

Chapter 11. ROADWAYS & PAVEMENTS

11.1 Introduction

11.1.1 Purpose

This section contains minimum criteria to be met on newly designed and constructed public and private (open to general public) streets and parking lots in the City. Roadway design shall meet or exceed these STANDARDS AND SPECIFICATIONS. Policies and technical criteria shall not be specifically addressed in this document and shall follow the provisions of the American Association of State Highway and Transportation Officials (AASHTO), CDOT Standard Specifications for Road and Bridge Construction (CDOT S&S), Highway Capacity Manual, Manual on Uniform Traffic Control Devices (MUTCD), and the Colorado Department of Transportation's Standard Plans ("M-Standards"). Improvements shall also be in conformance with the City of Northglenn Unified Development Ordinance.

11.1.2 City Capital Improvement Projects

It is recognized that the minimum requirements contained in these STANDARDS AND SPECIFICATIONS are not necessarily sufficient for plans, specifications, and contract administration purposes for City administered street capital improvement projects. Accordingly, the Engineering Division is authorized to develop and/or approve such additional requirements and procedures necessary for bidding, awarding, and administering for such projects, provided said additional requirements and procedures are substantially consistent with these STANDARDS AND SPECIFICATIONS and applicable provisions of other City ordinances and resolutions.

11.2 Roadway Design & Technical Criteria

This section sets forth the minimum design and technical criteria and specifications to be used in the preparation of all roadway plans. Within this chapter is, "A Policy on Geometric Design of Highways and Streets" as published by the American Association of State Highway and Transportation Officials (Latest Edition).

11.2.1 Drainage

The minor and major storm drainage systems shall be designed in accordance with the Urban Drainage and Flood Control District's Criteria Manual (UDFCD) (Latest Edition). Because safe and efficient movement of traffic is the primary function of roadways, the storm drainage function of roadways, (such as allowable gutter capacity and street overtopping), shall be designed to the limits set forth in the drainage criteria. Please refer to **Chapter 9 – Storm Drainage & Other Concrete Facilities** and **Chapter 10 - Concrete Sidewalks & Other Concrete Facilities** for the design standards for crosspans, inlets and sidewalk chases.

11.2.2 Geometric Design

Geometric design elements, such as horizontal and vertical alignments and sight distances shall be in accordance with the "A Policy on Geometric Design of Highways and Streets" by the American Association of State Highway and Transportation Officials (Latest Edition). Geometric design elements must also consider the requirements of the local Fire District.

Geometric Cross Section

Street cross sectional elements shall conform to the Standard Drawing as determined by the Engineering Division. Collector and arterial streets shall be constructed whenever the alignment of the proposed street is generally the same as the collector and arterial streets shown on the Comprehensive Plan, Transportation Plan, or whenever a traffic engineering analysis of the future traffic volumes indicates the need of a cross section greater than that of a local residential street. These cross sections can be found in **Standard Drawings R-1 and R-2**.



Additional Right of Way may be required to satisfy other criteria contained in these Standards and Specifications. Areas outside the Right of Way shall be contour graded, compacted, and sloped, as required for proper drainage, soil stability, and maintenance accessibility.

Curb Radii

Curb radii criteria for various intersections are listed on Table 11.1.

Table 11.1: Curb Radii Criteria

Classification	Major Arterial	Minor Arterial	Collector	Local
Major Arterial	45 feet	45 feet	45 feet	N/A
Minor Arterial	45 feet	40 feet	35 feet	N/A
Collector	45 feet	35 feet	30 feet	25 feet
Local	N/A	N/A	25 feet	20 feet

Horizontal Alignment

Streets shall intersect or connect to other streets at right angles, and intersections shall be constructed so that lanes are not offset through the intersection. If a street approaching another street is at an oblique angle, then the design shall have the intersecting streets at right angles for 100 linear feet from the intersecting flowlines. Horizontal and vertical alignment and Right of Way limits shall be coordinated so as not to obstruct sight distance at intersections, in accordance with City Code.

Street Design Criteria

Street design criteria for various street types are listed on Table 11.2. The requirements of the City of Northglenn Development Code, the City Transportation Plan, and the City's Comprehensive Plan shall be adhered to.

