of the proofrolling may be required.
2. Weather Limitations. Bituminous plant mix shall not be placed on any wet or frozen surface or when the temperature of the surface on which the bituminous plantmix is to be placed is less than those specified in the following table; or when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixtures:

Surface Temperature Limitations

<u>Compacted Thickness</u>	<u>Surface Course</u>	<u>Subsurface Course</u>
Less than 1" (25mm)	60° F (15.5°C)	55° F (13°C)
1" to 2",(25-50mm) inclusive	50° F (10°C)	45° F (7°C)
More than 2"(50mm) to and including 4"(100mm)	45° F (7°C)	35° F (1.7°C)
More than 4"(100mm)	N/A	25° F (-4°C)

- i. The meanings of the terms "surface course" and "subsurface course" applies to this subsection only, and shall be as follows:
 - a. Any plant mix pavement overlaid with surface course on the same contract is considered a subsurface course.
 - b. Plant mix bituminous base is considered a subsurface course.
 - c. Spot leveling or the bottom lift of a leveling course may be placed at 35° F (1.7°C) if additional courses are placed on the same contract.

- B. Transportation of Mixture. The mixture shall be transported from the paving plant to the work in vehicles equipped with tight metal compartments previously cleaned of all foreign materials. When necessary, the compartments shall be suitably insulated and each load shall be covered with canvas or other suitable materials of sufficient size to protect it from weather conditions. The inside surface must be lightly lubricated with an asphalt (load-bed) release agent from the WYDOT Materials Acceptance – Manufactured Products Qualified Products list just before loading, but excessive release agent will not be permitted.

- C. Placing Asphalt Mixture. The mixture shall be delivered on the work site at a temperature sufficient to allow for adequate workability and densification. Final rolling and density of the bituminous surface, subsurface, or leveling courses must be obtained prior to the mixture reaching a minimum temperature of 180° F (82°C).
 1. Unless otherwise permitted by the City or their designated representative, the mixture shall be spread by means of a mechanical self-powered paver, capable of spreading the mixture true to the line, grade, and crown shown on plans. Hand-placing and spreading will be permitted only in irregular areas where it is impractical to use a paving machine.
 2. Pavers shall be equipped with hoppers and distributing screws of the reversing type to place the mixture evenly in front of adjustable screeds. The mixture shall be dumped in the center of the hoppers and care exercised to avoid overloading and spilling over the mixer upon the base. Pavers shall operate, when laying mixtures, at such speed for a consistent and uniform laying of the mixture.

3. Pavers shall be equipped to automatically control the laying of the mixture to specified transverse slope and established longitudinal grade. The paver control system shall be automatically actuated from an independent line and grade control reference through a system of sensors and sensor-directed devices which shall maintain the paver screed at the proper transverse slope and height to establish the top surface of the compacted mixture at specified slope and grade.
 4. The screed or "strike-off" assembly shall produce the specified finished surface without tearing, shoving, or gouging, and which produces a finished surface of the evenness and texture specified. The screed shall be adjustable as to level and shall have an indicating level attached and shall be vibrating.
 5. Immediately after any course is screeded, and before roller compaction is started, the surface shall be checked, and all inequalities adjusted. Irregularities in alignment and grade along the outside edge shall also be corrected by the addition or removal of mixture before the edge is rolled.
 6. In narrow, deep, or irregular sections, intersections, turnouts, or driveways where it is impractical to spread and place asphalt mixes by machine methods, the Contractor may use approved spreading equipment or acceptable hand methods as allowed by the City or their authorized representative. Excessive loose rock shall be removed from surface prior to rolling the patch.
 7. The placing of the mixture shall be as continuous as possible.
- D. Joints. Transverse construction joints shall be made in a careful manner. The edge of the previously laid course shall be cut back as far as is necessary to eliminate irregularities incidental to finishing and rolling. After laying the finished mixture adjacent to a transverse construction joint, a skilled laborer shall follow up each rolling with a straightedge and corrective measures to insure a smooth riding surface.
1. Longitudinal joints against both hot and cold material shall be made with equal care. Mixtures spread and compacted (or partially compacted) by the machine shall not be disturbed by a rake in dressing the joint, unless one side is too high, nor shall surplus mixture be spread or scattered back of the machine when not needed to build up low spots. When spreading next to a warm or cold edge of a previously laid section of surfacing, the machine shall be adjusted to leave a "bead" of material, roughly one inch (1") (25mm) by one inch (1") (25mm), which shall be rolled in to compensate for uneven density at the joint. If one side of the joint is cold, the "bead" shall be moved back of the rake to the warm side of the joint but otherwise the machine-laid mixture shall not be disturbed.
 2. In making the joint along any adjoining edge such as curb, gutter, or an adjoining pavement, and after the hot mixture is placed by the finishing machine, just enough of the hot material shall be carried back to fill any space left open, and provide a small "bead" of extra material. This joint shall be properly "set-up" with the back of the

rake at proper height and bevel to receive the maximum compression under rolling. The work of "setting-up" this joint shall always be performed by competent workmen, who are capable of making a correct, clean, and neat joint.

