

SECTION 3.00 STREETS

3.01 GENERAL

The City Engineer must approve standards which vary from this section or standards that are not contained herein.

3.02 DESIGN

All streets (private and public) shall be designed and constructed in conformance with Asheville Standard Specifications and Details unless NCDOT Standard Specifications are applicable. NCDOT standards shall be used on all existing state roads, extensions of existing state roads, or roads to be maintained by NCDOT.

Consideration of allowing narrower residential streets shall be contingent upon special conditions which are beneficial to traffic flow such as limited on-street parking, use of alleys, minimizing driveway access points, or pattern and design of adjacent residential street system.

A. Street Classifications for City Specifications

ALLEYS

Typical width - 16 feet on 30 feet of right of way

Alleys may be utilized in commercial and residential zoning districts in the City of Asheville approved by the City Engineer and the Technical Review Committee. The purpose of an alley is to provide utility and vehicular access to developments that cannot be adequately served by existing streets or as a means of reducing or eliminating individual driveway accesses. All alleys are to be privately maintained with measures to ensure the travelway is not obstructed in any manner, including parking. The pavement design shall be approved by the Engineering Department and must be adequate to accommodate traffic if the alley will be used for public services (e.g. sanitation, fire protection). The City shall not be responsible for damage occurring to the pavement structure due to use of the alley for access in providing public services. An alley shall be constructed on a thirty (30) foot public right of way to the following minimum dimensions: 1) paved travel lane of sixteen (16) feet; 2) clear shoulders of seven (7) feet along each side. Under unique, site-specific circumstances, including such facts

as the absence of utility lines in the alley and/or lack of real property, the right of way may be reduced to twenty (20) feet with a minimum paved travel lane of twelve (12) feet and clear shoulders of four (4) feet on each side of the alley.

RESIDENTIAL STREET, CUL-DE-SAC OR LOOP STREET

Typical Width - 22 feet of pavement on 50 feet of right of way

A street whose primary function is to serve the immediately abutting residential land use, i.e. only local traffic generated by the residents in proximity of the street. Traffic volumes flowing from other intersecting residential streets shall not exceed the traffic volumes generated by the land use abutting the street. Primary design concern is directed toward fostering a safe and pleasant environment to the residential community with convenience to the motorist secondary. Particular emphasis is placed on providing adequate stopping sight distance in order to protect pedestrians using the facility.

CUL-DE-SACS are streets which serves abutting residential land use and which terminates in a turnaround constructed in accordance with Standard Detail 3.08 and originates at the intersection with another street. Other streets shall not intersect onto this street classification segment.

LOOP STREETS are streets which serves abutting residential land use and which terminates on the same street from which it originates. Short residential cul-de-sac streets may be considered to intersect onto this street classification segment.

NON-RESIDENTIAL CUL-DE-SAC (1000 FEET OR LESS)

Typical Width - 30 feet of pavement on 60 feet of right of way

Street which serves abutting non-residential land uses and which terminates in a turnaround constructed in accordance with Standard Detail 3.08 and originates at the intersection with another street. Other streets shall not intersect onto this street classification segment. This street may require additional turn lanes at the street intersection.

MARGINAL ACCESS STREET

Typical Width - 36 feet of pavement on 60 feet of right of way

Street which serves traffic generated by proximity land use which is other than residential. Design shall accommodate the vehicle type expected to use the facility which is typically larger than a passenger car. For a street serving recreational land use, design speed and roadway section may vary with the character of the terrain and the environmental constraints.

COLLECTOR STREET

Typical Width - 30 feet of pavement on 60 feet of right of way

Street which penetrates various land use classifications, and whose primary function is traffic service, collecting traffic from streets intersecting it and funneling it to major thoroughfares. A collector street shall be provided when the roadway collects traffic from more than 100 dwelling units, contains a commercial area of twenty (20) acres or more or contains other land uses which would account for similar traffic volume. Roadway section may vary for streets serving areas for which a master land use plan is approved and conditional constraints are imposed on land bordering the street. **A collector street may have parking on one side of the street.**

THOROUGHFARE

Typical Width - 69 feet back to back on a 90 foot right of way.

Street which serves as a primary traffic artery of the urban area, serving the major centers of activity and carrying traffic between such centers at moderate speeds. The typical facility will have two travel lanes in each direction and **a concrete or landscaped median**. Additional width of two (2) feet is provided for each direction of travel to facilitate bicycle traffic. Access to abutting property may be provided; however, the primary function is to carry traffic having origin and destination removed from the street proper. The thoroughfare classifications carry the majority of trips entering and leaving the urban area as well as the through trips. Access is primarily provided by at-grade intersections with center turn lanes and may be signal controlled.

