

---

# CHAPTER 8

## TRANSPORTATION STANDARDS

---

### TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
<b>8.01 ADOPTION OF STANDARDS OF THE COLORADO DEPARTMENT OF TRANSPORTATION (CDOT) WITH MODIFICATIONS .....</b>	<b>2</b>
(A) SECTION 401, PLANT MIX PAVEMENTS - GENERAL.....	2
(B) SECTION 403, HOT BITUMINOUS PAVEMENT .....	3
(C) SECTION 608, SIDEWALKS AND MULTI-USE PATHS .....	4
(D) SECTION 610, MEDIAN COVER MATERIAL.....	5
(E) SECTION 703, AGGREGATES.....	6
(F) SECTION 612, DELINEATORS AND REFLECTORS .....	6
(G) SECTION 614, TRAFFIC CONTROL DEVICES: .....	6
(H) SECTION 627, PAVEMENT MARKING.....	7
(I) SECTION 713, TRAFFIC CONTROL MATERIALS.....	7
<b>8.02 TRAFFIC SIGNALS.....</b>	<b>7</b>
<b>8.03 TRAFFIC SIGNS AND STRIPING.....</b>	<b>8</b>
(A) REQUIRED.....	8
(B) SIGNING AND STRIPING PLAN .....	8
(C) CONFORMANCE WITH MUTCD .....	8
(D) MATERIALS .....	8
(E) PRIVATE STREET SIGNS.....	8
<b>8.04 FIRE LANE SIGN SPECIFICATIONS .....</b>	<b>8</b>
(A) SIZE .....	8
(B) MATERIAL .....	8
(C) COLORS .....	8
(D) WORDING.....	8
<b>8.05 SIGNING FOR HANDICAPPED PARKING.....</b>	<b>9</b>
(A) MATERIALS .....	9
(B) REQUIRED SIGNS.....	9
(C) SIGN PLACEMENT .....	9

### LIST OF TABLES

<u>Table Number</u>	<u>Page</u>
Table 8-1: Marshall Method by Street Classification .....	3
Table 8-2: Hot Bituminous Pavement Design Mix.....	4
Table 8-3: Minimum Voids in the Mineral Aggregate (VMA).....	4

## 8.01 Adoption of Standards of the Colorado Department of Transportation (CDOT) with Modifications

The current version of the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction" is hereby adopted by reference in these Standards as the City of Boulder transportation construction standards, except as specifically amended by the provisions of this chapter.

### (A) Section 401, Plant Mix Pavements - General

- (1) **Subsection 401.02, "Composition of Mixtures,"** is amended to incorporate the following additions:
  - (a) A job-mix formula shall be submitted to the Director of Public Works for approval prior to placing any hot bituminous pavement. The formula shall indicate the aggregate gradation, asphalt cement content, hydrated lime content, and optimum density. If requested by the Director, a sample of the aggregate and asphalt cement shall be submitted for approval (for test purposes) prior to placing any hot bituminous pavement.
  - (b) The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate, and a single temperature for the mixture at the discharge point of the plant.
  - (c) When submitting the job-mix formula, the contractor shall supply certified test results on all asphalt cements, aggregates, and mixes used for hot bituminous pavement, and certify that all materials meet or exceed all required specifications and tests.
  - (d) The Director reserves the right to sample materials and mixtures throughout project construction to determine whether specifications and requirements have been met and to confirm the certified test results. The contractor is responsible for providing a bituminous mixture that meets the job formula and specifications.
  - (e) The contractor shall be responsible for providing adequate field testing of materials used on the project and providing copies of the test results to the City to assure compliance with these specifications.
  - (f) The top layer of hot bituminous pavement shall not contain any reclaimed asphalt material, unless approved by the Director.
- (2) **Subsection 401.11, "Tack Coat,"** is amended to incorporate the following additions:
  - (a) A tack coat shall be evenly applied to all existing asphalt or concrete surfaces that will be in contact with asphalt prior to hot bituminous pavement placement. A slow-setting, diluted emulsion shall be used, diluted with one part water to one part asphalt emulsion. The rate of application shall be 0.1 gallons per square yard of diluted asphalt emulsion. Before dilution, the emulsified asphalt shall comply with AASHTO M140 or M208.
  - (b) Only the amount of tack coat necessary for the day's operation is to be placed on the surface. All traffic not essential to the work shall be kept off the tack coat.
- (3) **Subsection 401.12, "Surface Conditioning,"** is amended to incorporate the following addition: All vegetation shall be removed from any existing surface to be overlaid.

