

SECTION 900
HOT BITUMINOUS PAVEMENT (ASPHALT) MIX DESIGN AND
CONSTRUCTION

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**SECTION 900
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CONSTRUCTION**

901.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

910.00 SCOPE

The intent of this section is to specify materials and methods to be used for the construction, overlaying, seal coating and pavement rejuvenating of streets, parking lots, and other miscellaneous work requiring the use of hot bituminous pavement (asphalt). This section shall cover work associated with aggregate base course, bituminous base and pavements of the plant mix type, bituminous prime coat, bituminous tack coat, rejuvenating applications and asphalt overlays. All workmanship and materials shall comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS and shall conform to the lines, grades, depths, quantities and the typical pavement cross section(s) shown on the approved plans or as directed by the Road & Bridge Superintendent / Elbert County Engineer.

920.00 ASPHALT PAVEMENT MIX DESIGN

921.00 Asphalt Mix Design Properties

All pavement shall be asphalt of the plant hot mix type unless otherwise approved in writing by the DPW Director or designee. Materials and construction shall comply with Section 403 of the CDOT *Standard Specifications for Road and Bridge Construction*, and have the following requirements:

- A. The asphalt cement shall be a Superpave Performance Graded (PG) binder of PG 76-28 or PG 64-22. The asphalt cement content shall be as determined by the mix design. The mix design shall be determined using SHRP (Strategic Highway Research Program) and *Colorado Procedure CP-L 5115 for the Superpave Method of Mixture Design*. Superpave PG asphalt binders shall comply with Table 702-2 Superpave Performance Graded Binders of the CDOT *Standard Specifications for Road and Bridge Construction*. The asphalt contractor shall furnish certified test results from an independent asphalt testing laboratory to show compliance of the proposed Superpave PG asphalt binder with the Superpave requirements for that mix.

The gradation of the mineral aggregate shall be grading SG (1½ inch nominal), S (¾ inch nominal), or both SG and S (in varying lifts) for new street construction. In no case shall grading SG be used for a permanent final lift of asphalt; however, the Road & Bridge Superintendent / Elbert County Engineer may require the use of grading SG in a pavement section. **GRADING SX (½ inch NOMINAL) SHALL BE USED FOR THE PERMANENT FINAL LIFT OR OVERLAY OF ALL ASPHALT, UNLESS APPROVED BY THE DPW DIRECTOR OR DESIGNEE** The minimum SX lift thickness shall be one and one-half (1½) inches. Aggregate gradation shall be in accordance with Table 703-3 of the CDOT *Standard Specifications for Road and Bridge Construction*. Streets with a low EDLA ≤ 40 shall contain a minimum of seventy (70) percent aggregate with two mechanically induced fractured faces. Streets with a high EDLA ≥ 40 shall contain a minimum of eighty (80) percent aggregate with two mechanically induced fractured faces.

- B. All mixes shall contain a maximum of twenty (20) percent native sands.
- C. All mixes shall contain a one (1) percent hydrated lime anti-stripping admixture.
- D. A maximum of twenty (20) percent Reclaimed Asphalt Pavement (RAP) shall be allowed in non-polymer and non-rubberized mixes, provided that all the requirements for asphalt pavement are met.
- E. The asphalt mix design shall comply with the SUPERPAVE MIX DESIGN PROPERTIES and MINIMUM VOIDS IN THE MINERAL AGGREGATE (VMA) REQUIREMENTS tables that follow. A copy of the mix formula shall be submitted to the DPW Director or designee for review and approval at least seven (7) days prior to starting paving work. In the event that a current job mix formula is not available for the materials proposed for use, the Contractor shall submit a job mix formula prepared by a recognized testing laboratory for review and approval by the DPW Director or designee. A report giving the properties of the materials and certifying their conformance to or deviations from the requirements of the specifications shall accompany the job mix formula.

NON-SUPERPAVE MIXES MAY BE APPROVED AT THE DISCRETION OF THE DPW DIRECTOR OR DESIGNEE. Viscosity graded asphalt cements may be permitted at the discretion of the DPW Director or designee and shall adhere to the requirements of AASHTO M226, Table 2.