LIMITED ACCESS THOROUGHFARE

Typical Width is 90 feet including a 30 foot wide median on a 110 foot right of way.

An urban major thoroughfare whose sole function is to carry large volumes of traffic safely and expediently through the urban area. Access onto the facility is controlled to occur only at intersections with major streets or in some cases limited to right-in/right-out access as approved by the Traffic Engineer. Such intersections are spaced at intervals which promote traffic progression with the absolute minimal delays incurred. The highest practical level of design shall be incorporated into facilities of this classification.

CONTROLLED ACCESS HIGHWAY

Typical Width as required by Federal Highway Administration and AASHTO.

A state highway, or section of state highway, especially designed for through traffic, and over, from, or to which highway owners or occupants of abutting property, or others, shall have only a controlled right or easement of access.

B. Horizontal Street Design

All streets shall conform to the Asheville Area Thoroughfare Plan when applicable or shall be designed and located in proper relation to existing streets and environment. Collector streets and thoroughfares shall be as directional as possible but consistent with topography and preserving developed properties and community values. Residential streets shall be designed to discourage high speed traffic and minimize excessive cuts, excessive fills and cut through traffic.

The design of streets shall conform to the curve controls in Figure 1 at the end of this chapter.

In accordance with NFPA 1141 Section 3-9.2, Fire Department vehicular access to all structures under construction shall be provided at all times. In areas where ground surfaces are soft or likely to become soft, hard all-weather surface across roads shall be provided.

A minimum tangent of 150 feet is required between reverse curves for major streets, highways, and collector streets. This tangent shall be extended as necessary to provide the minimum runoff lengths for the curves superelevation per AASHTO guidelines. A 100 foot minimum tangent distance will be required between reverse curves for all minor streets. The minimum tangent length of approaching an intersection

should be thirty (30) feet for residential streets. All intersections of streets classified as collector or greater shall have a tangent section not less than 100 feet approaching the intersection.

Compound horizontal curves with the same direction of curvature shall have the radius of the flatter circular arc no more than one and one half times the radius of the sharper circular arc. Streets shall intersect each other at right angles whenever possible. The minimum desirable intersection angle is eighty (80) degrees. At no time shall a street intersect any other street at less than seventy-five (75) degrees.

Intersections with a major street or highway shall be at least 800 feet apart. There shall be a minimum of 200 feet between centerlines of street jogs on collectors and major streets. Residential and marginal access streets shall not be offset less than 125 feet from their centerline, or as allowed by the Traffic Engineer.

Superelevation is to be used on all thoroughfares. Superelevation shall conform to Figure 1 at the end of this chapter and shall conform to NCDOT and AASHTO standards for superelevation design.

Tapers shall be used as necessary in street design. Approach tapers are used to shift lanes laterally. The taper lengths are determined by the following equations which shall be used as applicable:

$L = WS$ for posted speeds of 45 mph and greater;

$L = \frac{WS^2}{60}$ for posted speeds of 40 mph or less;

L = Length in feet

S = Speed in miles per hour

W = Lateral offset in feet.

Turn bay tapers shall be at least 15:1 for posted speeds of 45 miles per hour and more. The minimum turn bay taper allowed is 8:1.

Symmetrical reverse curve tapers are recommended for non-thoroughfare streets. Storage lengths for the turn bays shall be calculated using an acceptable method approved by the City Traffic Engineer.

Streets with medians shall be designed to allow for proper turning movements for a SU (single unit truck) design vehicle. AASHTO guidelines should be followed for the actual median design and median opening dimension.

C. Vertical Design

Street grades shall be established with respect to existing topography to avoid excessive grading and the removal of existing trees and vegetation whenever practical.

The minimum grade allowed on any street shall be one-half of one percent. (1/2%). The maximum allowable street grade shall be based upon the street classification as listed in Figure 1.

The maximum grade allowed when approaching an intersection is five percent (5%) for the last 100 feet of pavement before the intersection.

The vertical curve controls found in Figure 1 shall also be followed at all times. The table is located at the end of this chapter.

