

City of Concord

Technical Standards Manual

Article II

Streets & Pedestrian Paths



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**CONCORD TECHNICAL STANDARDS MANUAL
STREETS**

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1.0 Purpose

The purpose of this Article is to protect the safety of the traveling public in the City and to create a quality street network that will not require pre-mature maintenance. All public streets inside the municipal limits of the City must be constructed in conformance with City standards and specifications. If any conflicts arise between a City and North Carolina State Highway Commission standard, the more restrictive standard will apply.

- 1.1. The Director of Transportation, in consultation with other City departments and state agencies, may allow modifications to the design criteria. Modifications to the design criteria:
 - a. Must be based on sound engineering principles and practices,
 - b. Must not create an unsafe or hazardous situation,
 - c. Must be equivalent to the efficiency, functionality, durability, structural integrity, and long-term maintenance of the minimum criteria in this Article.
 - d. Classifications must be in conformance with the current City of Concord Transportation Plan.
- 1.2. The Director of Transportation is authorized to require studies or other pertinent information to help support or justify the modification.

2.0 Basic Design Considerations

Streets must be designed to accommodate the volume and type of traffic they are intended to serve and the geometry of the landscape on which they will be located.

- 2.1. **Traffic Volumes.** The Average Daily Traffic (ADT) volume is a measurement of the users' demand for a street. ADT is defined as the total volume during a given time period (in whole days), greater than 1 day and less than 1 year, divided by the number of days in that time period. The current ADT volume for a street can be readily determined when continuous traffic counts are available. When only periodic counts are taken, the ADT volume can be estimated by adjusting the periodic counts according to such factors as the season, month, or day of the week. If the ADT of a street is unknown, traffic count studies may be required to determine the design volume.
- 2.2. **Functional Classifications.** Individual streets do not serve travel independently of one another. Most vehicular travel involves movement through a network of streets. Therefore, the functional classification of a street must be determined before design criteria can be established for any proposed improvement. Functional classifications are based on the nature of the services streets are intended to provide and the minimum average daily traffic (ADT) typically served. Table 2-1 identifies each area street classification. To verify the functional classification of existing streets in City's transportation service area, please refer to the City's Transportation Plan. *Functional classifications for proposed streets must be approved by the Director of Transportation prior to the design of roadway layouts and preliminary plats.*

Table 2-1: Functional Classifications.

Classification	Function	Minimum Average Daily Traffic (ADT)
Freeway or Expressway	Serves substantial statewide or interstate travel and exists solely to serve vehicular traffic; does not serve pedestrian and bicycle traffic	8,000
Major Thoroughfare	Provides for expeditious movement of high volumes of traffic within and through urban areas	8,000
Minor Thoroughfare	Collects traffic from local streets and collectors and carries it to the major thoroughfare system; supplements the major thoroughfare system by facilitating minor thru traffic movements; and sometimes serves adjacent property	4,000
Major Collector	Serves intra-county travel corridors and traffic generators and provides access to the thoroughfare system	3,000
Minor Collector	Provides service to small local communities and traffic generators and provides access to the major collector system	1,000
Local Street	Provides access to adjacent property over relatively short distances	250
Alley	Provides access to adjacent property, typically to the rear of the structures located on the property served, and usually serves as a route for utilities, garbage collection, and garage access in residential areas	100

2.3. **Service Classifications.** Major collectors, minor collectors, local streets, and alleys may also be categorized as residential or non-residential.

- a. *Residential Streets.* Residential streets serve residential property. In general, 50% or more of the properties fronting a residential street are zoned for residential purposes.
- b. *Non-Residential Streets.* When less than 50% of the street frontage is adjacent to residential property, the street is considered a non-residential street.

3.0 Cross-Section Standards

- 2.4. **Terrain Classifications.** Two terrain classifications are applicable to the Concord area. These classifications affect street design criteria. All streets should be designed in accordance with the level terrain classification unless the necessary supporting data is presented and approved by the Director of Transportation for each street section designed using rolling terrain classification. The term “slope” in this subsection includes the rise and fall of the existing topography measured both parallel and perpendicular to the centerline of the proposed street.
- a. *Level.* Slopes in a level terrain range from 0% to 8%. In level terrain, horizontal and vertical street sight distances are generally long or can be designed to be so without construction difficulties or major expense.
 - b. *Rolling.* Slopes in a rolling terrain range from 8.1% to 15%. Natural slopes consistently rise above and fall below the street grade line, and occasional steep slopes offer some restriction to normal highway horizontal and vertical alignment.
- 2.5. **Design Speeds.** Designers should use the highest design speed that is practical to attain the best possible degree of safety, mobility, and efficiency. The design speed of a street should be a minimum of five (5) miles per hour (mph) above the anticipated posted speed. Geometric design features should be consistent with the selected design speed. Minimum design speeds for each functional classification are provided in Table 2-2.

Table 2-2: Minimum Design Speeds.

Classification	Minimum Design Speed (mph)	
	Level Terrain	Rolling Terrain
Freeway or Expressway	70	65
Major Thoroughfare	60	55
Minor Thoroughfare	50	45
Major Collector	50	50
Minor Collector	40	40
Local Street	40	40
Alley	20	15

3.0 Cross-Section Standards

3.1. Widths.

- a. *Rights-of-Way.* Right-of-way widths are based on the street type. Rights-of-way must be at least as wide as the minimum widths provided in the table below. Rights-of-way must be platted and dedicated in the location and at the width shown on the approved plans.

Table 3-1: Minimum Right-of-Way Widths.

Classification		Minimum Right-of-Way Width (feet)
Major Thoroughfare	All	100-120
Minor Thoroughfare	All	80-100
Major Collector	Non-Residential	80
	Residential	60
Minor Collector	Non-Residential	80
	Residential	60
Local Street	All	50
Alley	All	20
Cul-de-Sac	Non-Residential	80 70-foot radius
	Residential	60 60-foot radius

- b. *Pavement.* Pavement widths are based on the street classifications and locations. The width from the edge of pavement perpendicularly to the edge of pavement must be as least as wide as the minimum widths provided below:

Table 3-2: Minimum Pavement Widths.

Classification		Minimum Pavement Width (feet)
Major Thoroughfare	All	24 for each of two divided sections
Minor Thoroughfare	All	24 for each of two divided sections or 36' non-divided
Major Collector	Non-Residential	36
	Residential	34
Minor Collector	Non-Residential	36
	Residential with On-Street Parallel Parking	34
	Residential without On-Street Parking	24
Local Street	All	24
Alley	All	16
Cul-de-Sac	Non-Residential	48-foot radius
	Residential	38-foot radius

- 3.2. **Materials.** The following material standards and thicknesses represent the minimum acceptable standards of the City. Pavement designs must consider existing soil types and geotechnical conditions. The Engineering Department will review pavement designs.

3.0 Cross-Section Standards

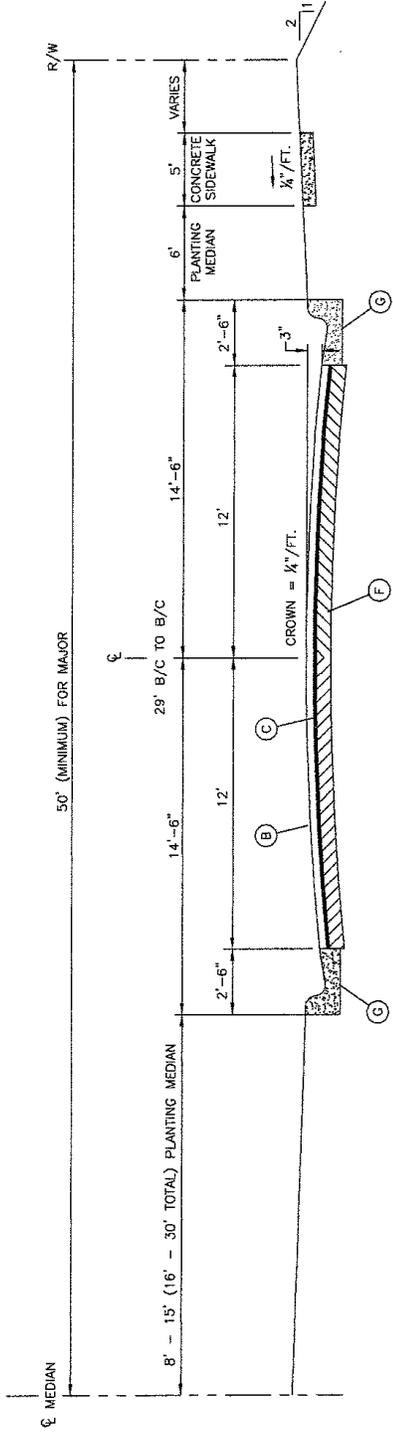
- a. *Base Course.* The material for the base course of the street must be crusher-run stone with aggregates ranging from one and one-half (1½) inch diameter particles to dust and must meet the standards of the NC DOT Standard Specification for Roads and Structure.
 - 1. The material should consist of tough durable aggregate, containing sufficient fines to ensure a well-bonded and uniform base after compaction.
 - 2. The aggregate must be free from an excess of flat, elongated, soft disintegrated pieces, and should not contain clay, silt, vegetative, or other objectionable matter.
 - 3. The mixing and shaping of the base course material must be performed with a power-driven motor grader, equipped with a blade not less than ten (10) feet long, and equal to or equivalent to a full size motor grader with 125 horsepower or greater.
 - 4. The base shall be compacted by rolling with ring or temping roller and with pneumatic tired roller. When completed, the base course must be smooth, hard, dense, unyielding and well bonded.
- b. *Intermediate Course.* The material for the binder course of the street must be consistent with NC DOT’s Superpave Manual. Asphalt plants providing the material for the binder course must be certified by NC DOT.
- c. *Surface Course.* The material for the surface course of the street must be consistent with NC DOT’s Superpave Manual. Asphalt plants providing the material for the surface course must be certified by NC DOT.