All asphalt pavement mix designs shall comply with the following properties:

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SUPERPAVE MIX DESIGN PROPERTIES

Roadway Classification	Residential (Parking Lot)	Minor Collector	Major Collector	Minor Arterial	Principal Arterial	Principal Arterial	Commercial/Industrial
Traffic Level	1	2	3	3	4	5	5
Traffic Loading (Total 18 kip ESALS over 20 yr design life)	less than 300,000	300,000 to 1,000,000	1,000,000 to 3,000,000	1,000,000 to 3,000,000	3.0 to 10.0 million	>10.0 million	>10.0 million
Design Gyration (Ndesign)	75	75	75	75	100	100	100
Max Gyration	104	117	134	134	152	174	174
Hveem Stability	28	28	28	28	30	30	30
Voids filled with asphalt, %	65-80	65-80	65-80	65-80	65-75	65-75	65-75
Lottman, Tensile Strength Ratio, %	80 min.	80 min.	80 min.	80 min.	80 min.	80 min.	80 min.
Lottman, Dry Tensile Strength, Min. psi	30 min.	30 min.	30 min.	30 min.	30 min.	30 min.	30 min.

- 1) Air Void of production mixes to be within one (1) percent of design mix Air Void at optimum Asphalt Content. Air Void determination for Ndesign shall be made from samples compacted at Ndesign. Maximum Theoretical Specific Gravity of mix to be by *Colorado Procedure CP-51 for the Superpave Method of Mixture Design*.
- 2) Further investigation or corrective action is required when production stability is below the mix design stability.

NOTES:

MINIMUM VOIDS IN THE MINERAL AGGREGATE (VMA) REQUIREMENTS

Nominal Maximum Size, in (mm) ¹	Design Air Voids of Total Mix ²		
	3.50%	4.00%	4.0 - 5.0%
1½ (37.5)	11.5	12.0	12.5
1 (25.0)	12.5	13.0	13.5
¾ (19.0)	13.5	14.0	14.5
½ (12.5)	14.5	15.0	15.5
⅜ (9.5)	15.5	16.0	16.5

¹ The Nominal Maximum size is defined as one size larger than the first sieve to retain more than ten (10) percent.

² Interpolate specified VMA values for design air voids between those listed.

Determination of the effect of water on the cohesion of the bituminous mixture shall be made in accordance with AASHTO T-283 (Lottman). Retained strength shall be a minimum of eighty (80) percent. The use of a one (1) percent hydrated lime anti-stripping admixture to improve the retained strength characteristics shall be required.

922.00 Asphalt Sampling and Testing

Asphalt pavement and asphalt cement sampling and testing shall be performed at the discretion of the DPW Director or designee at a minimum, a representative asphalt pavement sample shall be taken from the first one thousand (1,000) tons, and all mix properties shall be verified. On major arterials, the percent voids filled with asphalt cement, Hveem stability, and Lottman shall be verified at a minimum of every ten thousand (10,000) tons. All testing necessary to assure conformance of materials and workmanship to the specifications shall be at the Contractor's expense. Asphalt testing shall comply with ASTM D1559. Two (2) copies of all test reports shall be submitted directly to the DPW Director or designee.

At any time during construction and/or the warranty period, the DPW Director or designee may require a Colorado Registered Professional Engineer to certify the quality of materials or construction procedures, at the Contractor's expense. All commercial testing and laboratory work necessary to establish the job mix formula and to ensure conformance of materials and workmanship shall be by recognized methods and as specified in these CONSTRUCTION STANDARDS & SPECIFICATIONS. Two (2) copies of all test reports shall be submitted to the DPW Director or designee.

930.00 ASPHALT PAVEMENT CONSTRUCTION

931.00 Roadway Inspections

Refer to Section 154.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Adequate roadway inspections assure compliance to Elbert County requirements and are the basis for Elbert County's recommendation that roadway improvements be accepted for maintenance and/or release of the performance guarantee. It is the responsibility of the Contractor to contact the DPW Director or designee a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required roadway inspections shall include:

- A. Utilities and Culverts – All utility pipes, conduits and culverts have been installed in accordance with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.
- B. Curb and Gutter, Sidewalks and Crosspans – Verify that all concrete improvements have been installed in accordance with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.
- C. Structures – Verify that all structures have been installed in accordance with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