E. Bonds Between Existing and New Asphalt.

1. In order to obtain a good bond between existing and new asphalt pavements, all areas where the existing pavement is cut for the installation of an appurtenance or structure the Contractor shall saw cut, cold mill, or otherwise remove to a neat line the full depth of the existing asphalt pavement a minimum of twelve inches (12") (300mm) beyond the excavation. This entire edge shall be properly coated with bituminous tack coat prior to the installation of the new asphalt pavement. The new pavement section shall be applied in two (2) lifts. In addition, as directed by the City or their authorized representative, after the first lift is applied, the edge of the old asphalt pavement shall be milled down to the level of the first lift of the new pavement section or a minimum of one and one-half (1½") (37.5mm) from the surface. The milling shall extend at least twelve (12") (300mm) beyond the saw cut. The milled surface shall be thoroughly cleaned and have bituminous tack coat applied to and coated to cover the entire edge before applying the second lift. The second lift will then be applied overlapping the milled surface and the new first lift of the new pavement. If the second lift cannot be applied immediately after compaction of the first, the first lift shall have tack applied to its surface before the application of the second.

F. Compaction of the Mixture. As soon as the mixture will carry the compaction equipment without undue shoving or displacement, it shall be compacted with self-propelled rollers. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment which results in excessive crushing of the aggregate will not be permitted.

1. Rollers shall be self-propelled and capable of reversing without backlash. Pneumatic-tired rollers shall be equipped with covers or skirting to maintain tire temperature. Vibratory rollers shall be equipped with a variable amplitude and frequency system. Rollers and/or roller operation that adversely affect the surface of the plant mix pavement shall not be used.
2. All rollers shall be maintained in good mechanical condition, and those that cannot be driven along a straight path or operated without jerking, shall not be used. No leakage of petroleum products from any roller shall be allowed to come in contact with pavement being constructed, nor shall any roller be permitted to stand motionless on any portion of the work. The surfaces of all roller wheels shall be misted with sufficient water and/or asphalt release agent to prevent the pickup of bituminous materials, but under no circumstances shall the quantity of water or release agent used be detrimental to the surface of the pavement being rolled. Water shall not be applied directly in any manner to the asphalt surface.

3. As soon as the layer of asphalt concrete has been placed, it shall be thoroughly compacted by rolling. Except when compacting lifts greater than four inches (4") (100mm) in compacted thickness, rolling shall be commenced along the lower edge of the area to be rolled and continued until the edge is thoroughly compacted, after which the roller shall be gradually advanced to the crown point, both sides being rolled in like manner. Rolling shall be continued until the pavement layer has become thoroughly compacted throughout and is true to grade and cross-section.
4. For lifts greater than four inches (4") (100mm) in compacted thickness, rolling shall be commenced in the middle of the mat, after which the roller shall be gradually advanced to both edges. The roller should be advanced to a supported edge first, if applicable. Rolling of an unsupported edge should be delayed as long as possible, provided the required densities are obtained after the completion of the finishing rolling.
5. The finish rolling of the surface course shall be done with a tandem steel-wheeled roller until all roller marks are eliminated.
6. Along curbs, headers, manholes, and similar structures, and at all places not accessible to the roller, thorough compaction must be secured by any means necessary to produce a uniform surface finish and the required compacted thickness. At all contacts of this character, the joints between these structures and the surface mixture must be effectively sealed with a bituminous tack coat.
7. After final compaction, the surface course shall conform with the following requirements:
 - i. It shall be smooth and true to the established crown and grade. It shall have the average thickness specified and shall at no point be more than one-fourth inch (1/4")(6.25mm) less than the thickness shown on the typical cross-sections on the plans. Any low or defective places shall immediately be remedied to the satisfaction of the City or their designated representative by overlay or cutting out the course at such spots and replacing it with fresh, hot mixture which shall be immediately compacted to conform to the surrounding areas and shall be thoroughly bonded to it. The surface of the finished pavement shall be free from depressions exceeding one-fourth inch (1/4")(6.25mm) as measured with a ten foot (10') (3m) straight edge in any direction, and shall be free of puddles, "bird baths," or areas that do not drain.
 - ii. Areas that meet the thickness requirements but fail the smoothness requirements shall be corrected to the satisfaction of the City or their designated representative by overlay, removal and replacement, or diamond grinding. The grinder, if used, shall be a power-driven, self-propelled machine with a minimum 3-foot (1 m) wide cutting head and effective wheelbase of not less than 12 feet (3.5 m). The grinding equipment shall not cause excessive raveling, aggregate fracturing, or spalling. Bush hammers or other impact devices will not be allowed. Areas

corrected by diamond grinding shall be extended such that the completed correction appears workmanlike, neat, and is approximately rectilinear. Tack coat shall be applied to all areas that have been diamond ground.