Table 3-3: Base, Intermediate, and Surface Courses.

Classification		Base Course	Intermediate Course	Surface Course
Major Thoroughfare	All	*	*	*
Minor Thoroughfare	All	*	*	*
Major Collector	Non-Residential	*	*	*
	Residential	10” CABC or 5” B-25.0X	2.25” I-19.0X	2.0” SF 9.5X
Minor Collector	Non-Residential	*	*	*
	Residential	10” CABC or 5” B-25.0X	2.25” I-19.0X	2.0” SF 9.5X
Local Street	Non-Residential	*	*	*
	Residential	8” CABC or 4” B-25.0X	2.25” I-19.0X	1.5” SF 9.5X
Alley	All	8”CABC		1.5” SF 9.5X

* Pavement cross sections must be designed on a case by case basis.

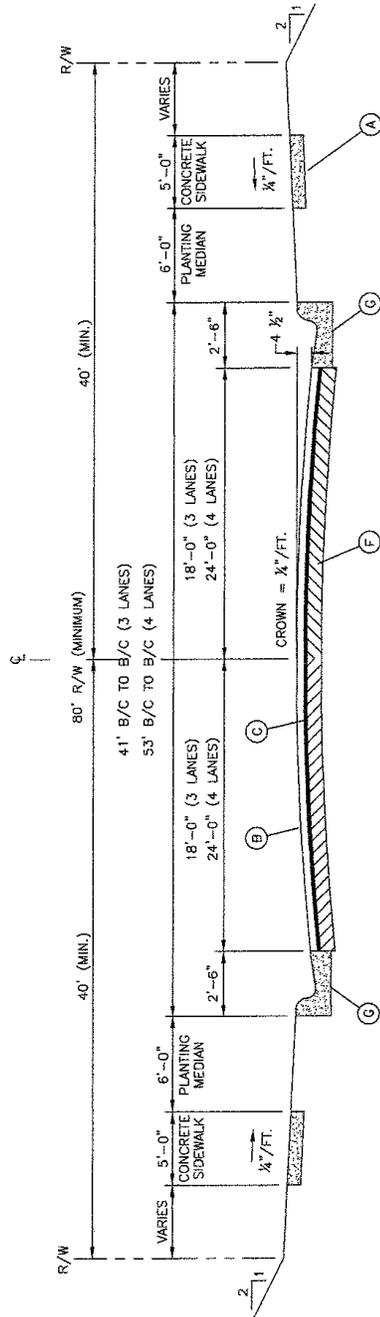
- d. *Street Shoulder.* Fill embankments must be formed of suitable materials placed in successive layers of not more than six (6) inches in depth for the full width of the cross section, including width of slope area.
1. No stumps, trees, brush, rubbish or other unsuitable materials or substances shall be placed in the embankments within any right-of-way or easement.
 2. Each successive six-inch layer shall be thoroughly compacted by a sheepsfoot roller, ten-ton, three-wheel power roller, pneumatic-tired roller or other method approved by the Director of Engineering. Embankments over and around all pipes and culverts shall be of select material, placed and thoroughly tamped and compacted as directed by the Director of Engineering or his/her representative.
 3. Any soft spots or pumping areas must be removed and replaced in the manner stated above until satisfactory compaction is achieved.



SECTION A-A
TYPICAL CROSS SECTION

- (B) PER APPROVED PAVEMENT DESIGN
- (C) PER APPROVED PAVEMENT DESIGN
- (E) PER APPROVED PAVEMENT DESIGN
- (G) 2'-6" STANDARD CURB AND GUTTER

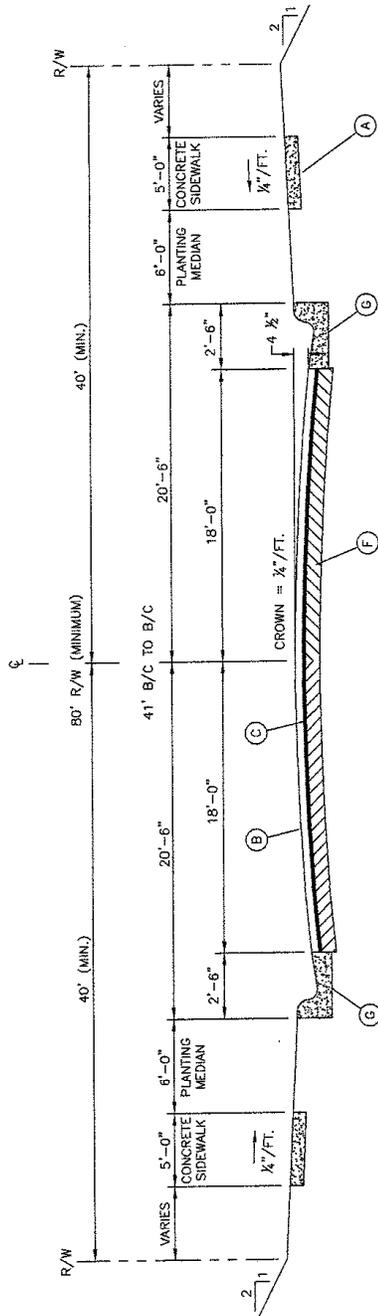
TYPICAL SECTION
MAJOR THOROUGHFARE AND MINOR THOROUGHFARE
WITH MEDIAN



SECTION A-A
TYPICAL CROSS SECTION

- (A) 4" SIDEWALK
- (B) PER APPROVED PAVEMENT DESIGN
- (C) PER APPROVED PAVEMENT DESIGN
- (F) PER APPROVED PAVEMENT DESIGN
- (G) 2'-6" STANDARD CURB AND GUTTER

TYPICAL SECTION
MINOR THOUGHFARE
NON-DIVIDED

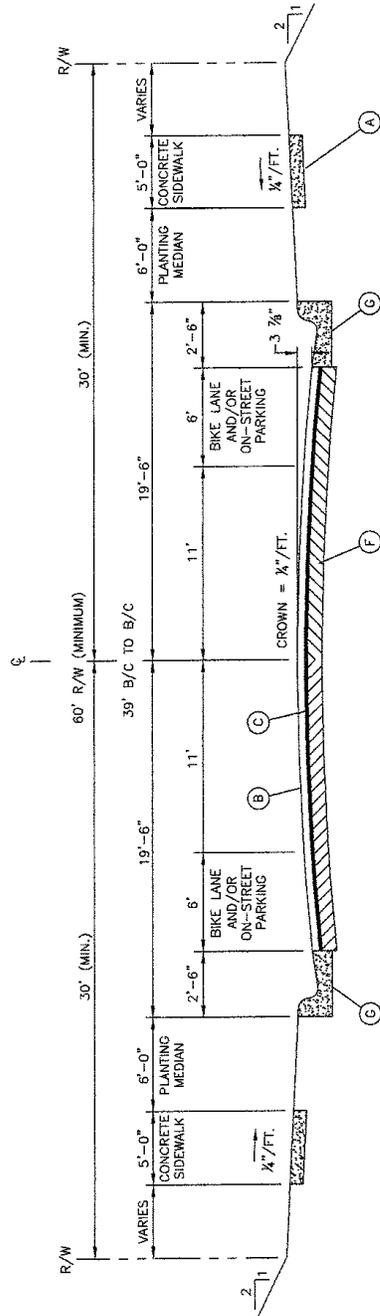


SECTION A-A
TYPICAL CROSS SECTION

DIMENSIONS FOR NONRESIDENTIAL STREETS
USING 2'-6" STANDARD CURB AND GUTTER
(SEE STANDARD DRAWING NO. 21A FOR NONRESIDENTIAL CUL-DE-SACS)

- (A) 4" SIDEWALK
- (B) PER APPROVED PAVEMENT DESIGN
- (C) PER APPROVED PAVEMENT DESIGN
- (F) PER APPROVED PAVEMENT DESIGN
- (G) 2'-6" STANDARD CURB AND GUTTER

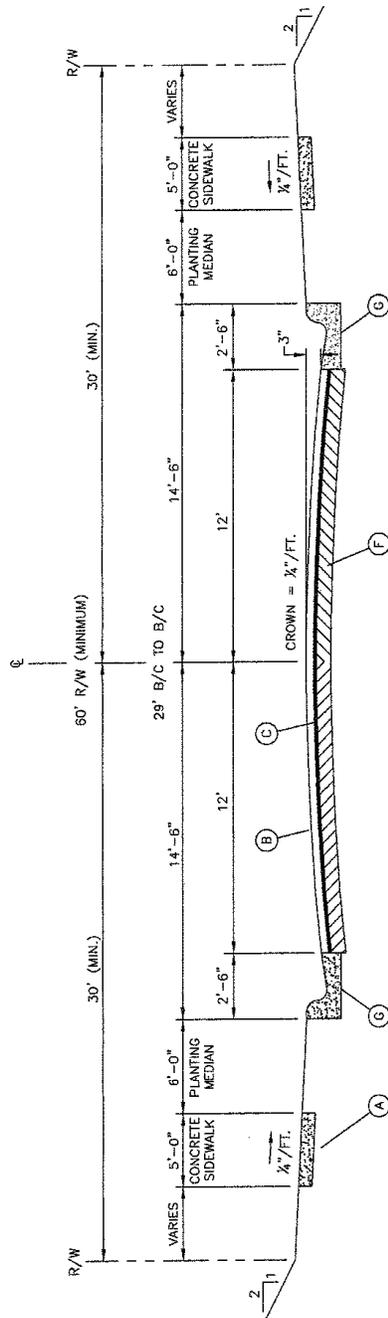
TYPICAL SECTION
NON-RESIDENTIAL MAJOR COLLECTOR AND NON-RESIDENTIAL MINOR COLLECTOR