Table 11.2: Street Design Criteria

	Parking Lots & Private Streets	Local Streets	Minor Collector	Major Collector	Minor Arterial	Major Arterial
Design Speed	N/A	30	35	40	45	50
Posted Speed	N/A	25	30	35	40	45
Traffic Volumes		< 2,500 /day		<12,000	>12,000	
Continuity		Limited		< 2 miles	Several miles, generally connecting with inter-city routes	
Safety		Designed for the safety of pedestrians and bicyclists and the ease of access to adjacent parcels of land	Designed to handle traffic volumes loading from and onto local, other collector, and arterial roadways			



	Parking Lots & Private Streets	Local Streets	Minor Collector	Major Collector	Minor Arterial	Major Arterial
Traffic Control		Stop signs, yield signs or Right of Way rules for uncontrolled intersections. Traffic requirements in other than residential areas may require special design consideration by the applicant's Designer and the City's Transportation Engineer	Regulation of traffic accomplished using stop signs and channelization. Traffic signals normally use only at intersections with major collectors and arterial streets		Regulation of traffic accomplished by signs and channelization. Traffic signals will normally be located only at intersections with streets of high classification. Parking should be prohibited	
Driveways - Drive Cut see Chapter 10		Back-out drives permitted	No back-out drives permitted			
Function		Local streets provide direct access to adjacent property. Traffic carried by local streets should have an origin or a destination within the neighborhood. Local streets are utilized in single family residential areas. Utility line easements should be available	Collector streets collect and distribute traffic between arterial and local streets and serve as main connectors within communities, linking one neighborhood with another. Traffic carried by collector streets should have an origin or a destination within the community. Utility easements should be available		Arterial routes permit relatively unimpeded traffic movement and are intended for use on these routes where four (4) moving lanes and one (1) left-turn lane are required but where a major arterial cross-section would not be warranted. No parking is allowed	
Right of Way		Sixty feet (60') with detached walk. Attached walks to be used only with written permission from the Engineering Division.		Seventy-foot (70') minimum, eighty-foot (80') average	One hundred feet (100') minimum	
Number of Moving Lanes		2		2	4 (minimum)	
Access Conditions		In accordance with Chapter 11 of these STANDARDS AND SPECIFICATIONS	In accordance with Chapter 11 of these STANDARDS AND SPECIFICATIONS			



	Parking Lots & Private Streets	Local Streets	Minor Collector	Major Collector	Minor Arterial	Major Arterial
Planning Characteristics		Local streets should not intersect major arterial streets	Collector streets should have continuity throughout a neighborhood but need not extend beyond the neighborhood intersections with collectors, major collectors and arterial streets should be at least one-quarter (1/4) mile apart		Arterials should be spaced from one-half (1/2) to one (1) mile apart and should, where possible, be continuous. Arterials should act as boundaries between neighborhood areas. Arterial cross-section should be employed where traffic demands are high and Right of Way acquisition costs are prohibitive. Detached sidewalk required. Separate major land uses	
Type of Curb and Gutter		Six inches (6") vertical with detached walk. Four-inch (4") combination curb, gutter and walk, with attached walk only with written permission from the Engineering Division	Six (6) inch vertical	Six (6) inch vertical		
Sidewalk Width		Five-foot (5') minimum, attached or detached from curb	Five feet (5') minimum. Detached from curb	Eight-foot (8') minimum, detached from curb or as required by the Engineering Division		
Cul-de-sacs		In accordance with Chapter 11 of these STANDARDS AND SPECIFICATIONS				
Street Widths		Thirty foot(30') minimum paved width plus two (2) two and a half foot (2.5') curb and gutter pans	Thirty-seven-foot (37') - forty-nine foot (49') paved with two (2) two and a half foot (2.5') gutter pans	Four (4) - twelve-foot (12') travel lanes, one (1) sixteen-foot (16') left-turn lane/striped or curbed median, and two (2) two and a half foot (2.5') gutter pans plus acceleration/deceleration lanes at intersections. Variation from these dimensions must be approved by the Engineering Division		
Streetlight Spacing		200' (+/- 40)			150' (+/-50)	
Right & Left Turn Lanes	Required at all accesses along arterials. May be required at accesses along collectors but shall be determined at time of development by the Engineering Division. Minimum dimensions: 150' storage, 100' taper, except for arterial/arterial intersections which shall be designed to accommodate 200' storage and 100' taper					
Cross Slope	Max 4% - Min	Maximum 4% - Minimum 2%				



	Parking Lots & Private Streets	Local Streets	Minor Collector	Major Collector	Minor Arterial	Major Arterial
without Super Elevation	1%					
Maximum Curb Line Grade Break without Vertical Curve	1%	1% at Curb Returns, 0.5% at Other Locations				
Super Elevation Maximum	N/A	N/A	4%	4%	4%	4%
Minimum Degree Curve	N/A	38.2 (150'R)	22 (260'R)	10 (575'R)	8.5 (675'R)	7 (820'R)
Maximum Street Grade	N/A	N/A	150'	300'	400'	500'
Minimum Street Grade	0.75%					
Maximum Grade at Intersection	4% for 50% when approaching ROW	4% for 50'	4% for 150'	3% for 300'	2% for 300'	2% for 400'
Tangents between Horizontal Curves	N/A	N/A	150'	300'	400'	500'
K-Values - Sag	N/A	37	37	64	79	96
K-Value - Crest	N/A	19	19	44	61	84

The corner sight distance is measured from a point on the minor road, parallel to the roadway, 15 feet from the edge of the major road pavement, and from an eye height of 3.5 feet on the minor road to the height of the object and an eye height of 4.25 feet on the major road.