- (4) **Subsection 401.16, “Spreading and Finishing,”** is amended to incorporate the following additions:
- (a) The bituminous mixture shall be placed with an asphalt paver if possible. The contractor shall receive permission from the Director to use placement methods other than a paver. The lift thickness shall be at least twice the maximum particle size for the hot bituminous pavement mix. The maximum lift thickness for the final lift shall be 2 inches, unless otherwise approved by the Director.
  - (b) Areas to be patched shall be excavated and squared to a neat line, leaving the sides of the excavation vertical. Prior to placement of the patch, the exposed sides of the existing pavement shall be thoroughly coated with slow-setting Emulsified Asphalt. Hot bituminous pavement shall then be placed and compacted in succeeding layers; no layer shall be more than 3 inches deep.

**(B) Section 403, Hot Bituminous Pavement**

- (1) **Subsection 403.02, “Materials,”** is amended to incorporate the following additions:
- (a) Design mixes shall be established using the Marshall Method of compaction. The method will be applied based on street classification according to Table 8-1, “Marshall Method by Street Classification.”

**Table 8-1: Marshall Method by Street Classification**

Design Method	Laboratory Compaction	Street Classification
Marshall Method, ASTM D 1559 Asphalt Institute MS-2	50 blows per side	Local, Collector, and Minor Arterial (ESAL < 1 million)
Marshall Method, ASTM D 1559 Asphalt Institute MS-2	75 blows per side	Major Arterial (ESAL < 1 million)

- (b) The design mix for hot bituminous pavement shall conform to Table 8-2, “Hot Bituminous Pavement Design Mix,” and Table 8-3, “Minimum Voids in the Mineral Aggregate (VMA).”
- (c) The addition of any recycled material is subject to approval by the Director prior to use in any asphalt mix. All mixes including recycled material shall meet all standard specifications and contain no more than 10% recycled material.
- (d) Hot bituminous pavement for patching shall be Grading C with AC-10 asphalt cement.
- (e) A minimum of one percent hydrated lime by weight of the combined aggregate shall be added to all aggregate for hot bituminous pavement.

**Table 8-2: Hot Bituminous Pavement Design Mix**

Property	Test Method	Value
Voids, Percent	MS-2; AASHTO T269	3-5
Stability, Minimum	MS-2; AASHTO T245	1800
Flow (0.01")	MS-2; AASHTO T245	8-16
Aggregate retained on the No. 4 Sieve with at least two Fractured Faces % Min.	CP-45	70
Accelerated Moisture Susceptibility Tensile Strength Ratio (Lottman) Min.	AASHTO T283	80
Minimum Dry Split Tensile Strength, PSI	AASHTO T283	30
Voids in Mineral Aggregate, VMA, % Min.	MS-2	See Table 8.01-3
Grade of Asphalt Cement		AC-10

**Table 8-3: Minimum Voids in the Mineral Aggregate (VMA)**

Nominal Maximum Size*, Inches (mm)**	Design Air Voids **		
	3.0%	4.0%	5.0%
1 ½ (37.5)	11	12	13
1 (25.0)	12	13	14
¾ (19.0)	13	14	15
½ (12.5)	14	15	16
3/8 (9.5)	15	16	17

\* The Nominal Maximum Size is defined as one sieve larger than the first sieve to retain more than 10%.  
 \*\* Interpolate specified VMA values for design air voids between those listed.

**(C) Section 608, Sidewalks and Multi-Use Paths**

- (1) Subsection 6.08.03(e), “Joints,” is amended to incorporate the following additions.

All jointing of bikepath, bikeway, and bike trail concrete pavement shall be saw cut at the nearest contraction joint and shall be removed and replaced full width. No partial removal and replacement will be allowed. No longitudinal joints will allowed in either sidewalk or bikepath concrete pavements.

- (2) Subsection 6.08.03 9(g), “Pedestrian/Bike traffic,” is added as follows:

A well signed, safe, functional detour for pedestrians shall be provided whenever a sidewalk is to be obstructed or blocked due to construction or any other activity. The proposed detour shall be approved by the city prior to construction or blockage of the sidewalk.

Sidewalks adjacent to any development type construction activity of any kind shall be maintained at all times in an unobstructed and safe condition as set forth in Section 8-2-11, B.R.C. 1981.

A well signed, safe, functional detour for bikes and pedestrians shall be provided whenever an existing bikeway, bikepath or bike trail is obstructed or blocked due to construction. The proposed detour shall be approved by the Director prior to construction. The shall be of appropriate width as determined by the Director and shall be constructed of asphalt or concrete so that it will function and can be maintained at all times and in all weather conditions.

