CHAPTER 2

TRANSPORTATION DESIGN

TABLE OF CONTENTS

LIST OF TABLES

Number **Page**

(B) Base Alley Standard

Except for residential streets approved pursuant to Chapter 9-12, "Subdivision," B.R.C. 1981, and Section 2.09, "Residential Streets," all new alleys shall provide at a minimum the base alley standard components listed in Table 2-4, "Base Alley Standard Components."

Table 2-3: Base Street Standard Components

Street Component	Base Standard
Right-of-Way	60' Minimum Width
Paved Street Section	36' Minimum Width, Curb Face to Curb Face
Travel Lanes	Two Travel Lanes, Two-Way Traffic
Curb and Gutter	Required Both Sides
Parking	Parking Allowed Both Sides
Sidewalks	5' Minimum Width, Detached, Required Both Sides
Streetscape Planting Strips*	8' Preferred Width (6' Minimum), Required Both Sides

*NOTE: In commercial streetside retail zones where 12-foot wide attached sidewalks may be provided, streetscape planting strips may be created using street trees in planting pits with tree grates (15-foot width between back of curb and back of walk).

Table 2-4: Base Alley Standard Components

Alley Component	Base Standard
Right-of-Way	20' Minimum Width
Paved Street Section	18' Minimum Width, Pavement Edge to Pavement Edge
Travel Lanes	Two-Way Traffic Allowed
Parking	Parking on Alley Not Permitted

2.07 Street Geometric Design

(A) Minimum Requirements

Except for State Highways and the geometric design variations allowed for residential streets approved pursuant to Chapter 9-12, "Subdivision," B.R.C. 1981, and Section 2.09, "Residential Streets," all city streets shall be designed in conformance with this section. The design standards outlined in this section are minimum design standards, and all street design shall meet or exceed these standards. On streets designated collector or arterial in the TMP, the Director may specify standards to be applied to street design that may exceed the minimum standards in this section based on functional need to ensure safe and efficient operation of the street.

(B) Right-of-Way

The right-of-way width required for new streets shall comply with the requirements of Section 9-9-8, "Reservations, Dedication, and Improvement of Rights-of-Way," B.R.C. 1981, and shall include without limitation the following elements:

(1) The paved roadway section including without limitation travel lanes, turning and speed change lanes, transit lanes, bicycle lanes, and parking lanes;

(2) Curbs and gutters or drainage swales;

(3) Roadside and median landscaping areas;

(4) Sidewalks and multi-use paths; and

(5) Any necessary utility corridors.

(C) Lane Width

Street lanes shall meet the minimum width specifications shown in Table 2-5, "Minimum Street Lane Widths," of these Standards.

Table 2-5: Minimum Street Lane Widths

Travel Lanes*	Auxiliary Lanes*	On-Street Bicycle Lanes	Parking Lanes
11'	10'	5', with parking lane	8' from curb face
		6.5' from curb face w/out parking lane	

*NOTES: Travel and Auxiliary lane dimensions do not include gutter pan width. Auxiliary lanes include, without limitation, turning and speed change lanes.

(D) Horizontal Alignment

(1) **Conformance to Street Plan:** Horizontal alignment shall conform to the pattern of streets in the Boulder Valley Comprehensive Plan, TMP, and adopted right-of-way plans and shall provide continuous alignment with existing, planned, or platted streets with which they will connect.

(2) **Extension to Property Line:** All streets shall be extended to the property lines across the property to be developed, unless the street to be constructed has been approved by the City as a cul-de-sac or other no-outlet street.

(3) **Minimum Horizontal Curve:** Street curvatures shall meet the minimum specifications shown in Table 2-6, "Minimum Horizontal Street Curve Specifications," of these Standards.