D. Geometrics

Radii

A minimum radius of 25 feet to the back of curb shall be required where residential streets intersect **or as approved by the City Traffic Engineer.**

A minimum radius of 30 feet measured to the back of curb shall be required where a residential street intersects with a non-residential street **or as approved by the City Traffic Engineer.** It is recommended that the designer consider larger radii or 2-centered compound curves where needed to provide for turning movements of larger vehicles.

A minimum radius of 40 feet will be required where collectors intersect thoroughfare streets **or as approved by the City Traffic Engineer.**

Cul-de-sacs

Cul-de-sac dimensions shall be as shown in Standard Detail 3.08 and 3.08A **unless otherwise approved by the City Engineer or their representative.**

The City discourages the use of cul-de-sacs and encourages connectivity of streets for safety and improved access. Where permitted a pedestrian connection to adjacent development may be required.

A cul-de-sac radius shall be 45 feet or as approved **by the City Engineer and the Fire Marshall**. The standard maximum length for a cul-de-sac shall be **1000 feet, or as approved by the City Engineer or their designee**. The length may be varied depending upon the density within the subdivision. The **waiver** must be approved by the City Council upon recommendation by the City Engineer and public safety officials. The recommendation for a **waiver** shall consider the development density, land configuration, as well as all safety concerns.

The length of a cul-de-sac shall be measured from the last point of alternate access within the subdivision. No median shall be allowed in a 45 foot radius cul-de-sac. A median may be permitted where the cul-de-sac radius is increased and it can be demonstrated that all emergency vehicles can be readily accommodated.

Driveways (Non-residential)

Standard concrete driveway aprons as shown in Standard Detail 3.15 shall be used when the ADT for the driveway is less than 500 vehicles.

Street type turnouts shall be used when the driveway ADT is greater than **1,000 vehicles**, when access by larger trucks must be accommodated, **or as required by the Traffic Engineer**. A minimum radius of **20 feet** shall be used on all street type turnouts. Street type driveways shall have a minimum width travel lane of 22 feet.

Non-residential driveways that are unpaved shall have a minimum 20 foot paved surface strip measured from the back of the driveway apron.

Driveways without islands shall be a minimum of 20 feet wide. Non-residential driveways with islands shall have a **14** foot entrance lane. A **14** foot exit lane shall be required when one exit lane is used, and a 24 foot exit shall be used for 2 exit lanes.

The number of street and driveway connections permitted serving a single property frontage or commercial development shall be the minimum deemed necessary by the Traffic Engineer for reasonable service to the property without undue impairment of safety, convenience, and utility of the roadway. Normally, not more than two driveways shall be permitted for any single property frontage.

The arrangement of driveways should be related to adjacent driveways and nearby street intersections. Driveways close to street intersections shall be at least 40 feet from the point of tangency of the radius curvature of the intersecting street. All driveways serving high volume generators shall be located a minimum of 200 feet from the intersection of public roads unless otherwise approved by the Traffic Engineer.

Where two driveways are proposed along a single property frontage to facilitate operations, the minimum distance between the centerlines of the drives shall be 100 feet **or as approved by the Traffic Engineer**. The minimum distance between the centerlines of driveways into shopping centers and other high volume generators shall be a minimum of 400 feet for right-in/right-out access or 800 feet for full service access.

Driveways (Residential)

Residential drives shall be 12 to 18 feet wide and shall conform to Standard Detail 3.15 for concrete driveway aprons. Any driveway which will cross a sidewalk area **or abuts a street with curb** must have a concrete apron and may transition to other material (e.g. asphalt) beyond the back of the sidewalk.

Residential drives shall be located a minimum of 20 feet from the point of tangency of curb radii of street intersections.

Curb and Gutter

Curb and gutter shall be required on all streets. Rolled or Valley curb as shown on Detail (3.10A) may be used on residential streets that service less than 20 homes provided the following conditions are met:

- **Catch basins must be installed every 150 feet unless stormwater calculations can they be further apart (maximum 250 feet apart);**
- **Water meter boxes must be located behind the sidewalk, if sidewalk is required as part of the development or at the property line;**
- **If sidewalk is required for the development, a 5 foot grass strip must be provided between the back of curb and the sidewalk.**

All median curb shall be standard 1'6" mountable curb as shown in Standard Detail 3.11. Curb and gutter within parking lots may be 1'6", 2'0", or 2'6" standard curb and gutter. All other curb and gutter shall be standard either 2'0", 2'6" curb and gutter **or rolled or valley curb as stated above**. Where curb and gutter is used on a street section 35 feet and greater, ABC shall be required to extend beyond the curb and gutter in accordance with Standard Detail 3.10. A minimum transition of five (5) feet shall be provided where curb and gutter types intersect.