**(D) Section 610, Median Cover Material**

- (1) **Subsection 610.02, “Materials,”** is amended to incorporate the following additions:

Patterned concrete shall be colored concrete and meet the requirements of Section 601 with the following exceptions:

Field Compressive Strength (28 days), psi (Not a specification requirement)	3000
Cement Content, lbs./cu. Yd., minimum	610
Max. Water/cement ratio lbs. Water/lbs. Cement	0.55
Entrained and Entrapped Air, percent	5 – 8
Slump, AASHTO T 119, inches	2 – 5
Coarse Aggregate, AASHTO M43	Size No. 8
Fine Aggregate, AASHTO M6, percent of total aggregate	50 - 78

- (a) An approved water reducing admixture shall be used in the mix.
- (b) The coloring agent shall be integral to the concrete mixture.
- (c) The color and pattern shall be as defined in the plans as approved by the City.
- (d) Colored wax curing membrane shall be as recommended by the supplier of the coloring agent.

- (2) **Subsection 610.03, “Construction Requirements,”** is amended to incorporate the following additions: Patterned concrete may be used for median cover material. Construction shall conform to the requirements of CDOT Subsection 608.03 with the following exceptions:

- (a) While the concrete is still plastic, a special pattern forming tool shall be applied to the concrete surface to form the specified pattern. All tears and voids resulting from the pattern forming shall be repaired.
- (b) Curing shall include application of two coats of colored wax curing membrane. The first coat shall be applied within 2 hours of finishing. The second coat shall be applied between 10 and 20 days following the first application.

## (E) Section 703, Aggregates

**Subsection 703.04, “Aggregate for Hot Plant Mix Bituminous Pavement,”** paragraph 3 is deleted and replaced with the following revision:

- (1) The aggregate from individual sources shall have a percentage of wear of not more than 40 when tested in accordance with AASHTO T96 after 500 revolutions. The aggregate from individual sources shall contain no more than a 1 percent deleterious material including clay lumps, vegetable matter, friable particles, and other deleterious substances tested in accordance with AASHTO T112.
- (2) For quarries or sources which contain minerals which are not of similar composition, the abrasion and friable particle requirements shall be applied to each mineral composition.
- (3) All aggregate shall meet the sodium or magnesium sulfate test in accordance with AASHTO M29.

## (F) Section 612, Delineators and Reflectors

**Subsection 612.02, “Materials,”** is amended to incorporate the following additions: All delineators shall be “unistrut safe hit” flexible, reflective delineators, and shall be anchored according to manufacturer’s recommendations.

## (G) Section 614, Traffic Control Devices:

- (1) **Subsection 614.02, “Sign Posts and Sign Structures,”** is amended to incorporate the following additions:
  - (a) “TELESPAR” (or an approved equivalent) post size shall conform to manufacturer’s recommendations according to the total sign area square footage and wind loading.
  - (b) All traffic signs or sets of signs with a total surface area less than or equal to 1 square feet shall be installed as shown in Technical Drawing 2.93, the Type III small sign detail, in Chapter 11 of these Standards. All traffic signs (or sets of signs) with a total surface area greater than 1 ½ square feet shall be installed as shown on Technical Drawings 2.81 and 2.82, the Type I and Type II large sign details, in Chapter 11 of these Standards.
  - (c) All traffic signs shall be mounted 7 feet from the top of the curb to the bottom of the sign, except the following:
    - (i) “KEEP RIGHT” and “ONE WAY” signs mounted in medians, which shall be mounted at a height of 5 feet, from the top of the curb to the bottom of the sign.
    - (ii) “NO PARKING” signs shall be mounted at a height of 6 feet, 7 inches to the bottom of the sign.
    - (iii) Street name signs mounted by themselves shall be mounted at the same height as if they were accompanied by a “STOP” sign.
- (2) **Subsection 614.04, “Sign Panels,”** is amended to incorporate the following additions:
  - (a) All reflective sheeting shall be Type IV (3M Scotchlite 3990 VIP Diamond Grade or approved equivalent), except all “no parking” signs, which shall be Type I (Scotchlite Engineer grade, or approved equivalent). Dating stickers shall be 3M #75-0300-1370-2, or approved equal.

- (b) All 9-inch street name signs shall be mounted on extruded aluminum alloy 6063-T6, or approved equal, with 0.091 inch thick web, 0.250 inch thick edges, and square edges. All non-extruded signs shall be mounted on 0.100 gage aluminum.

## **(H) Section 627, Pavement Marking**

**Subsection 627.03, “General,”** is amended to incorporate the following additions:

- (1) All crosswalk lines shall be applied longitudinally, and shall be 24 inches wide by 10 feet long.
- (2) White and yellow skip markings shall be 5 inches wide. If preformed plastic is used, these skip markings may be 4 inches wide.