Table 2-6: Minimum Horizontal Street Curve Specifications

Design Criteria	Local Street	Collector Street	Arterial Street
Minimum Design Speed	20 mph	35 mph	40 mph
Minimum Centerline Radius	100 feet	300 feet	500 feet
Minimum Reverse Curve Tangent	50 feet	100 feet	200 feet
Minimum Intersection Approach Tangent	100 feet	200 feet	300 feet

(4) **Design Horizontal Curve:** The design horizontal street curvature shall meet or exceed the minimum horizontal curvature and be calculated using the following equation:

$$R = V^2 / 15 * (e-f)$$

Where: E = rate of superelevation per foot

Side Friction Factors	
Design Speed	Side Friction

F = side friction factor
V = vehicle speed in MPH
R = radius of curve in feet

(mph)	Factor (f)
30	0.22
35	0.20
40	0.18
45	0.16

(5) **Intersections and Street Spacing**

(a) **Angles:** All streets shall intersect at right angles (90°).

(b) **Minimum Street Spacing:** Spacing between streets, as measured from centerline to centerline, shall equal or exceed the minimum distances shown in Table 2-7, "Minimum Street Spacing," of these Standards.

Table 2-7: Minimum Street Spacing

Street Type	Minimum Street Spacing
Local	150 feet
Collector	300 feet
Arterial	500 feet

(c) **Street Spacing for Signalized Intersections:** Signalized intersections shall be spaced at half-mile intervals, although other locations may be approved by the Director if adequate signal progression can be maintained.

(d) **Corner Radii:** The minimum property line corner and flowline radii at intersections shall meet or exceed the minimum radii specifications shown in Table 2-8, "Minimum Intersection Radii," of these Standards.

Table 2-8: Minimum Intersection Radii

Street Type	Minimum Flowline Radius	Minimum Property Radius
Local	25 feet	15 feet
Collector	30 feet	15 feet
Arterial	30 feet	10 feet

(6) **Road Width Transition Tapers:** Where two street sections or different widths are to be connected, a transition taper is required between the outside traveled edge of the two sections. The length of the transition taper shall be calculated using the following equation:

$$L = WS$$

Where: S = Speed in MPH
L = Length in feet
W = Width of offset in feet

This transition is not to be used in the design of left turn storage lanes or speed change lanes.

(7) **Left Turn Lanes**

(a) **Storage Length:** Left turn lane storage length shall be determined based on traffic volumes using the Leisch nomographs provided in the ITE *Guidelines for Major Urban Street Design.* The left turn lane storage length shall not be less than 50 feet. Where dual left turn lanes are provided, the lane storage length shall be based on at least 60 percent of the single lane storage length.

\(b) **Lane Change Taper:** Left turn lane change tapers shall be calculated using the equation for bay tapers in Subsection (8).

(8) **Speed Change Lanes:** Speed change lanes required for transitional access to turning lanes shall be designed according to the design standards provided in the ITE "Guidelines for Major Urban Street Design," as follows:

(a) **Bay Tapers:** Bay tapers are required for the lane transition from the travel lane into a turn lane. The bay taper length shall be calculated using the following equation:

$$\mathbf{L = WS / 3}$$

Where: S = Speed in MPH
L = Length in feet
W = Width of offset in feet

(b) **Approach Tapers:** Approach tapers are required to transition the position of travel lanes to accommodate turn lanes. The approach taper length shall be calculated using the following equation:

$$\mathbf{L = WS^2 / 60}$$

Where: S = Speed in MPH
L = Length in feet
W = Width of offset in feet

(9) **Cul-de-sacs:** Where allowed, cul-de-sacs shall have a minimum pavement diameter of 90 feet, curb face to curb face, and a minimum right-of-way diameter of 115 feet, except for residential streets approved pursuant to Chapter 9-12, "Subdivision," B.R.C. 1981, and Section 2.09, "Residential Streets." Cul-de-sacs are prohibited on arterial and collector streets, and are strongly discouraged on local and residential streets. The Director may permit cul-de-sacs where there is no other possible street or driveway access to a property from a public right-of-way, or if a cul-de-sac would avoid direct property access to a collector or arterial.

(E) Vertical Alignment

(1) **Minimum Street Grade:** All street grades shall equal or exceed the minimum street grade of 0.5 percent.