- D. Subgrade/Base Course – Verify that the surface proposed to be built upon meets all requirements including, but not limited to, depth of treatment, type of treatment, moisture content, compaction and an approved proof-roll.
- E. Paving and Testing – Verify that mix design and submittals are approved and comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Verify that minimum air and asphalt temperatures adhere to these CONSTRUCTION STANDARDS & SPECIFICATIONS. In the case of wind, cold temperatures or threatening weather, trucks hauling asphalt shall have a “weather-proof” tarp. The beds of trucks hauling asphalt shall be clean, and the asphalt shall be free of debris. Verify that thickness of asphalt pavement, rolling equipment and patterns, and grade of utility castings comply with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.
- F. Construction Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:
 - 1. Remove and replace areas of failing asphalt. Subgrade failures shall be corrected before placing asphalt. Heating and scarifying and/or grinding and overlaying areas of failing asphalt, in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS, may be required by the DPW Director or designee.
 - 2. Remove and replace areas that have ponding water.
- G. Final Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:
 - 1. Remove and replace areas of failing asphalt. Subgrade failures shall be corrected before placing asphalt.
 - 2. The final top lift or overlay of asphalt thickness (one and one-half (1½) inches minimum) shall be in accordance with the Pavement Deflection Testing Report or as specified in the contract documents. All areas to receive a final top lift or an overlay of asphalt shall be cleaned and prepared, including, but not limited to:
 - a. All lips of gutters, inlets, and crosspans shall have concrete exposed to a depth equal to the thickness of the final top lift or overlay of asphalt.
 - b. All joints shall be straight (vertical) and shall have a minimum of one and one-half (1½) inches of elevation difference. This is to ensure that an asphalt mat of consistent thickness is installed from edge of gutter to edge of gutter.
 - c. All weeds shall be cut, and debris, mud, and waste materials removed.

- d. Before paving, tack coat shall be applied to the area(s) that are to receive a final top lift or overlay of asphalt, including exposed concrete faces and utility castings.

932.00 Delivered Mix Temperature

The asphalt mix discharge temperature from the plant mixer shall be between 320°F and 350°F for PG 76-28 binders and between 290°F and 320°F for PG 64-22 binders. The minimum delivered mix temperature, measured behind the paver screed, shall be 280°F for PG 76-28 binders and 235°F for PG 64-22 binders. The minimum rolling (initial compaction) temperature shall be 185° F.

933.00 Weather Limitations

Asphalt shall be placed only on properly constructed subgrade and interim lifts that are free from water, snow, and ice. The asphalt shall be placed only when weather conditions permit the pavement to be properly placed and finished as determined by the DPW Director or designee Engineer. Asphalt pavement mixtures shall be placed in accordance with the following temperature limitations:

Compacted Layer Thickness (Inches)	Minimum Air and Surface Temp. (Degrees F and rising)	
	Top Layer	Other Layers
1½ or less	60	50
>1½ to 3	50	40
3 to 4	--	35

Air temperature shall be taken in the shade. Surface is defined as the existing base on which the new pavement is to be placed.

The DPW Director or designee may waive minimum temperature requirements for placing prime coats and layers of asphalt below the top layer of the pavement section.

THE FINAL TOP LIFT OR OVERLAY OF ASPHALT SHALL NOT BE PLACED BETWEEN OCTOBER 1ST AND APRIL 1ST, UNLESS APPROVED BY THE DPW DIRECTOR OR DESIGNEE.

934.00 Construction of Pavement Sections

in no case shall the compacted asphalt layer thickness be greater than SIX (6) inches FOR SG MIXES, FOUR (4) INCHES FOR S MIXES, AND TWO (2) INCHES FOR sX MIXES.

934.01 Base Course Composite Sections

All work shall be observed and tested by the project Soils Engineer or representative and certified by a Colorado Registered Professional Engineer. The standard procedures for base course composite construction include the following:

- A. The subgrade shall be prepared and conditioned to comply with all specifications. After passing compaction tests, the subgrade shall be proof-rolled in accordance with Section 361.04 Proof-Roll Observation and Testing of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
- B. All failing areas shall be delineated by the project Soils Engineer and shall be reworked and retested until passing.
- C. Upon passing all compaction tests and proof-rolls, geotextile fabric shall be installed on the subgrade if required by the approved pavement design
- D. Base course (Aggregate Base/Recycled Concrete) shall be placed on the fabric and prepared and conditioned to meet specifications.
- E. After passing all compaction tests, the base course shall be proof-rolled.
- F. All failing areas shall be delineated by the project Soils Engineer and shall be reworked and retested until passing.
- G. Upon passing all compaction tests and proof-rolls, geotextile fabric shall be installed on the base course, if required by the approved pavement design.
- H. In the event the subgrade, base course or any step of this process is subject to rain, snow or other factors after the proof-roll has been performed, the project Soils Engineer shall evaluate the areas proposed to be paved and shall and make a recommendation to Elbert County. Paving shall not commence unless approved by Elbert County.