TYPICAL CROSS SECTION

- (A) 4" SIDEWALK
- (B) 2.0" SF9.5X SURFACE COURSE
- (C) 2.25" 1-19.0X INTERMEDIATE COURSE
- (D) 10" COMPACTED AGGREGATE BASE COURSE OR 5" B-25.0X
- (E) 2'-6" STANDARD CURB AND GUTTER

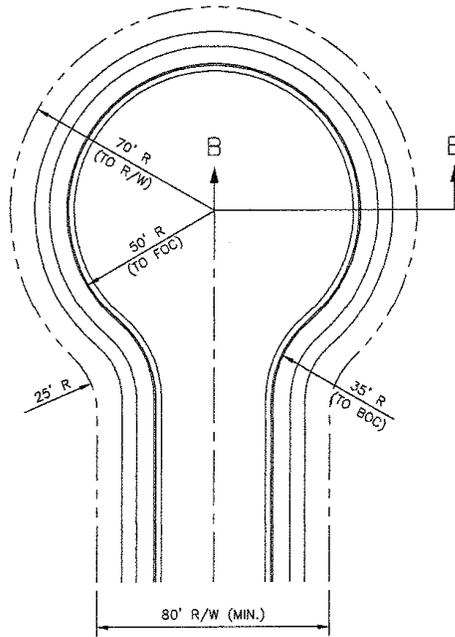
TYPICAL SECTION
RESIDENTIAL MINOR COLLECTOR WITH ON STREET PARKING



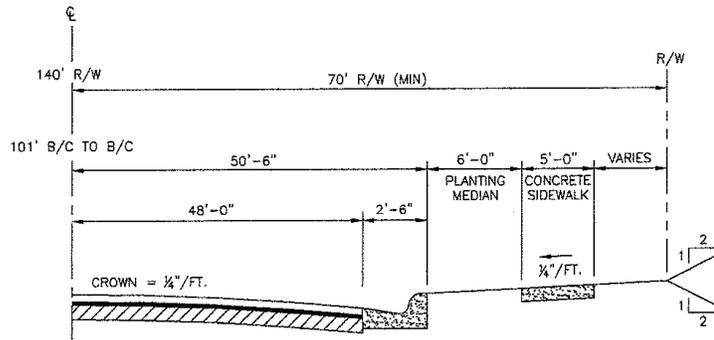
SECTION A-A

- (A) 4" SIDEWALK
- (B) 2.0" SF 9.5X SURFACE COURSE
- (C) 2.25" 1-19.0X INTERMEDIATE COURSE
- (F) 10" COMPACTED AGGREGATE BASE COURSE OR 5" B-25.0X
- (G) 2'-6" STANDARD CURB AND GUTTER OR

TYPICAL SECTION
MINOR COLLECTOR WITHOUT ON-STREET PARKING



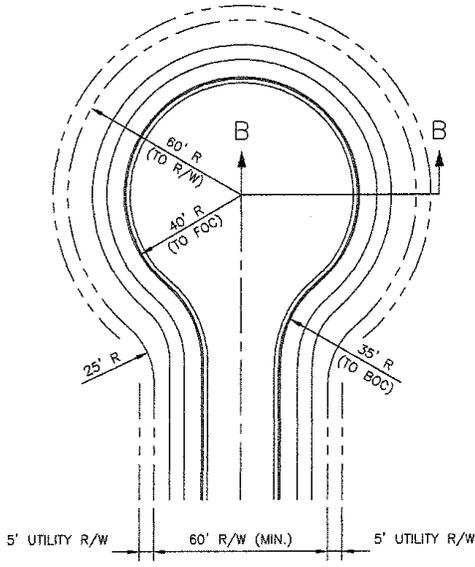
PLAN



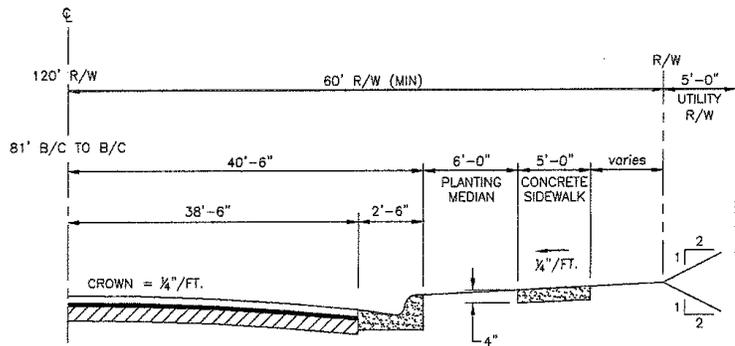
SECTION B--B

DIMENSIONS FOR NONRESIDENTIAL CUL-DE-SACS
USING 2'-6" STANDARD CURB AND GUTTER

NONRESIDENTIAL CUL-DE-SAC



PLAN



SECTION B-B

DIMENSIONS FOR RESIDENTIAL CUL-DE-SACS
USING 2'-6" STANDARD CURB AND GUTTER

RESIDENTIAL CUL-DE-SAC

Cul-de Sac Design Standards

- 4.1. **Design Standard Exceptions.** Cul-de-sacs are subject to the same design guidelines as those given for the local street classification, with the exception of the following design standards that are specific to cul-de-sacs.
- a. *Service Limits.* A cul-de-sac can serve no more than twenty (20) residential units.
 - b. *Lengths.* Cul-de-sacs must not exceed the lengths provided in Table 4-1. Length is measured from the center of the terminus to the centerline of the closest intersecting street providing access to the cul-de-sac.

Table 4-1: Maximum Lengths for Cul-de-Sacs.

Zoning District	Maximum Length (feet)
AG	1,000
B-1	500
C-1	500
C-2	500
CC	300
CD	1,500
I-1	1,500
I-2	1,500
O-I	500
PUD	500
RC	300
RE	1,000
RL	1,000
RM-1	800
RM-2	800
RU	300
RV	800

- c. *Connectivity Provisions.* If the cul-de-sac is located along a corridor included in the City of Concord's Transportation Plan or if the cul-de-sac is located along a corridor that will serve as a future thru street in accordance with a recorded subdivision plat or site plan, preliminary and final engineering plans must show a stub (extension of the street right-of-way) from the terminus of the cul-de-sac to the edge of the area being developed. The stub must be duly signed in the field as to the potential for future extension.
- d. *Termini.* The terminus of the cul-de-sac must be designed to allow vehicles to

5.0 Slope Standards

turn around and exit to the adjoining street.

1. *Radii.* The radius for the terminus (bulb or turnaround) must not be less than forty (40) feet to the face of curb as shown on the detail drawings.
2. *Islands.* An island may be located in the center of the terminus of the cul-de-sac. Islands must meet the design standards provided in Section 7.6.

5.0 Slope Standards

5.1. **Longitudinal Grade.** Longitudinal grades may range between one percent (1.0%) and twelve percent (12%). Table 5-1 identifies the maximum longitudinal grade for each functional classification.

Table 5-1: Maximum Longitudinal Grades.

Classification	Conditions (Terrain or Proximity to Intersection)	Maximum Grade
Freeway or Expressway		*
Major Thoroughfare		*
Minor Thoroughfare		*
Major Collector	Level Terrain	6%
	Rolling Terrain	9%
	Intersection in \leq 100 feet	3%
Minor Collector	Level Terrain	6%
	Rolling Terrain	9%
	Intersection in \leq 100 feet	5%
Local Street	Level Terrain	9%
	Rolling Terrain	12%
	Intersection in \leq 100 feet	5%
Alley	Level Terrain	9%
	Rolling Terrain	12%
	Intersection in \leq 100 feet	5%

* Consult the latest edition of AASHTO's *The Policy on Geometric Design of Highways and Streets*.

5.2. Transverse Grade.

- a. *Street Surface.* Transverse grades on the street surface must have a one-fourth ($\frac{1}{4}$) inch rise to one (1) foot run slope. Superelevation rates, minimum runoff lengths, and methods of distribution should be designed in accordance with AASHTO guidelines.

Table 5-2: Maximum Superelevation Transverse Slope for Minimum Centerline Radius.

Classification	Maximum Superelevation Transverse Slope (feet/feet)	
	Level Terrain	Rolling Terrain
Freeway or Expressway	*	*
Major Thoroughfare	*	*
Minor Thoroughfare	*	*
Major Collector	0.04	0.04
Minor Collector	0.04	0.04
Local Street	normal crown	normal crown
Alley	N/A	N/A

* Consult the latest edition of AASHTO’s *The Policy on Geometric Design of Highways and Streets*.

b. Street Shoulder.

1. *Minimum width.* The minimum shoulder width shall be 6 feet wide measured from the edge of pavement. The transverse grade for street shoulders shall be ¼” per foot.
2. *Fill/Cut Slopes.* The maximum transverse grade for street shoulders is a one (1) foot rise to two (2) foot run slope.

6.0 Curve Standards

6.1. **Horizontal Centerline Curve Radius.** Table 6-1 provides the minimum horizontal centerline curve radii for each functional classification.

Table 6-1: Minimum Horizontal Centerline Curve Radii.