- iii. Areas that fail to meet the thickness requirements shall be corrected by removal and replacement, overlay, reduced compensation, or through other remedy acceptable to the City or their designated representative. Upon approval of the City or their designated representative, additional coring may be performed to assess the severity and extent of any thickness deficiency. Additional coring shall be at the expense of the Contractor.
8. At no point shall the density of the binder and surface course be less than 93% of the theoretical maximum (Rice) specific gravity. Longitudinal joints shall be at least 91% of the theoretical maximum (Rice) specific gravity, measured within six (6) inches of the joint. (See Division 400, Section 402.03.)
- G. Construction Testing and Sampling. All testing and sampling shall be done in accordance with the latest ASTM methods unless otherwise specified. Test results shall be forwarded immediately by the testing lab to the City or their designated representative and general Contractor. The following tests shall be required during construction:
1. Asphalt Content and Gradation. One asphalt content and gradation test shall be made per each five hundred tons (500 t) (454 metric t) or portion thereof of asphaltic mixture placed per day. These tests shall be performed on samples taken prior to screeding. The percentage of asphalt content may be determined by Ignition Oven or by Extraction Method (ASTM D 2172, D 6307, AASHTO T164).
 2. Mixture Properties. A complete test series, as described below, shall be performed for each five hundred tons (500 t) (454 metric t), or portion thereof.
 - i. Marshall Mix Design: Laboratory-compacted bulk specific gravity (G_{mb}), theoretical maximum (Rice) specific gravity (G_{mm}), air voids, voids in mineral aggregate, voids filled with asphalt, Marshall stability, Marshall flow.
 - ii. Superpave Mix Design: Laboratory-compacted bulk specific gravity (G_{mb}), theoretical maximum (Rice) specific gravity (G_{mm}), air voids, voids in mineral aggregate, voids filled with asphalt,.
 3. Density Tests. At least three (3) mat and three (3) longitudinal joint density tests for each five hundred tons (500 t) (454 metric t) or portion thereof shall be performed. Density testing will be based on cores unless the City or their designated representative authorizes the use of nuclear density gauges correlated with cores. The theoretical maximum (Rice) specific gravity values for each lot shall be used for computation of density of the same lot.

4. Preconstruction Test and Sampling. All sampling and testing of materials shall be done in accordance with the latest ASTM methods unless otherwise specified. The Contractor shall:
 - i. Submit suitable samples of all materials including asphalt cement to a City-approved AASHTO-accredited materials testing laboratory for mixture design, and to determine compliance of materials to these specifications, with results provided to the City or their designated representative at least two (2) weeks prior to paving;
 - ii. Or shall submit certification that the materials to be used are in conformance with these specifications and that the mixture design for use with these materials is approved and on file with the City Engineer. The City reserves the right to require confirmation testing, provided by the Contractor, of material properties for mix designs more than one year old.
 5. The Contractor shall be responsible for all tests and sampling, mixture property testing, and all asphalt content and gradation testing. The Contractor shall select and pay for an AASHTO-accredited testing firm, acceptable to the City or their designated representative. If the initial test fails to meet minimum requirements, the Contractor shall pay for any and all additional tests until the requirements herein are met.
 6. The City reserves the right to perform such additional testing, using an AASHTO-accredited laboratory, deemed necessary to verify the testing provided by the Contractor. In case of dispute, the City's results shall govern.
- H. Warranty or Inspection of Asphaltic Concrete Pavement. After completion of the asphalt and concrete work and prior to the end of the specified two-year warranty period, the City or their designated representative will inspect all asphalt and concrete areas installed on this project. At the time of the inspection, all areas of asphalt where there exists a one quarter inch (1/4") (6 mm) separation between the new asphalt and the existing asphalt or the new asphalt and the new concrete, the Contractor will be required to crack seal these locations following City specifications. The sealant shall conform to ASSHTO M 301 or Section 304, Page 11 of 11 modified ASTM D 3405. Any pavement found to have settled more than one-quarter inch (1/4") (6mm) shall be repaired in a manner acceptable to the City or their designated representative.