A minimum five (5) foot section of curb and gutter shall remain when removing curb for the installation of a driveway, street turnout or repair of curb and gutter. When less than five (5) feet of the curb remains, the curb shall be removed to the next joint.

Where sidewalk or street construction occurs adjacent to existing granite curb, the granite curb shall be adjusted to a height no less than five (5) inches above the pavement edge adjacent to the curb.

Parking Lots

Parking lots shall be designed to provide safe maneuverability of vehicles. A minimum parking stall dimension of 9' x 18' shall be provided. Handicap parking spaces shall be a minimum dimension of 8 feet with a five (5) foot lane adjacent to the space (or minimum lane width of eight (8) feet where van accessibility is required) properly marked with signage in accordance with the N.C. Building Code. All parking facilities shall have dimensions as outlined on Figure 2.

At locations where sidewalk abuts an 18 foot deep parking bay, the sidewalk shall be a minimum width of six (6) feet. In parking lots where end islands are required, Standard Detail 3.09 is recommended.

A minimum pavement structure consisting of 6 inches of ABC and 2 inches of I-2 shall be used along the travel aisle on parking facilities for multi-family (excluding duplex and triplex development) and non-residential developments. Access drives for these facilities shall also meet this minimum pavement standard.

All minimum stall depths and module widths shall be measured to the face of curb when curb and gutter is used.

All paved parking facilities shall be striped in accordance with the MUTCD with four (4) inch white lines.

Sidewalks

Sidewalks shall be constructed within the street right of way in accordance with City Standards and the Unified Development Ordinance. Any location in which sidewalk is not within the dedicated street right-of-way must be privately maintained unless a sidewalk easement dedicated to the City of Asheville is provided of sufficient width to maintain the sidewalk. Sidewalks shall be installed at the time of roadway construction or widening unless otherwise approved by City Council. **The City Engineer may allow the developer to pay a fee in lieu of constructing the sidewalk in appropriate locations as described in Section 7-11-6 of the UDO. This fee must be paid prior to the issuance of the Zoning Permit.**

Sidewalk shall be provided along streets within new developments and expansions of existing developments which are non-residential, **multi-family, or single family residents as required in the UDO.** Sidewalk shall be required as follow provided in Section 7-11-6 of the UDO.

The City is receptive to reviewing alternate designs relative to the provision of pedestrian facilities not outlined herein. Such alternate designs may include greenways or a combination of sidewalks and greenways. **The requirement for sidewalk may be waived by City Council.**

All sidewalks shall be constructed in accordance with Standard Detail 3.16. The minimum thickness of a sidewalk shall be 4 inches. At locations where a driveway crosses a sidewalk a 6 inch depth is required. **Sidewalks shall have a uniform slope toward the roadway of 1/4 inch per foot.** The utility strip between the sidewalk and the back of curb shall not be less than 1/4 inch per foot nor greater than 1/2 inch per foot toward the roadway **unless approved by the City Engineer.** The design and construction shall conform to ADA standards. **Where no curb and gutter exists on a road that requires sidewalks, the City Engineer may require curb and gutter installation in addition to the installation of the sidewalk.**

A sidewalk may be constructed so as to provide a gradual meander and to facilitate the installation of landscape material or to avoid existing obstacles such as power poles, fire hydrants, street lights, etc. The design of the sidewalk shall be such that pedestrian safety is provided and the usability of the sidewalk is not effected.

All sidewalks shall be constructed of either concrete or asphalt material consistent with Standard Detail 3.16. Alternative type materials may be presented to the City Engineer for consideration. Pervious materials not meeting ADA requirements shall not be allowed due to concerns for pedestrian accessibility/usability and maintenance costs.

Sidewalks shall typically be a minimum distance of five (5) feet off of the back of curb with a minimum width of five (5) feet. This requirement may be varied upon the approval of the City Engineer, depending on various site constraints. **In the event that the sidewalk must be built adjacent to the curb, the sidewalk must be 6 feet wide.**

Where sidewalks and/or greenways intersect any section of curb and gutter or street section, a wheelchair ramp in accordance with Standard Detail 3.17 shall be installed.

Pipes, drains, flumes or other concentrated stormwater devices shall not discharge across a sidewalk, but rather shall be piped or flumed under the sidewalk.