Classification	Minimum Horizontal Centerline Curve Radii (feet)	
	Level Terrain	Rolling Terrain
Freeway or Expressway	*	*
Major Thoroughfare	*	*
Minor Thoroughfare	*	*
Major Collector	310	230
Minor Collector	310	230
Local Street	230	150
Alley	90	90

* Consult the latest edition of AASHTO’s *The Policy on Geometric Design of Highways and Streets*.

6.0 Curve Standards

6.2. **Tangent Between Reverse Curves.** Table 6-2 provides the minimum tangent between reverse curves for each functional classification.

Table 6-2: Minimum Tangent Between Reverse Curves.

Classification	Minimum Tangent Between Reverse Curves (feet)
Freeway or Expressway	*
Major Thoroughfare	*
Minor Thoroughfare	*
Major Collector	200
Minor Collector	200
Local Street	100
Alley	0

* Consult the latest edition of AASHTO's *The Policy on Geometric Design of Highways and Streets*.

Table 6-3: Rate of Vertical Curvature (K).**

Classification		Level Terrain	Rolling Terrain
Freeway or Expressway	Crest	*	*
	Sag	*	*
	Stop	*	*
Major Thoroughfare	Crest	*	*
	Sag	*	*
	Stop	*	*
Minor Thoroughfare	Crest	*	*
	Sag	*	*
	Stop	*	*
Major Collector	Crest	45	30
	Sag	45	30
	Stop	20	14
Minor Collector	Crest	45	30
	Sag	45	30
	Stop	20	14
Local Street	Crest	30	20
	Sag	30	20
	Stop	14	9
Alley	Crest	30	20
	Sag	30	20
	Stop	14	9

* Consult the latest edition of AASHTO's *The Policy on Geometric Design of Highways and Streets*.

** $K = (\text{Length of the Vertical Curve in Feet}) \div (\text{Percent Algebraic Difference in the Grades Before and After the Vertical})$

7.0 Intersection Standards

- 7.1. **Angles of Intersection.** When practical, streets must intersect at an angle of ninety (90) degrees. The centerlines of the intersecting streets should remain straight for a minimum of fifty (50) feet from the point of intersection of the two streets. In no case should the angle of intersection be less than seventy (70) degrees.
- 7.2. **Corners.**
- a. *Quantity.* Intersections shall not have more than four (4) corners.
 - b. *Right-of-Way.* Property lines at intersections must be established so that the distance from the edge of pavement at the street turnout to the property line is at least as great as the distance from the edge of pavement to the property line along the intersecting streets.
 1. This property line can be established as a radius or as a sight triangle.
 2. Minimum and maximum street right-of-way curve radii are provided in Table 7-1.

Table 7-1: Minimum and Maximum Right-of-Way Curve Radii at Intersections.

Zoning District	Minimum Radii (feet)	Maximum Radii (feet)
AG	30	N/A
B-1	30	45
C-1	30	N/A
C-2	30	N/A
CC	30	45
CD	30	N/A
I-1	30	N/A
I-2	30	N/A
O-I	30	45
PUD	30	45
RC	30	45
RE	30	N/A
RL	30	N/A
RM-1	30	N/A
RM-2	30	N/A
RU	30	N/A
RV	30	45

- 7.3. **Backs-of-Curb.** Curbs must be rounded at the corners of intersections to facilitate the movement of traffic. The minimum corner radii for backs-of-curb at street intersections

7.0 Intersection Standards

are provided in Table 7-2.

Table 7-2: Minimum Corner Radii for Backs-of-Curb at Intersections.

Classification	Minimum Corner Radii (feet)
Freeway or Expressway	*
Major Thoroughfare	*
Minor Thoroughfare	*
Major Collector	30
Minor Collector	30
Local Street	30
Alley	20

* Consult the N.C. Department of Transportation Division of Highways' Transportation Plan.

7.4. **Distances between Intersections.** Proposed streets that intersect opposite sides of the same street (either existing or proposed) should be designed to intersect directly opposite one another as shown in Figure 7-1a.

a. *Minimum lengths for Local Streets and Minor Collectors.*

1. A minimum length of 200 feet between street centerlines must separate proposed streets that cannot be aligned to create a shared intersection as shown in Figure 7-1b.
2. A minimum length of 400 feet between centerlines must separate streets with opposing left-hand turns as shown in Figure 7-1c.

b. *Minimum lengths for higher street classifications.* Minimum lengths for higher street classifications must be reviewed and approved by the Director of Transportation, but in no case can the distance be less than 400 feet.

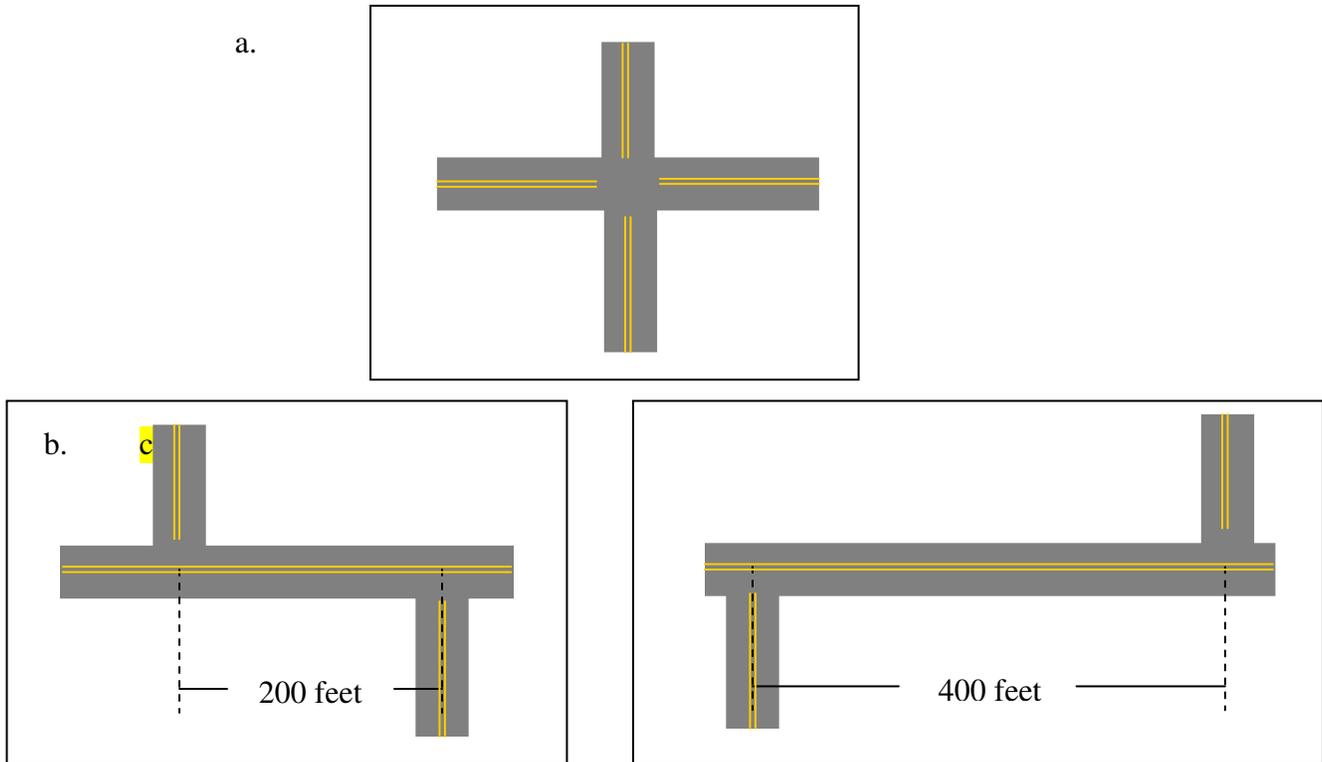


Figure 7-1: Two Streets Intersecting the Same Street.

7.5. **Sight Triangle Easements.** Sight triangle easements are required in every zoning district of the City except for the CC District. Sight triangle easements must be shown on all plans and recorded on a final plat.

- a. *Locations.* Sight triangles must be maintained on property located at the intersection of:
 1. Two streets of any classification,
 2. A street and a railroad, and
 3. A street and a driveway.
- b. *Size and Measurement.* A sample illustration is provided in Figure 7-2.
- c. *Intersections of Two Streets or Streets and Railroads.* The lengths of the legs of a site triangle are based on the widths of the intersecting rights-of-way and the functional classification of the streets where the intersection occurs.
- d. *Sight Triangle Measurements.* Based on Width of Right-of-Way. Sight triangles are measured from the following three points:
 1. *Point 1.* The point of intersection of two right-of-way lines,
 2. *Point 2.* The point along right-of-way one a distance from Point 1 as determined by the width of right-of-way one in accordance with Table 7-3, and

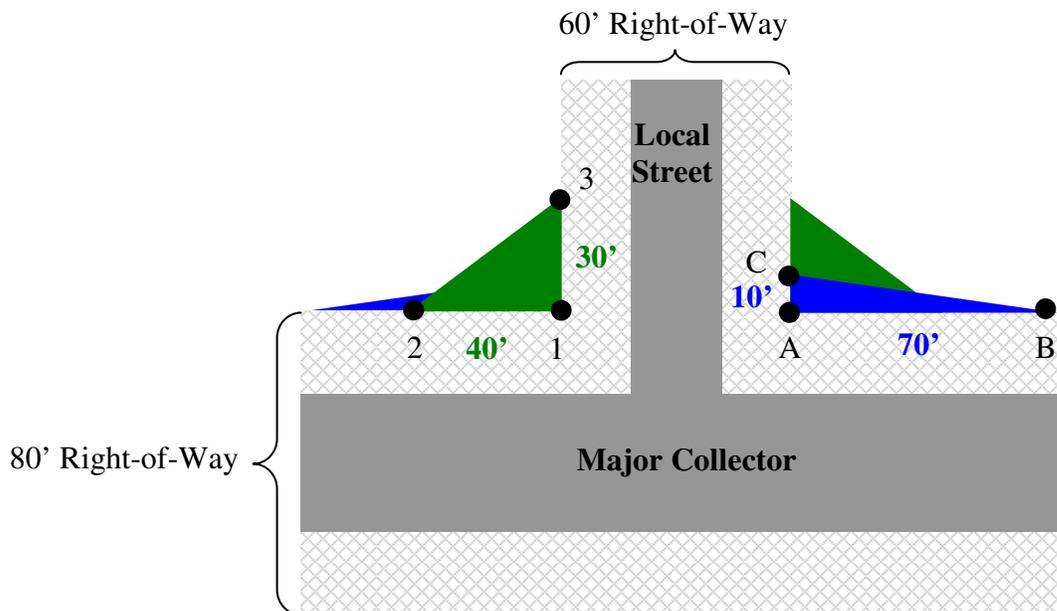
3. *Point 3.* The point along right-of-way two a distance from Point 1 as determined by the width of right-of-way two in accordance with Table 7-3.