## **(I) Section 713, Traffic Control Materials**

- (1) **Subsection 713.04, “Sign Panel Backgrounds,”** is amended to incorporate the following addition: Aluminum sign panels may also have a Class II (A-1) anodic coating clear finish as defined in the “Aluminum Association Standards for Anodically Coated Aluminum Alloys for Architectural Applications.”
- (2) **Subsection 713.06, “Messages,”** is amended to incorporate the following additions:
  - (a) All street name signs on non-signalized intersections shall be 9 inches wide with 6-inch, upper-case, series D capital letters, together with 4 ¾-inch, lower-case, series D letters for the name of the street, and a 3 ½-inch, upper-case, series D capital letter together with 3-inch, lower-case, series D letters for “Avenue,” “Street,” 3-inch block numbers below the abbreviation of “Ave.,” “St.,” etc. The “Ave” etc. and block numbers shall be centered on the sign with a 1-inch separation between them. On numbered streets, a 6-inch, series D number shall be used with 4 ¾-inch, lower-case, series D letters for “th”, “st” and “nd” to be held in line with the number that it follows.
  - (b) All reflective sheeting for street name sign faces shall be Type IV (3M Scotchlite 3990 VIP Diamond Grade or approved equal). Dating stickers shall not be placed on street name signs.
- (3) **Subsection 713.08, “Glass Beads for Traffic Markings,”** is amended to incorporate the following addition: All glass beads shall conform to CDOT Specification #M247-81 (1990) Type I non flotation unless otherwise specified by the Engineer.
- (4) **Subsection 713.14, “Pavement Marking Tape,”** is amended to incorporate the following addition: Preformed plastic material shall be 3M Stamark Series 5730 for all transverse and longitudinal lines, or approved equal. All lane use symbols shall be 3M Stamark Series 6330, or approved equal.

## **8.02 Traffic Signals**

All traffic signal design and construction shall be performed in accordance with the Section 2-2-11, “Traffic Engineering,” B.R.C. 1981 and these Standards.

## **8.03 Traffic Signs and Striping**

### **(A) Required**

The applicant for construction approval shall be responsible for the installation of all traffic control devices, street name signs, and markings prior to the opening of roadways, bike paths, etc.

### **(B) Signing and Striping Plan**

A complete signing and striping plan shall be submitted as part of project or development construction plans, to be approved by the Director prior to installation. The plan shall specify the various types and combinations of approved signs, pavement markings, and barricades required for each project or development.

### **(C) Conformance with MUTCD**

All signs, sign materials, and barricade warning lights shall conform to the standards set forth in the "Manual on Uniform Traffic Control Devices" (current edition), and these Standards.

### **(D) Materials**

The quality of material used in traffic signs, type and quality of all vandal-proof sign hardware, and quality of all metal square sign posts shall be in conformance with these Standards, subject to approval by the Director.

### **(E) Private Street Signs**

Private streets shall be signed as such and shall include the message "NO CITY MAINTENANCE."

## **8.04 Fire Lane Sign Specifications**

### **(A) Size**

Fire lane signs shall be 12 inches by 18 inches.

### **(B) Material**

Fire lane sign material shall be 0.100-inch thick aluminum alloy 6061-T6 with Scotchlite Engineer Grade Reflective Sheeting, or an approved equivalent.

### **(C) Colors**

Fire lane sign colors shall be red letters on a white background. The letter on the symbol shall be black.

### **(D) Wording**

Fire lane signs shall including the wording, "FIRE LANE," "FIRE LANE" with an appropriate arrow, or indicate a no parking symbol ("P" with a slash).

## 8.05 Signing for Handicapped Parking

Handicapped parking signs required for handicapped parking spaces shall meet the following standards:

### (A) Materials

Sign materials shall conform to the standards set forth in the MUTCD and these Standards.

### (B) Required Signs

Two signs shall be required for handicapped parking spaces as follows:

- (1) **Sign #1:** Sign #1 (R7-8) shall be 12 inches by 18 inches with green lettering on a white background. This sign shall read, "RESERVED PARKING", followed by a blue handicapped symbol and a green arrow indicating the stalls restricted to handicapped parking.
- (2) **Sign #2:** Sign #2 shall be 21 inches by 15 inches with white lettering on a blue background. This sign shall read, "VEHICLES NOT DISPLAYING THE STATE HANDICAPPED AUTHORIZATION MAY BE TOWED AT OWNER'S EXPENSE. FOR PERMIT INFORMATION CONTACT THE LOCAL MOTOR VEHICLE OFFICE," and shall display a symbol of accessibility.

### (C) Sign Placement

The handicapped parking signs shall be placed as shown on Technical Drawing 2.86, "Handicapped Parking Sign Details," in Chapter 11 of these Standards, and are to be set directly facing or no more than 45 degrees from the line of travel of a vehicle entering the stall. These signs may be mounted on a post or may be mounted permanently on an adjacent wall using anchor bolts. Such signs shall be placed at the center of the end stalls of each handicapped parking area and at every second stall in-between.