E. Pavement Design

A pavement design will be necessary for all collector streets and thoroughfares in accordance with these specifications. The pavement design and traffic analysis shall be signed and sealed by a North Carolina Professional Engineer. Pavement design shall be based on subgrade conditions, a 20 year design life and projected traffic loading. Subgrade conditions shall be based upon corrected soaked CBR values at 0.1 inch penetration as per ASTM D1883. Soil testing and borings shall be taken every five hundred (500) feet. This requirement may be reduced to 1000 feet when located in areas with consistent soil profiles as determined by a registered soil scientist or professional engineer.

Design methods which may be used consist of Asphalt Institute, DOT, and ASSHTO. In no case shall the pavement design be less than the minimum design as specified in Standard Detail 3.01 or 3.02, as applicable.

Rigid pavement design shall follow either the 1986 AASHTO Method or the Portland Cement Association Method.

F. Pavement Markings

All collectors and thoroughfares shall be marked in accordance with the latest revisions of the MUTCD unless otherwise approved by the City Traffic Engineer. This shall be noted on roadway and subdivision plans as a requirement of the Developer and shall be done prior to issuance of a Certificate of Occupancy for the development or final acceptance of the roadway by the City of Asheville or NCDOT. The pavement markings for all collector streets and thoroughfares shall be thermoplastic. These markings are to be applied in accordance with the manufacturer's instructions.

The pavement markings along thoroughfare streets with four (4) or five (5) lanes or which are median-divided facilities shall be installed such that the outside lanes are fourteen (14) feet in width to accommodate bicycle traffic unless otherwise approved by the Traffic Engineer.

G. Roadway Widening

All roadway widening shall be in conformance with Standard Detail 3.18.

H. Bridge Design

All public or private bridges shall be designed to withstand HS-20 highway loading unless otherwise approved by the City Engineer and shall be properly signed and sealed by a North Carolina Professional Engineer.

3.03 SIGHT DISTANCE

Sight distance shall mean the length of roadway visible to the driver traveling along the roadway or waiting to enter or cross the roadway. The sight triangle shall include both the horizontal and vertical plane and shall exist at all street intersections and multi-family and non-residential driveway intersections.

The City shall review all proposed development plans, including site, subdivision, landscape plans, infrastructure plans and sign plans for compliance with these requirements. All new development within the City's extraterritorial zoning jurisdiction shall meet these requirements as a part of the plan approval process.

Some objects located within sight distance areas may not significantly obstruct the required visibility of the driver. The driver may be able to see over, under or around some objects within sight distance areas. Objects that may be required within sight distance areas include fire hydrants, utility poles and traffic control devices which are located to minimize visual obstruction. Other objects twelve (12) inches in diameter and smaller, such as tree trunks and sign posts, may be allowed within sight distance areas if located individually or in combination so as to not substantially restrict the driver's view. The determination of what objects, if any, may be located within sight distance areas shall be made by the **Traffic** Engineer. Trees greater than twelve (12) inches in diameter and located in the street right of way shall be evaluated in accordance with other applicable City policies and requirements.

It is recognized that in some cases conditions may exist that prevent the attainment of desirable sight distance due to social, economic or environmental consideration. In such cases, the maximum practical sight distance, up to the desirable values, shall be obtained. In addition, where desirable sight distance is not attained, additional measures, such as warning signs, reduced speed zones and other traffic controls may be imposed. In all cases, unless otherwise provided by Ordinance or granted an exemption, the minimum provision of adequate stopping sight distance shall be required. Conditions existing within the Central Business District shall attempt to meet these requirements as a part of any site development or building alteration.

The City shall remove sight distance obstructions located within the right of way of City maintained streets. The City will notify the N.C. Department of Transportation of sight distance obstructions located within the right of way of State maintained roadways. The City shall provide written notification to the property owner(s) on which a sight distance obstruction exists on private property. The property owner shall be responsible for the prompt removal of the obstruction on their property and shall be solely liable for any and all consequences resulting from their negligence and/or failure to remove the obstruction.

A. Intersection Sight Distance

In order for vehicles to safely maneuver into or through an intersection, sufficient sight distance must be provided so as to avoid collisions. Intersection sight distance is measured from a driver's eye 3.5 feet high to an object 4.25 feet high as measured from the pavement surface.

The amount of sight distance required at an intersection depends on the type of traffic control at the intersection and the speeds of the vehicles.

1. Yield Sign Control

This type of design requires that the side street be posted with yield signs. The sight distance for the driver on the side street must be sufficient for the driver to observe a vehicle on the through street approaching from either the left or the right and bring his/her vehicle to a stop prior to reaching the intersection as shown in Figure 3. The assumed operating speed approaching the yield sign is 10 mph resulting in a stopping sight distance of 45 feet.