Table 7-3: Sight Triangle Leg Length along a Right-of-Way Measured from the Point of Intersection

Right-of-Way Width (feet)	Length (feet)
50	25
60	30
70	35
80	40
90	45
≥100	50

- e. *Functional Classification.* Additional site triangle easements are needed at the intersection of two streets if at least one of the streets has the following functional classification:
 1. freeway or expressway;
 2. major thoroughfare;
 3. minor thoroughfare, major collector; or
 4. minor collector.
- f. *Measuring.* Site triangles are measured from the following three points:
 1. Point A. The point of intersection of the two street right-of-way lines,
 2. Point B. The point along the right-of-way of the street with the highest functional classification (highest ADT) a distance of 70 feet from Point 1, and
 3. Point C. The point along right-of-way of the intersecting street a distance of 10 feet from Point 1.

Figure 7-2: Sight Triangle Sample Illustration



- g. *Intersections of Streets and Residential Driveways.* Sight triangles are measured from the following three points:
 - 1. Point 1. The point of intersection of the street right-of-way line and the edge of the driveway pavement,
 - 2. Point 2. The point along the street right-of-way a distance of ten (10) feet from Point 1, and
 - 3. Point 3. The point along the edge of the driveway pavement a distance of ten (10) feet from Point 1.
 - h. *Intersections of Streets and Non-Residential Driveways.* Site triangle requirements are addressed during the driveway permitting process.
 - i. *Objects Not Allowed within Sight Triangles.* Objects within sight triangles must be restricted to give the users of the street or driveway an unobstructed view of oncoming vehicles and pedestrians. No structures, berms, vegetation, or other visual obstruction with a height equal to or greater than two (2) feet above the street surface elevation is allowed within the sight triangle, except those listed in the following subsection.
 - j. *Objects Allowed within Sight Triangles.* The following objects are allowed within sight triangles:
 - 1. Public utility poles,
 - 2. Official warning signs or signals,
 - 3. Other signs that meet all of the following criteria:
 - (a) Conform to the City's sign ordinance, and
 - (b) Are mounted at a height equal to or greater than ten (10) feet above the street surface, and
 - (c) Have supports that do not obscure the view of oncoming vehicles and pedestrians.
 - 4. Supporting members or appurtenances to permanent buildings lawfully existing prior to April 11, 1996.
- 7.6. **Roundabouts/Traffic Circles.** Roundabout/traffic circle designs must be reviewed and approved by the Director of Transportation based on current engineering standards.

8.0 Median and Island Standards

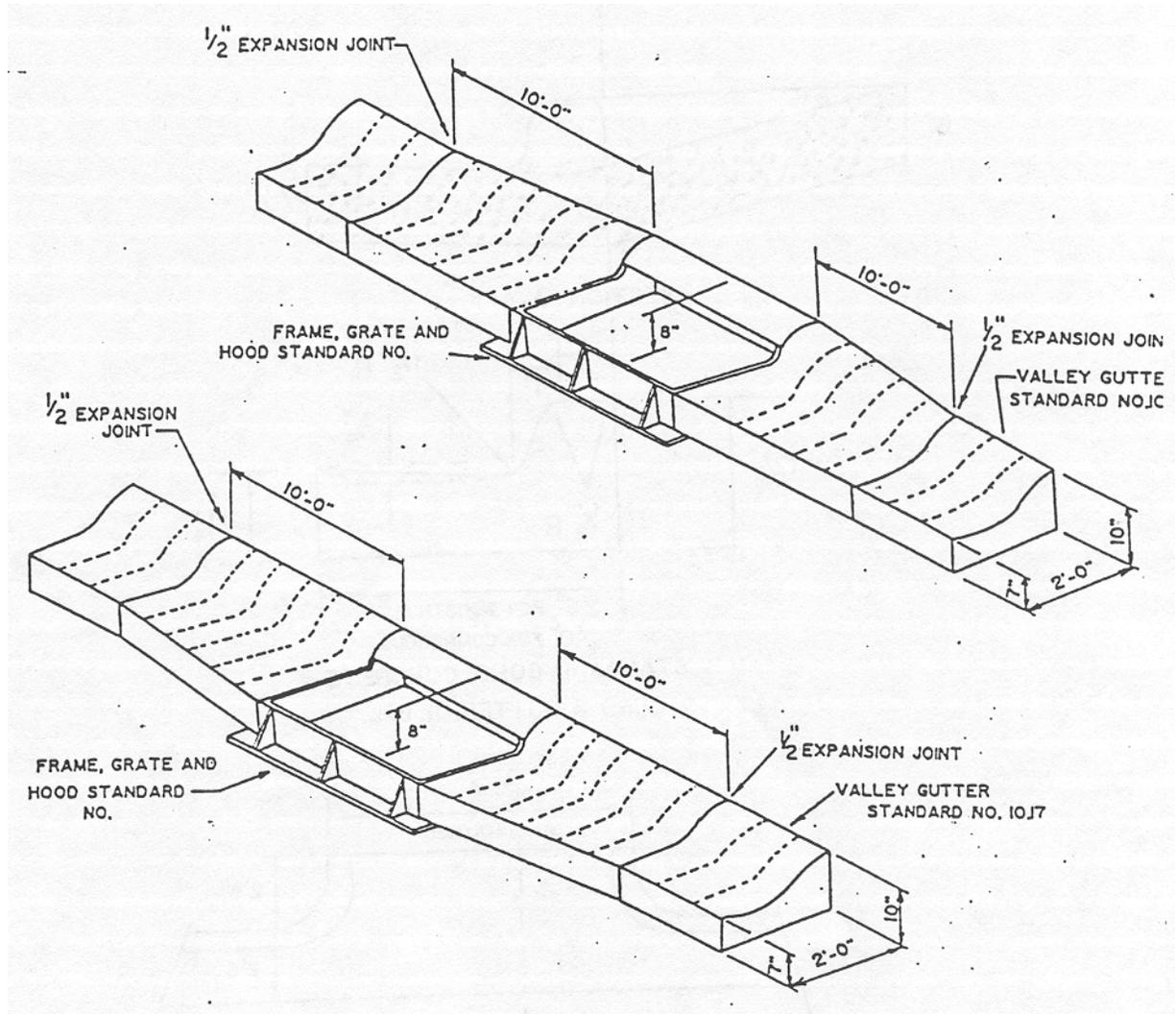
- 8.1. *Where Required.* Entrance roads shall include a median in conformance with the City's development ordinances, except that the Director of Transportation may waive this requirement if the Director determines that such a median is not practical or such installation would create a hazard.
- 8.2. *Size.* Islands and medians must be a minimum of 75 square feet in size and at least 4 feet wide. Where median widths are specified, a median of not less than the designated width must be provided.
- 8.3. *Contents.* Structures, permanent materials or plantings within the island should not obscure the visibility of cars entering a cross street for a distance of 20 feet back from the curb face of the cross street, unless a larger setback is needed due to inadequate sight distance created by horizontal or vertical curve alignment. Islands must be landscaped at a density equivalent to a Class "A" buffer as set forth in the Landscaping Standards of in the City's development ordinances.
- 8.4. *Specifications.* The nose of the median must be at least 6 feet from edge of perpendicular thru lane. Standard curbing must be used. A minimum 14-foot travelway must be provided on each side of the median/island.

9.0 Drainage Standards

A drainage system must be provided that adequately facilitates the movement of stormwater off and under streets. This drainage system may include curbs and gutters, catch basins, stormwater pipes, and graded channels. Each component of the drainage system should be designed by a registered professional engineer and installed in accordance to City construction specifications and standards. Please refer to Article 1 Section 3 of these Technical Standards.

9.1. Curbs and Gutters.

- a. *Required Locations.* Concrete curbs and gutters must be included on all new streets and all existing streets that provide access to a new development or subdivision, except those listed in the following subsection.
- b. *Exemptions.* Concrete curbs and gutters are not required along the following streets:
 1. Interstate highways,
 2. Numbered State highways with topography that does not allow for reasonable or practical installation, and
 3. Numbered State highways where the N.C. Department of Transportation has not determined the ultimate right-of-way width.



c. *Specifications.*

Figure 9-1: Curb and Gutter Detail.