934.02 Lime Stabilized Composite Sections

Lime stabilization shall comply with Section 361.03 Lime-Treated Subgrade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

934.03 Full Depth Asphalt Sections

Subgrade preparation for full depth asphalt sections approved by the DPW Director or designee's shall comply with Section 361.00 Subgrade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

934.04 Herbicide

All subgrade surfaces to be paved shall be treated with an herbicide approved by the DPW Director or designee

934.05 Prime Coat

If required by the DPW Director or designee, subgrade shall be primed to comply with Section 407 of the CDOT *Standard Specifications for Road and Bridge Construction*. Bituminous material shall be MC-70 applied at the rate of two-tenths (0.20) to thirty-five one-hundredths (0.35) gallons per square yard.

934.06 Asphalt Compaction

Asphalt compaction shall comply with Section 401.17 of the CDOT *Standard Specifications for Road and Bridge Construction*.

Asphalt density tests shall be taken every one-hundred fifty (150) linear feet per driving lane, per lift. Pavement test sections may be required by the DPW Director or designee. Densities shall be between ninety-two (92) percent and ninety-six (96) percent of the Rice unit weight as determined by an independent asphalt testing laboratory. Other methods of determining unit weight are subject to approval by the DPW Director or designee.

DURING THE FINAL OVERLAY OF ASPHALT, ALL VALVE BOXES AND MANHOLES SHALL BE BROUGHT TO STREET GRADE. THEY SHALL BE BROUGHT TO GRADE USING THE INTERNAL SCREW ADJUSTMENT OR ONE DROP-IN PAVING RING. NO JACK-HAMMERING SHALL BE PERMITTED.

934.07 Tack Coat

Tack coat materials and construction shall comply with Section 407 of the CDOT *Standard Specifications for Road and Bridge Construction*. Bituminous material shall be SS-1 emulsion, diluted by mixing one (1) gallon of SS-1 emulsion with one gallon of clean water, applied at the rate of five one-hundredths (0.05) to fifteen one-hundredths (0.15) gallons per square yard.

934.08 Seal Coat

Seal coat materials and construction shall comply with Section 409 of the CDOT *Standard Specifications for Road and Bridge Construction*. The type of bituminous material, cover aggregate, and rates of application shall be as shown on the approved plans.

934.09 Rejuvenating Agent

Rejuvenating agent materials and construction shall comply with Section 407 of the CDOT *Standard Specifications for Road and Bridge Construction*.

**935.00 TRENCH CUTS AND EXPLORATORY
POTHOLE/CORE REPAIR**

935.01 Trench Cuts

**TRENCH CUTS IN STREETS LESS THAN FIVE (5) YEARS OLD SHALL
BE ALLOWED AT THE DISCRETION OF THE DPW DIRECTOR OR
DESIGNEE**

Backfill of utility trenches shall comply with Section 350 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Utility trench patches shall be in accordance with the Detail Drawings.

935.02 Exploratory Pothole/Core Repair

**POTHOLING AND CORING STREETS LESS THAN FIVE (5) YEARS
OLD SHALL BE ALLOWED AT THE DISCRETION OF THE DPW
DIRECTOR OR DESIGNEE**

All potholes/cores shall be patched with a temporary patch material immediately after drilling is complete if permanent patch material is not available. Within seventy-two (72) hours of drilling, potholes/cores shall be permanently patched, unless otherwise approved by Elbert County. An area to be patched shall be saw cut or jack hammered to make it symmetrical, and all spoils shall be removed. All asphalt edges shall be cleaned, dried and tacked, and all concrete edges shall be doweled and/or jointed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS. If base material is disturbed during potholing/coring, it shall be replaced with CDOT "Class 6" base course material, crusher fines, recycled concrete, or other suitable backfill material approved by the DPW Director or designee. Squeegee is not allowed as backfill material. Replacement material shall be compacted to ninety-five (95) percent of Maximum Standard Proctor Density (ASTM D698 or AASHTO T99) and shall have a moisture content within two (2) percent of the optimum.

Asphalt shall not be patched with concrete and vice versa. The asphalt patch mix shall be an approved Superpave SX (½ inch nominal) mix. Asphalt patch and concrete replacement mixes shall comply with and be placed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Potholes/cores in concrete pavement shall be repaired by completely removing and replacing a portion of concrete up to construction joints and/or expansion joints. No concrete patching shall be allowed. Any colored and/or patterned concrete shall be replaced with the existing concrete color and type.