Where proper sight distance cannot be achieved for the driver on the side street at the design speed of the roadway, it may be necessary to have a posted speed reduction on the approach to the intersection or to replace the yield sign with a stop sign. Due to the possibility that a vehicle must stop at the yield sign, adequate sight distance at the intersection shall be provided for safe departure from a stopped condition as required by the section on stop sign controlled intersections.

2. Stop Sign Control

At approaches to intersections that are controlled by stop signs or at driveways and alleys where the driver is required to stop before entering the street by the City Code, the driver must have an unobstructed view of the entire intersection and adequate sight distance for any of the various vehicular movements allowed upon departure of the intersection. These movements may include crossing the street, turning left or turning right onto the street. Where the through street is either undivided or divided with a median narrower than 20 feet, the crossing or left turn movements are treated as a single operation. Where the median can provide storage for the design vehicle (20 feet wide for a passenger car), the crossing or left turn movement may be considered in two phases.

An obstruction to the driver's view shall not be located within the sight triangles as defined herein to permit adequate view of the intersection. In addition, there shall be no sight obstructions located in the triangular areas shown in Figures 4

through 6 to allow for safe departure through the intersection. The measurement of intersection sight distance is along the centerline of the appropriate lane of the roadway and is measured from an eye height of 3.5 feet above the surface of the roadway to an object 4.25 feet above the surface of the roadway. The location of the driver's eye (d1) is dependent on the classification of the intersecting streets. For all intersections where the through street is a thoroughfare, the driver's eye location shall be 15 feet back from the face of curb extended through the intersection, or the edge of pavement if there is no curb. At all intersections where the through street is a local or collector street, and for ramp type driveways, the driver's eye shall be located 10 feet behind the face of curb extended, or the edge of pavement if there is no curb. The sight distance lengths d2 and d3 shown in Figures 4 through 6 for left or right turns onto the through street are dependent on the design speed of the roadway and are presented in Table 3.1. Figure 7 shows the measurement method for determining the sight line for left turns from the through street. Table 3.2 gives the minimum sight distance for this movement across one, two, or three lanes (d1).

3. Traffic Signal Control

At intersections controlled by traffic signals, the minimum sight distance will be stopping sight distance for all side street movements except for the right turn movement. The right turn movement shall have intersection sight distance to allow right turn on red, except where it is economically impractical due to existing major features such as permanent buildings and existing, large, mature trees. The minimum sight distance for the right turn movement limited by existing major features shall be stopping sight distance. Where intersection sight distance cannot be achieved, right turn on red will be restricted.

TABLE 3.1
Intersection Sight Distance for Stop Sign
and Traffic Signal Controlled Intersections

Operating Speed (MPH)	Minimum Intersection Sight Distance
20	230 feet

25	300 feet
30	380 feet
35	470 feet
40	575 feet
45	700 feet
50	845 feet
55	990 feet
60	1,150 feet

Source: AASHTO Green Book, 1990.

TABLE 3.2
Minimum Sight Distance for
Left Turn from Through Street

Operating Speed (MPH)	Minimum Left Turn Sight Distance (feet)		
	1 lane	2 lanes	3 lanes
20	180	200	220
25	230	250	275
30	280	300	330
35	320	350	385
40	370	400	440
45	420	450	500
50	470	500	550
55	550	550	610
60	650	650	670

Source: AASHTO Green Book, 1990.

B. Stopping Sight Distance

At a minimum, stopping sight distance must be available to the driver at all locations along roadways. Stopping sight distance applies to horizontal as well as vertical alignments. Stopping sight distance on horizontal curves is measured along the centerline of the inside lane around the curve and the line of sight is a straight line between two points on the centerline of the lane. On vertical curves, stopping sight distance is measured on a straight line between the driver's eye and an object on the roadway surface. The height of the driver's eye shall

be measured at 3.5 feet above the roadway surface and the object shall be 0.5 feet above the roadway surface. Figures 8 and 9 illustrate the measurement of stopping sight distance horizontally and vertically, respectively. A more detailed explanation of the measurement of stopping sight distance is included in A Policy on Geometric Design of Highways and Streets, 1990, by AASHTO (AASHTO Green Book). The minimum stopping sight distance required is based on wet pavements and depends on the design speed and the grade of the roadway. Table 3.3 presents the minimum stopping sight distances for various design speeds on level terrain. Table 3.4 presents factors for adjusting the length of stopping sight distance for grades.