1. Curbs and gutters must be built in accordance with NCDOT Standards. NCDOT Standard 846.01 is to be used on all major and minor collector streets. Valley curb is allowed on local streets and alleys.

9.2. **Catch Basins.**

a. *Required Locations.* Catch basins shall be located:

1. as outlined in Article 1 Section 3 of these Technical Standards, and
2. On both sides of the street at low points.

b. *Specifications.*

1. Catch basin frames and grates must be in accordance with NCDOT Standards. Improvised grates will not be acceptable.

10.0 Sidewalk Standards

2. Catch basin frames must be cast with the following statement: “Dump No Waste Drains to Stream” or a comparable statement as approved by the Director of Environmental Services.
3. Catch basins must be built in accordance with NCDOT Standards.
4. Catch basins walls must be built straight with inside joints struck smooth. Precast catch basins may be acceptable with the approval of the Director of Engineering.

9.3. Pipes.

a. *Stormwater.*

1. *Required Locations.* Stormwater pipes should be placed at all low points in the street grade to transmit storm water transversely across the street. Additionally, stormwater pipes should be parallel the street, but not under the street, when necessary to transmit stormwater from one catch basin to another.
2. *Size.* The minimum pipe diameter shall be fifteen (15) inches, regardless of the size of the drainage area.
3. *Depth.* The minimum cover for all pipe shall be two (2) feet.
4. *Material.* All pipe must be concrete conforming to the N.C. DOT Standard Specification of Road and Structures. For special conditions, alternative pipe materials recommended by the manufacturer for the type installation involved, and approved by the Director of Engineering will be considered. Any concrete pipe laid between the concrete curbs shall be reinforced.

b. *Construction.* All pipe must be laid with the bell or groove upgrade and joint entirely interlocking.

c. *Groundwater.* Subdrainage must be provided where the groundwater table is within two (2) feet of the subgrade. Subdrainage design must be approved by the Director of Engineering.

d. *Graded Channels.* Ditches proposed within the street rights-of-way will need to be approved on a case to case basis. Ditches should be a minimum of thirty-six (36) inches deep and two (2) feet in width.

10.0 Sidewalk Standards

10.1. **Locations.** Sidewalks should be provided for the safe movement of pedestrians, separate from the movement of vehicular traffic, through residential, commercial, and industrial areas, as well as public places. Sidewalks must be constructed along both sides of all new streets in a subdivision and along any street that provides access to the subdivision. Sidewalks will not be required along interstate highways (not designed for curb and gutter).

10.2. **Specifications.** Sidewalks must:

- a. Have a minimum five (5) foot width;
- b. Be constructed of not less than three thousand (3,000) pound-per-square-foot concrete;
- c. Be a minimum of four (4) inches thick when adjacent to standard 30" curb and gutter, the sidewalk must be six (6) inches thick when adjacent to valley curb and gutter,
- d. Be constructed on an adequately compacted and properly graded base,
- e. Have a lateral slope of one-quarter (1/4) inch per foot toward the street,
- f. Be steel-trowelled and light broom finished and cured properly,
- g. Have tooled joints at intervals of not more than five (5) feet and expansion joints at intervals of not more than forty (40) feet,
- h. Be separated from the back-of-curb by a six-foot planting strip, and
- i. Meet all current Americans with Disabilities Act (ADA) standards.

10.3 **Transitions to Street Grade.** Access ramps must meet current NC DOT standards and be constructed with materials that are approved by the Director of Transportation.

11.0 Curb and Gutter, and Sidewalk Exemptions

Applicability. Refer to Article 10 of the UDO.

12.0 Guardrails

12.1. **Applicability.**

- a. Guardrails must be provided in all areas required in accordance with the NC DOT Roadway Design Manual.
- b. Additionally, guardrails must be provided along all areas, regardless of the design speed, where an eight-foot or greater drop in elevation exists between the edge of pavement and the area extending 40 feet beyond the edge of pavement, unless:
 1. Greater than or equal to 13 feet of flat, unobstructed area exists beyond the edge of pavement, and
 2. A 3:1 or flatter unobstructed slope exists beyond the flat area, and
 3. At least 8 feet of flat, unobstructed area exists beyond the toe of the slope.

13.0 Street and Subdivision Naming Standards

13.1. Uniqueness.

- a. Proposed street and subdivision names must not duplicate nor too closely approximate phonetically the name of any street within Cabarrus County.
- b. Where proposed streets are extensions of existing streets, the existing street names shall be used except where a new name can reasonably be used to facilitate proper house numbering or to avoid further street name duplication.

13.2. Labels. In addition to names to identify new streets, the following labels must be included:

- a. A street oriented in a general north-south direction must be labeled a "Street;"
- b. A street oriented in a general east-west direction must be labeled an "Avenue;"
- c. A street that changes direction may be labeled a "Drive," "Lane," or "Road;"
- d. A street that forms a loop where both ends intersect with the same street may be labeled a "Circle;" and
- e. A cul-de-sac or street terminating in a similar dead-end must be labeled a "Place" if oriented in a north-south direction and a "Court" if oriented in an east-west direction.

14.0 Sign Standards

14.1. **Standard Signs.** In all subdivisions that include public streets, except as provided below, standard street signs should be installed by the City of Concord. The developer must reimburse the City for the full cost of the installation. The performance of installation, maintenance, and replacement are the responsibility of the City.

14.2. **Custom Signs.** [Encroachment process.] In subdivisions with architectural standards, restrictive covenants, and a property owner's association, custom street signs may be installed by the developer with all costs of installation, maintenance, and replacement paid by the developer.

14.3. **Specifications.** Custom street signs must comply with the Manual on Uniform Traffic Control Devices published by the U.S. Department of Transportation and may be installed only after written approval by the City Director of Transportation. Submission requirements for consideration of custom street signs shall include detailed color drawings, plans and specifications of the proposed street signs, and a written statement describing funding for installation, maintenance, and replacement.

14.4. **Replacement.**

- 14.5. **Regulatory and Warning Signs.** Replacement of lost or damaged regulatory or warning signs, as defined by the Uniform Manual, must be accomplished immediately by the City using standard street signs until the developer or property owner's association installs replacement custom street signs. If the developer or property owner's association fails to install replacement custom street signs for regulatory and warning signs within ninety (90) days, the replacement by the City shall be considered permanent and the full cost must be paid by the developer or property owner's association.
- 14.6. **Guide Signs.** Replacement of lost or damaged guide signs, as defined by the Uniform Manual, must be accomplished by the developer or property owner's association within ninety (90) days or the City must install standard street signs with full costs paid by the developer or property owner's association.

15.0 Unopened, Dedicated Street Standards

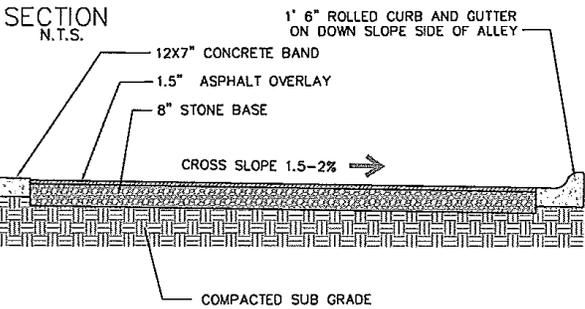
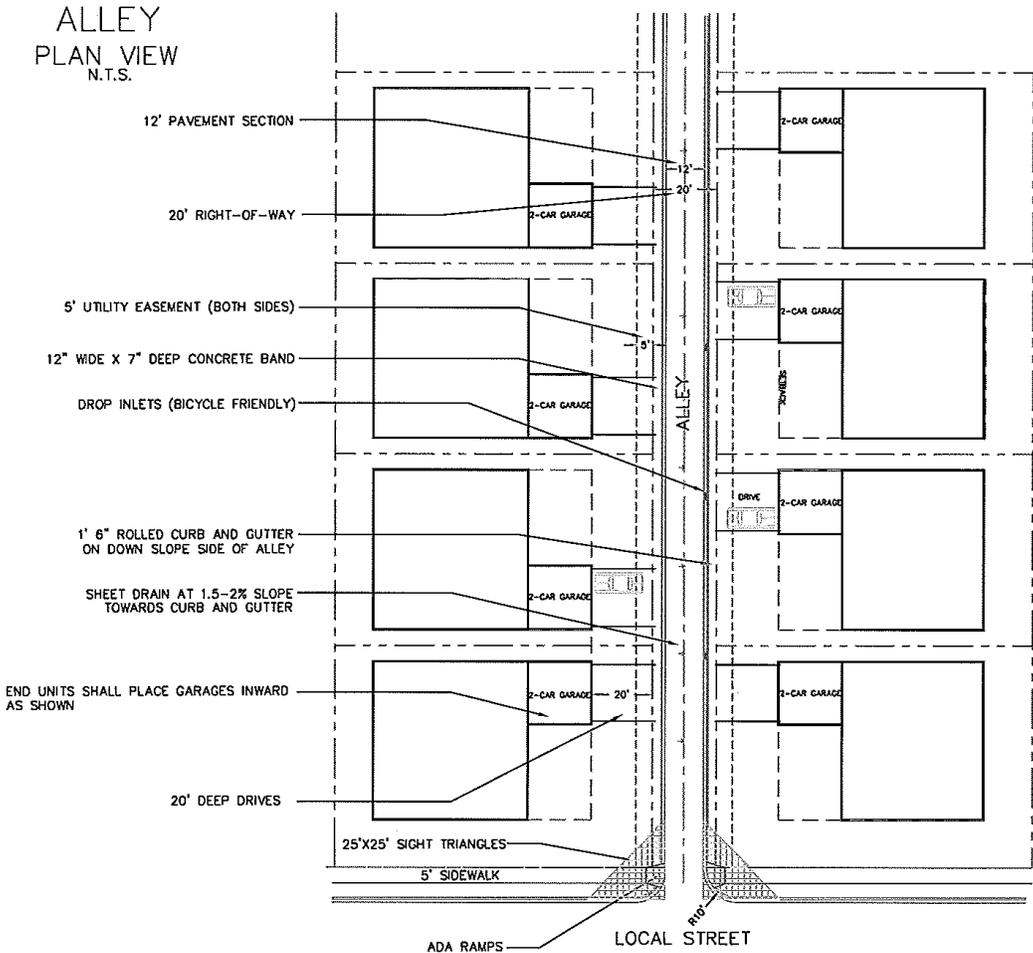
Streets for which right-of-way has been dedicated by subdivision plat or deed to the North Carolina Department of Transportation or the City of Concord and recorded with the Cabarrus County Register of Deeds, but have never been constructed, will not be constructed or maintained by the City until the following conditions have been met:

- 15.1. Right-of-way have been dedicated, and surveyed if necessary, sufficiently wide for the street and utilities, as determined by the Director of Engineering.
- 15.2. Right-of-way has been cleared and graded to meet City standards for slope and drainage.
- 15.3. Roadway shall be improved with a surface of crusher-run stone to a depth of not less than eight (8) inches, two and a quarter (2.25) inches of intermediate course, and two (2) inches of surface course. Width of roadway shall be not less than eighteen (18) feet.
- 15.4. The Director of Engineering or his/her authorized representative has inspected all work.
- 15.5. The Director of Engineering or his/her authorized representative has issued a certificate of completion for the required improvements.

16.0 Alley Standard

For developments utilizing alleys in their design, the following standard shall be used. Alleys are private streets and the City does not accept for maintenance.

16.0 Alley Standard



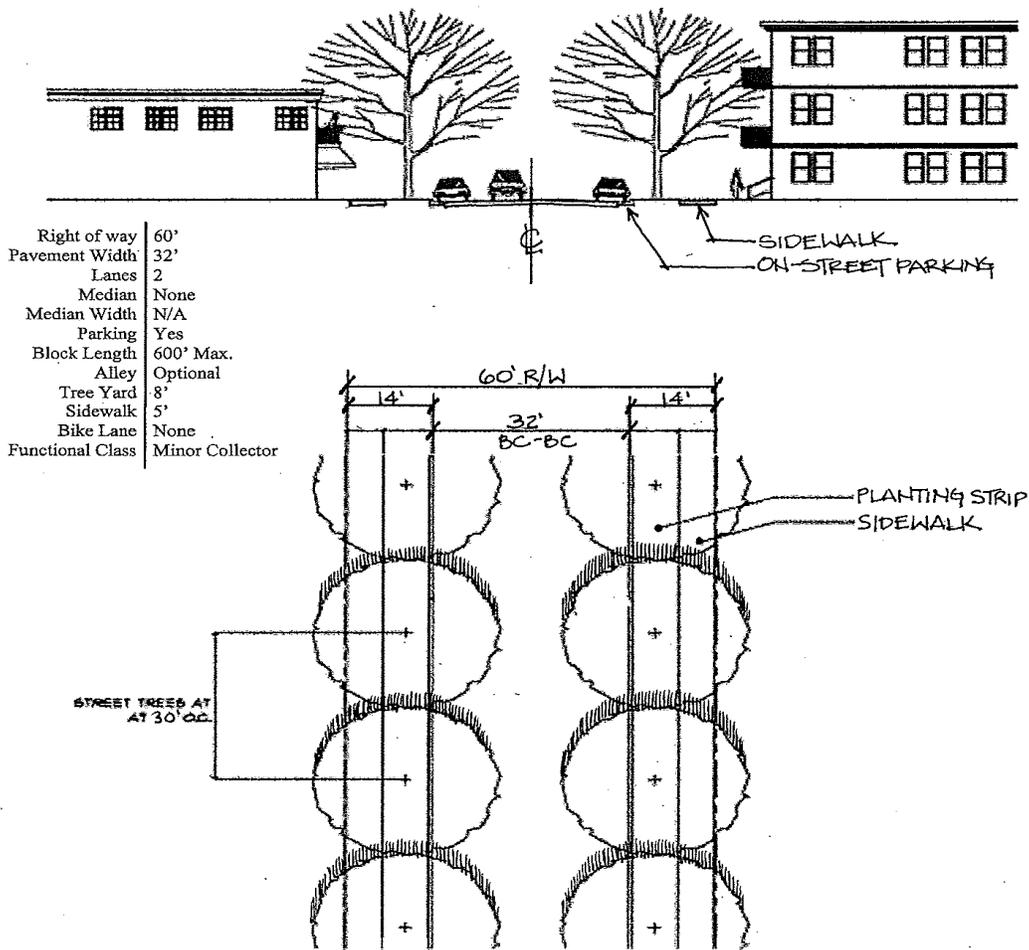
- Notes:
1. Alley lengths shall be no greater than 500'
 2. Alleys shall meet perpendicular to other alleys or streets
 3. Horizontal curves in alleys shall have at least a 30' radius

17.0 Mixed Use Development Standards

For developments using Mixed Use Zoning, the following details shall be used in the design of streets. The City Engineering Department has the right to modify these details if certain circumstances arise that impact safety of utilities.

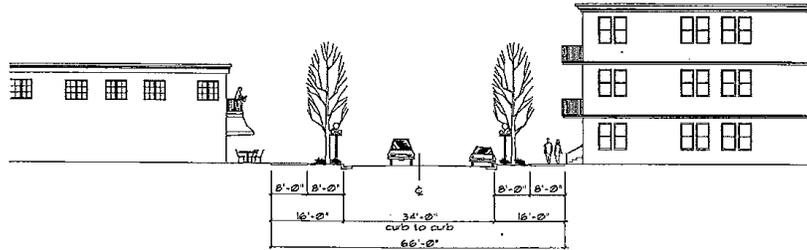
Mixed Use Development Local Street

Designed to serve local access needs of residential, live work, and commercial activities.



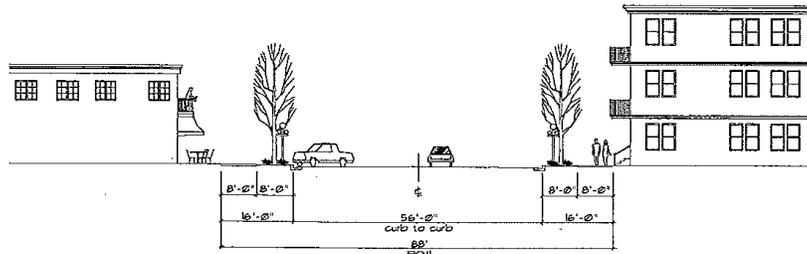
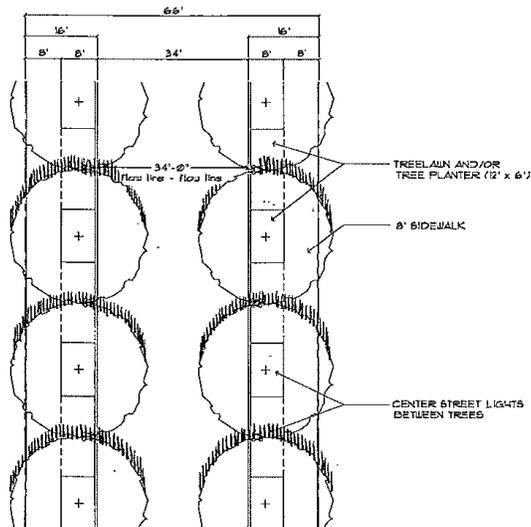
Mixed Use Development Collector Street

Designed to provide access from adjacent arterial streets into the mixed use activity center and serve as non-arterial perimeter streets.



Collector Street with Parallel Parking

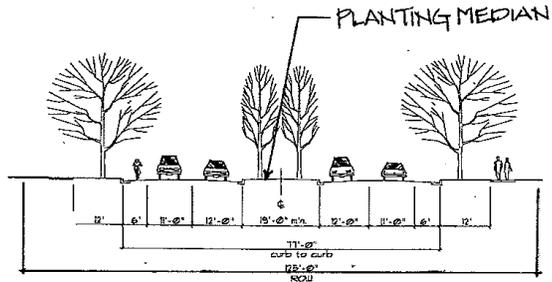
Right of way	66' Parallel Parking 88' Diagonal Parking
Street Width	34' Parallel Parking 56' Diagonal Parking
Lanes	2
Median	None
Median Width	N/A
Parking	Yes, Parallel or Diagonal
Max. Daily Traffic	5,000
Min. Horiz. Radius	700'
Block Length	600' Max.
Alley	Optional
Tree Yard	8'
Sidewalk	8'
Bike Lane	Permitted, not striped
Functional Class	Commercial/Industrial Collector
Other	Transit stops accommodate where appropriate (space 800-1200')