No jagged or otherwise uneven patches shall be allowed.

936.00 HEATING AND SCARIFYING

Heating and scarifying materials and construction shall comply with Section 405 of the CDOT *Standard Specifications for Road and Bridge Construction*.

937.00 PAVEMENT DEFLECTION TESTING

Prior to installation of the final asphalt top lift or overlay, the Developer shall furnish the DPW Director or designee with two (2) copies of a Pavement Deflection Testing Report prepared by a Colorado Registered Professional Engineer utilizing non-destructive deflection testing to assess and predict the performance of the pavement.

The Colorado Registered Professional Engineer shall have a past history and knowledge in performing these tests. Qualifications of the Colorado Registered Professional Engineer shall be submitted to the DPW Director or designee for approval before the start of work.

The pavement evaluation shall be performed in accordance with accepted engineering practices. The report shall generally incorporate the following testing and pavement evaluation techniques:

- A. Environmental study (frost cycle, drainage, etc.)
- B. Pavement surface evaluation
- C. Soil borings in areas of high deflection
- D. Pavement deflection analysis (Falling Weight Deflectometer, Dynaflex or other method approved by the DPW Director or designee)

The report shall evaluate the existing condition of the base and binder course by performance of deflection tests at a minimum of one hundred (100) foot spacing per traffic lane. The report shall determine the thickness of the final lift of asphalt to ensure that the pavement section shall meet a twenty (20) year or greater pavement life. **PAVEMENT DEFLECTION TESTING AND THE FINAL TOP LIFT OR OVERLAY OF ASPHALT SHALL ONLY BE PERFORMED BETWEEN APRIL 1ST AND OCTOBER 1ST, UNLESS PERMISSION IS GRANTED BY THE DPW DIRECTOR OR DESIGNEE.**

If the pavement section is not projected to meet a twenty (20) year or greater pavement life based on the pavement deflection test results, the report shall detail the deficiencies and associated causes and shall recommend remedial measures to develop a twenty (20) year design life. The DPW Director or designee shall evaluate the report and inform the responsible party of the required pavement operations.

The final asphalt top lift or overlay shall have grading SX (½" nominal) asphalt mix, unless otherwise approved by the DPW Director or designee. **IN NO CASE SHALL A FINAL TOP LIFT OR OVERLAY OF ASPHALT BE LESS THAN ONE AND**

**ONE-HALF (1/2) INCHES THICK, UNLESS APPROVED BY THE DPW
DIRECTOR OR DESIGNEE.**

Pavement Deflection Testing is not required for Elbert County Capital Improvement Projects (CIP's) or street reconstruction, unless otherwise specified in the contract documents.

938.00 GRINDING

Grinding shall consist of "milling", "grinding", or "cold planing" the existing pavement surface to establish a new surface profile and cross section in preparation for a bituminous overlay. After grinding, the surface shall have a grooved or ridged finish that is uniform and resistant to raveling or traffic displacement. This textured surface shall have grooves of one-quarter (1/4) inch \pm one-eighth (1/8) inch.

Grinding shall consist of milling the existing pavement surface from edge of gutter to edge of gutter to a minimum depth of one and one-half (1 1/2) inches and as required by the Pavement Deflection Testing Report or specified in the contract documents, unless otherwise directed by the DPW Director or designee. Grinding around utility castings shall be to a minimum depth of one and one-half (1 1/2) inches and as required by the Pavement Deflection Testing Report or specified in the contract documents.

The Contractor shall remove the cuttings immediately behind the grind machine by belt loader, end loader, power sweeper and/or by hand. The grinding machine shall be equipped with a pressurized watering system for dust control. Flushing into Elbert County's storm drainage system as a means of cleanup shall not be allowed.

939.00 ACCEPTANCE OF PUBLIC ROADWAYS

Workmanship shall meet all Elbert County CONSTRUCTION STANDARDS & SPECIFICATIONS. This includes thickness, crowns, drainage, areas around manholes and service covers, trench settlement and edges against curb and gutter and drain pans. Acceptance of roadways shall comply with Section 200.00 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Pavement shall not exhibit any distress such as alligator cracking, block cracking, edge cracking, potholes, trench settlement, raveling, heaving, sinking, separation from curb and gutter, patching or ponding at the completion of the warranty period. Ponding of water in asphalt pavement shall not exceed one-eighth (1/8) inch in depth. Where ponding exceeds one-eighth (1/8) inch in depth, pavement shall be removed and replaced at the discretion of the DPW Director or designee.