TABLE 3.3
Minimum Stopping Sight Distance
For Level Conditions

Design Speed (MPH)	Stopping Sight Distance
10	45 feet
15	75 feet
20	125 feet
25	150 feet
30	200 feet
35	250 feet
40	325 feet
45	400 feet
50	475 feet
55	550 feet
60	650 feet

Source: AASHTO Green Book, 1990.

TABLE 3.4
Adjustment Factors for Stopping
Sight Distance on Grades

Design Speed (MPH) (Feet)	Increase for Downgrades Correction in Stopping Site Distance (Feet)			Decrease for Upgrades* Correction in Stopping Sign Distance		
	3%	6%	9%	3%	6%	9%
20	0	5	10	0	5	5

25	5	15	20	0	5	10
30	10	20	30	5	10	20
35	15	30	50	5	15	25
40	20	40	70	10	20	30
45	25	55	95	15	25	35
50	30	70	120	20	30	40
55	40	90	N/A	25	40	N/A
60	50	110	N/A	30	50	N/A

*Assumed speed is lower than the design speed since vehicles normally travel at a slower speed on an upgrade.

Source: AASHTO Green Book, 1990.

3.04 MATERIALS

Portland cement concrete for curb and gutter, driveways, and sidewalks shall have a minimum 28 day compressive strength of 4000 psi, a non-vibrated slump between 2.5 and 4 inches, a minimum cement content of 564 pounds per cubic yards, an air entrainment of 5- 7 %, and a maximum water-cement ratio of 0.532.

Joint filler shall be a non-extruding joint material conforming to ASTM C1751.

Concrete Curing Agents shall be free from any impurities which may be detrimental to the concrete and meet Section 926 of NCDOT Standard Specifications for Roads and Structures.

Aggregate for Portland cement concrete shall meet the requirements for fine and course aggregate of Section 1014 of the NCDOT Standard Specifications for Roads and Structures.

Portland Cement and admixtures shall meet the requirements of Section 1000 of the NCDOT Standard Specifications for Roads and Structures.

Water for mixing or curing the concrete shall be free from injurious amounts of oil, salt, acid, or other products injurious to the finished product.

Aggregate Base Course shall consist of an approved coarse aggregate produced in accordance with the requirements indicated in Section 910 for either Type A, B, or C aggregate as described in the NCDOT Standard Specifications for Roads and Structures.

Bituminous Surface Course, Type I-1 and I-2, shall consist of a mixture of coarse and fine aggregates, asphalt cement, and shall meet the requirements in Section 645 of the NCDOT Standard Specifications for Roads and Structures.

Bituminous Concrete Base Course, Type HB, shall conform to the general, material, and construction specifications as specified in Section 610 and Section 630 of NCDOT Standard Specifications for Roads and Structures.

Bituminous Concrete Binder Course, Type H, shall conform to the general, material, and construction specifications as specified in Section 610 and Section 640 of NCDOT Standard Specifications for Roads and Structures.

Tack Coat shall be asphalt or asphalt cement and shall meet the general, material, and construction specifications as specified in Section 605 of NCDOT Standard Specifications for Roads and Structures.

Concrete Pavement shall meet Section 700 of NCDOT Standard Specifications for Roads and Structures.

Concrete Pavers may be used on privately maintained streets in accordance with Standard Detail 3.04. The City of Asheville will not maintain decorative type paved street surfaces such as pavers or imprinted designs within public right of way. An encroachment agreement for decorative paved or concrete surfaces is required when located within City or State right of way.

Geotextile Fabric may be used to stabilize a roadway, subgrades, slopes, and for other uses as necessary. At least one week prior to using this fabric, a sample and its associated engineering data shall be submitted to the City Engineer for approval. Areas stabilized with fabric shall be indicated on "as-built" drawings with the manufacturer name and type fabric indicated.

3.05 CONSTRUCTION AND INSPECTION

No construction shall be conducted until the following applicable items have been obtained: all grading permits, City or NCDOT Encroachment Contracts, performance bonds, and City of Asheville subdivision and plan approval.

A. Streets

No base material shall be placed on a roadway until the storm sewer, subgrade, utilities, and all appurtenances have been inspected and meet City of Asheville Standard Specifications.