Collector Street with Diagonal Parking

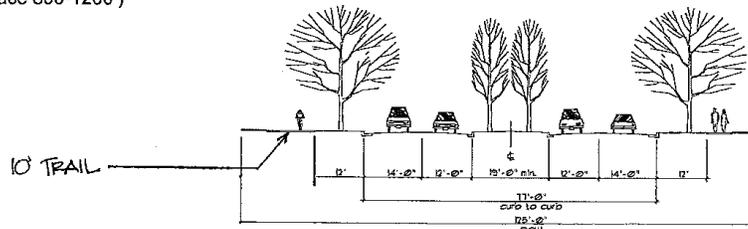
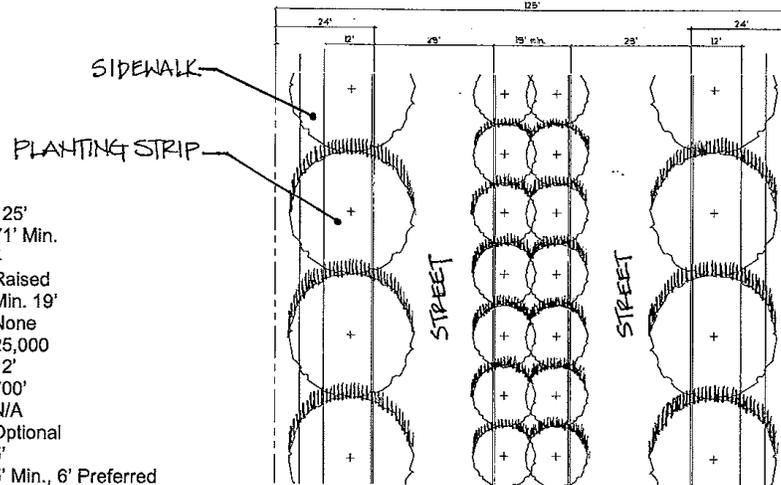
Mixed Use Development 4-Lane Parkway

Parkways provide rapid and relatively unimpeded traffic movement and carry high volumes of traffic to mixed use centers.



Parkway with On-Street Bike Lane

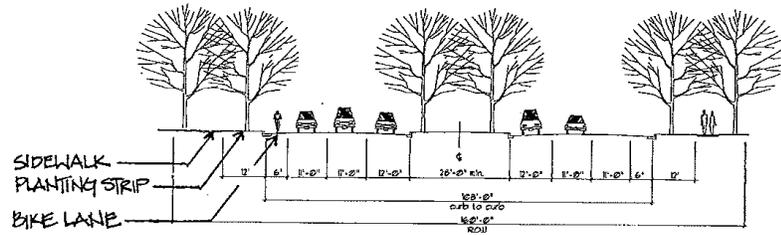
Right of way	125'
Street Width	71' Min.
Lanes	4
Median	Raised
Median Width	Min. 19'
Parking	None
Max. Daily Traffic	25,000
Tree Yard	12'
Min. Horiz. Radius	700'
Block Length	N/A
Alley	Optional
Sidewalk	5'
Bike Lane	5' Min., 6' Preferred
Functional Class	Minor Arterial
Misc.	Transit stops accommodate where appropriate (space 800-1200')



Parkway with Adjacent 10' Trail

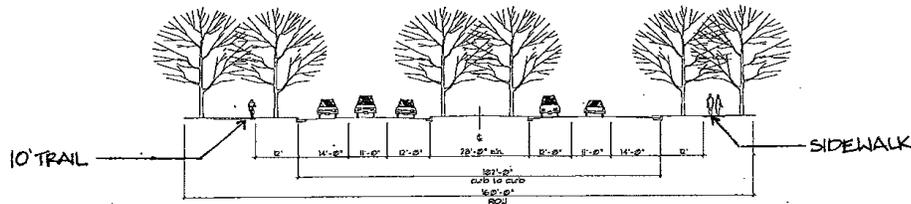
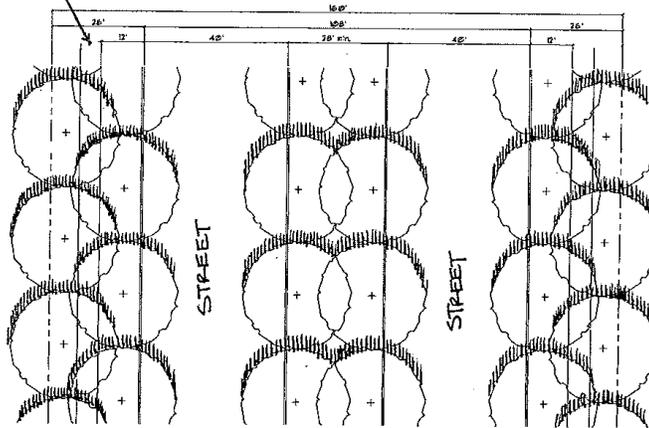
Mixed Use Development 6-Lane Parkway

Parkways provide rapid and relatively unimpeded traffic movement and carry high volumes of traffic to mixed use centers.



Parkway with On-Street Bike Lane

Right of way	160'
Street Width	108' Standard or 102' with adjacent trail'
Lanes	6
Median	Raised
Median Width	Min. 28'
Parking	None
Max. Daily Traffic	36,00
Min. Horz. Radius	1100'
Block Length	600' Max.
Alley	Optional
Tree Yard	12'
Sidewalk	5'
Bike Lane	6' Standard
Functional Class	Principal Arterial
Misc.	Transit stops shall be accommodated where approp. (at 800'-1200')

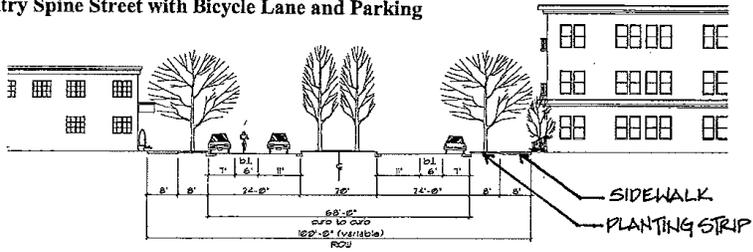


Parkway with Adjacent 10' Trail

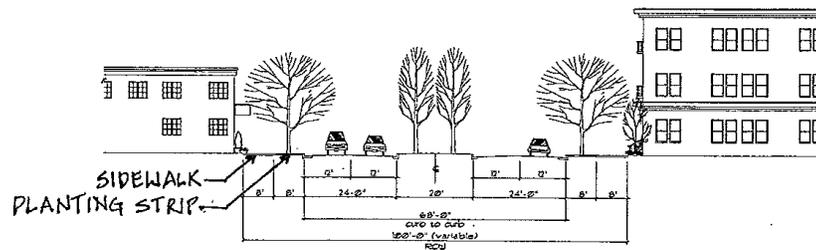
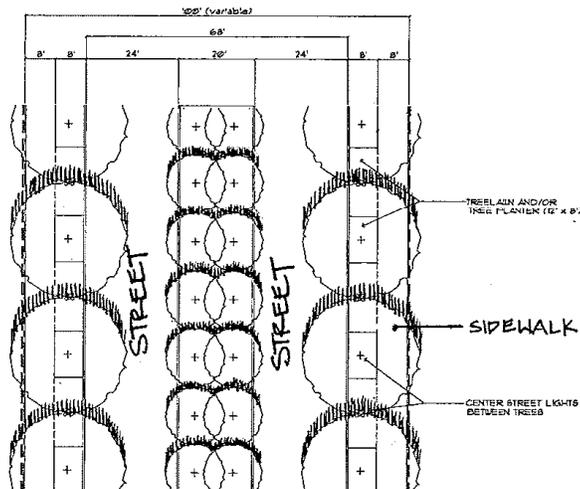
Mixed Use Development Entry Spine Street

Entry/Spine streets provide the main access from arterial streets, included right-in/right-out and server as a focus of activity for large mixed use centers.

Entry Spine Street with Bicycle Lane and Parking

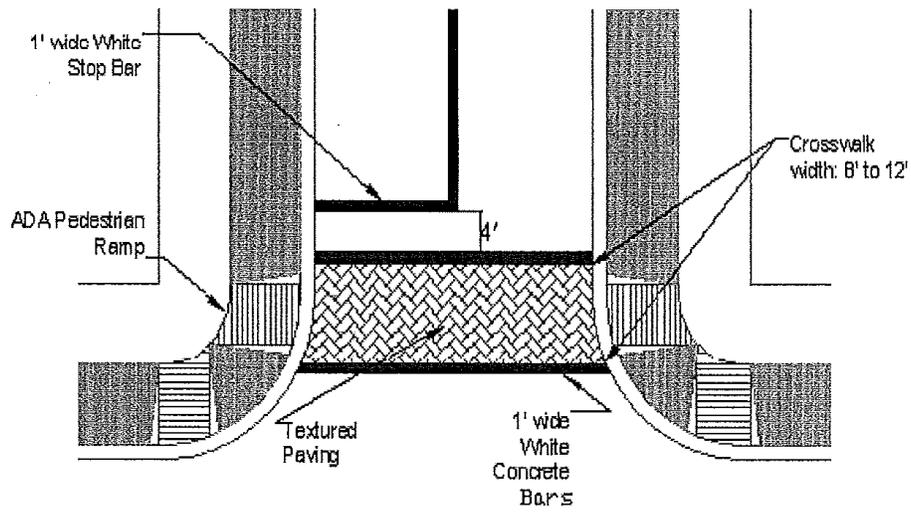


Right of way	100'
Street Width	68'
Lanes	2 or 4
Median	Raised
Median Width	Min. 20'
Parking	Yes/Optional
Max. Daily Traffic	7,500
Min. Horz. Radius	700'
Block Length	600' Max.
Alley	Optional
Tree Yard	8'
Sidewalk	8'
Bike Lane	6' Optional
Functional Class	Major Collector
Misc.	Transit stops shall be accommodated where approp. (at 800'-1200')



Entry Spine Street with No Parking

Typical Crosswalk for Mixed-Use Districts



Block Structure-Mixed Use Neighborhood Center



Block Structure-Mixed Use Commercial Center 1 and 2