Stopping Sight Distance (Table 11.3) is measured from the driver's eye, 3.5 feet above the pavement to the top of an object 0.5 feet high on the pavement.

Table 11.3: Stopping Sight Distance

	Arterial	Collector	Residential Local
Minimum Corner Sight Distance	500'	400'	300'
Minimum Stopping Sight Distance	350'	275'	200'

Sight Obstructions are determined by any object more than 30 inches above the flowline elevation of the adjacent street. Those items, including berms, buildings, cut slopes, hedges, trees, bushes, utility cabinets or other plantings shall be removed.

Emergency Access Requirements

The access shall be a minimum of twenty (20) feet from edge to edge of roadway and shall be in an access easement. The slope shall be a minimum of one-half percent and a maximum of eight (8) percent. The cross slope shall be no less

than one (1) percent and no more than four (4) percent with a minimum vertical clearance of thirteen and one-half (13.5) feet. The surface must be paved.

Sidewalks, Curb & Gutters, Ramps, & Driveways

Refer to **Chapter 10– Concrete Sidewalks & Other Concrete Facilities** for these features.

Cul-De-Sacs

The following criteria shall be used for cul-de-sac horizontal geometry:

- The minimum property line radius shall be fifty feet (50').
- The minimum flowline radius shall be forty feet (40'). See the detail drawing in **Appendix G.4.**
- The maximum length of the cul-de-sac as measured along and between the radius point and the Right of Way line on the abutting street shall be five hundred feet (500') or a maximum of fifteen (15) residential dwelling units, whichever is greater.

Deceleration Lanes

The design of the arterial street system depends upon the proper control of access to developments. The location and design of access points must minimize traffic hazards and interference to through traffic movements. To ensure proper control, the following standards for deceleration lanes have been established. The need for deceleration lanes is established by the approved traffic study for the final plat or final development plan. Design criteria shall be in accordance with AASHTO "A Policy on Geometric Design of Highways and Streets", (Latest Edition).

Acceleration Lanes

At intersections, it is desirable to provide acceleration lanes for vehicles turning right onto the arterial from a cross street. The design elements of these acceleration lanes shall be in accordance with the Colorado Department of Transportation Roadway Design Manual, Latest Edition.

Off-Site Design

The design grade, and existing ground at that design grade, of all roadways that dead end due to project phasing, subdivision boundaries, etc., shall be continued in the same plan and profile as the proposed design for at least three hundred feet (300') or to its intersection with an arterial roadway.

If the off-site roadway adjacent to the proposed development is not fully improved, the developer is responsible for the design and construction of a transition for the safe conveyance of traffic from his improved section to the existing roadway. The following formula shall be applied to the taper of lane change necessary for this transition:

$$L = WS / 60 \quad S \leq 40 \text{ MPH}$$

$$L = WS \quad S > 45 \text{ MPH}$$

Where:

L = Length of Transition in Feet W = Width of Offset in Feet

S = Speed Limit or 85th Percentile Speed

The City of Northglenn Engineering Division should be contacted to establish unusual transition criteria. This contact is the responsibility of the applicant.

Barricades

Whenever roadways terminate due to project phasing, subdivision boundaries, etc., barricades are required across the width of terminated roadway. Design and construction shall comply with the requirements of the Manual of Uniform Traffic Control Devices, most recent edition. Details shall be shown on the construction drawings and installation shall be provided by the Developer/Contractor.

Requirements of Improvements Adjacent to Existing Roadways

Where proposed street construction will widen existing roadways or add a right turn lane, then the following requirements shall apply:

- Existing cross slope of adjacent lanes shall be maintained. Where this is not possible, the change in cross slope for the new lane shall not exceed 2.0%.
- The removal limits shall be sawcut in a clean straight line and shall not be in the traveled wheel path.
- The entire adjacent lane along the new improvements shall be roto-milled two (2) inches and overlaid with the final lift of the new improvements. Geosynthetic fabric may be required at the joint to prevent the pavements from reflective cracking.
- A geotechnical investigation shall be conducted on all roadways adjacent to the development to evaluate the condition of the asphalt. (Refer to **Chapter 5 - Design Report Requirements**) The investigation shall consist of borings or other suitable method of sampling, at spacing of no more than 250 feet unless otherwise accepted by the Engineering Division. The results of this investigation shall be submitted to the Engineering Division for determination of what, if any, existing asphalt may be utilized to meet the requirements of the Developer's Agreement.

Type 4 object markers shall be accompanied by a "future street extension" sign for the entire cross section of the roadways if it is planned for the street to be continued in the future.

Pavement markings, striping, signs, traffic signals and streetlights are addressed in **Chapter 12- Traffic Operation Devices**.