(2) **Maximum Street Grade:** Street grades shall not exceed the maximum street grades shown in Table 2-9, "Maximum Street Grades," of these Standards.

Table 2-9: Maximum Street Grades

Street Type	Maximum Street Grade
Local	8%
Collector	6%
Arterial	5%
Intersection Approach (Minimum 50')	4%
Signalized Intersection Approach (Min. 50')	2%

(3) **Design Controls for Vertical Curves:** Design control for sag and crest vertical curves, (based on a design speed of 30 mph) shall meet the specifications shown in Table 2-10, "Vertical Curve Design Control," of these Standards. For design speeds in excess of 30 mph, design control shall be in accordance with the current edition of "A Policy on Geometric Design of Highways and Streets,", prepared by the American Association of State Highway and Transportation Officials.

Table 2-10: Vertical Curve Design Control

Algebraic Difference in Grades	Sag Curve Minimum Vertical Curve Length	Crest Curve Minimum Vertical Curve Length
0.5 - 1.0 %	50 feet	100 feet
1.0 - 3.0 %	100 feet	100 feet
3.0 - 5.0 %	200 feet	150 feet
5.0 - 7.0 %	300 feet	200 feet
7.0 - 8.0 %	300 feet	300 feet
Min. Vert. Sight Distance	N/A	250 feet

(4) **Vertical Sight Distance:** Vertical curve sight distance shall equal or exceed 250 feet. Greater vertical sight distance may be required by the Director to ensure safe travel and street crossings for all transportation modes.

(F) Sight Distance

All streets and alleys shall provide adequate sight distance as set forth under Section9-9-7, "SightTriangles," B.R.C. 1981.

(G) Medians

The Director will require raised medians on new arterial streets. Raised medians may be permitted on all streets subject to review and approval by the Director.

(1) **Median Widths:** Medians shall be at least 4 feet wide, curb face to curb face. If left turn lanes are installed in the median, the median width adjacent to the left turn storage lanes shall be 4 feet and the median width at the start of the left turn lane bay taper shall be at least 14 feet wide, curb face to curb face. Median design widths shall conform to Table 2-11, "Median Width Design Standards," of these Standards.

Table 2-11: Median Width Design Standards

Function	Minimum Width	Recommended Width
Separation of Opposing Traffic	4 feet*	10 feet*
Pedestrian Refuge or Traffic Control Device Location	6 feet*	14 feet

Medians Separating Left Turn Lanes	14 feet	20 feet

* NOTE: Cannot accommodate left-turn lanes

(2) **Landscaping in Medians:** Landscaping in medians shall comply with the requirements of Chapter 3, "Streetscaping," of these Standards.

(H) Vertical Clearance of Structures

At least 17.5 feet of vertical clearance shall be provided for all overhead structures. Vertical clearance is measured from the crown of the street to the lowest portion of the structure on all streets and alleys.

2.08 Sidewalks

(A) Required

Sidewalks are required on both sides of all new streets, except for residential streets that were approved without required sidewalks pursuant to Chapter 9-12, "Subdivision," B.R.C. 1981, and Section 2.09, "Residential Streets."

(B) Conformance with the Transportation Master Plan

Off-street sidewalks may be required as part of any project or development proposal in conformance with the TMP.

(C) Compliance with Americans with Disabilities Act (ADA)

All public sidewalks shall comply with the requirements of the ADA's "Standards for Accessible Design," which includes without limitation sidewalk widths, grades, locations, markings, surface treatments, and access ramps.

(D) Minimum Widths

Sidewalk widths shall conform to the dimensions shown in Table 2-12, "Minimum Sidewalk Widths," of these Standards.

Table 2-12: Minimum Sidewalk Widths

Minimum Sidewalk Width			
	Adjacent Land Use		
Street Type	Commercial/Retail	Commercial/Industrial	Residential
Local	12	5	4
Collector	12	5	5
Arterial	12	8	8

Note: All off-street multi-use/bike paths designated in the Transportation Master Plan shall be 12 feet wide.