Field density testing of the subgrade soils from a certified soils laboratory will be required. The soils laboratory shall perform sufficient Proctors to evaluate the compaction characteristics of various soils used in the roadbed. Field density testing of the ABC used and an asphalt mix formula will be required before either is inspected or approved. Soil test should be taken every 200 feet at a minimum. More frequent test may be required by the City Engineer or their designee.

The subgrade shall be compacted as described in Section 2.05 Earthwork. Inspection of the subgrade prior to placement of base course, and inspection of the base course prior to placement of asphalt shall be performed by proofrolling and/or field density testing at the direction of the Inspector.

B. Curb and Gutter, Driveways, and Sidewalks

No concrete shall be placed until the forms and subgrades have been approved by the Inspector.

The surface of sidewalks shall be finished to grade and cross section with a float, troweled smooth and finished with a broom.

Subgrade shall be excavated to the required depth, and shaped to the proper cross-section. Where tree roots are encountered, they shall be removed to a depth of 1 foot for the full width of the excavation. The subgrade shall be stable and thoroughly compacted.

Forms shall be set and maintained true to the required lines, grades, and dimensions. Forms shall be constructed with material of such strength and rigidity to prevent any appreciable deflection between supports. Straight forms shall be within a tolerance of 1/4 inch in 10 feet from a true line horizontally or vertically. Forms shall be thoroughly cleaned of all dirt, mortar and foreign material before being used. All inside form surfaces shall be thoroughly coated with commercial quality form oil.

Grooved Contraction Joints shall be cut to a depth equal to at least 1/3 of the total slab thickness. The joint shall be no less than 1/8 inch in width and cut at intervals equal to the width of the sidewalk. A 1/2 inch expansion joint filled with joint filler shall be placed between all rigid objects and placed no farther than 50 feet apart for sidewalks

and curb and gutter, extending the full depth of the concrete with top of the filler 1/2 inch below the finished surface.

3.06 FIRE LANES

Fire Lanes shall be installed and inspected in accordance with the public street requirements of Section 3.05 A and 3.05 B. Fire lanes shall be provided for any building or facility which is set back more than 150 feet from a public street or exceeds 30 feet in height and is set back more than 50 feet from a public street.

Fire lanes shall be at least 20 feet in width with the street edge closest to the building at least 10 feet away from the building. The surface of the fire lane shall be paved with a minimum of 8 inches of ABC stone and 2 inches of I-2 asphalt.

Fire lanes shall be designated by signs posted at a minimum height of:

- (1) 60" to the top of the sign when pedestrians do not pass by or under the sign. This application includes signs mounted on the building face, a column, or other fixed mounting surface;
- (2) 84" to the top of the sign when the pedestrian path does pass by or beneath the sign. This application includes signs mounted on a fixed post located in a sidewalk and/or traffic island.

Signs shall be placed at a maximum center-to-center spacing of 50 feet on both sides of the fire lane or an additional sign beneath the fire lane sign lettered as "both sides". Signs shall be a type "R8-31" or equivalent reflective sign no less than 12" x 18" in size, white background, with the wording "No Parking Fire Lane" in red letters.

A plan shall be submitted to the Fire Official which indicates all fire lanes and proposed fire lane sign placements for the project site for the fire official's approval.

3.07 TRAFFIC CONTROL AND STREET NAME SIGNS

Traffic Control and Street Name Signs shall be installed by the Developer in new subdivisions. **These signs will be maintained by the City of Asheville provided the street will be publicly maintained.** These signs shall be consistent with the MUTCD. All specialty traffic control and street name signs and posts must comply with appropriate standards for size, reflectivity, location, etc.

3.08 PEDESTRIAN CROSSINGS

All marked pedestrian traffic crossings must be approved by the City or NCDOT Traffic Engineer prior to installation.

All mid-block pedestrian traffic crossings shall be designated as a crosswalk with pavement marking and signage in accordance with MUTCD and must be approved by the City or NCDOT Traffic Engineer prior to installation.

3.09 TRAFFIC SIGNALS

The City of Asheville reserves the right to install traffic signals at the time the development is completed. The developer may be desirous of placement and operation of a traffic signal to promote easier and safer ingress and egress to the development both on-site and off-site at an earlier date than the City would normally schedule and be willing to fund. The developer can purchase and install the traffic control signal hardware, meeting the specifications of the City of Asheville. The developer shall release, give or donate the traffic signal to the City of Asheville and shall retain no rights or ownership of personal property therein. Traffic signal warrants in accordance with MUTCD shall be met for any proposed traffic signals.

All signal installations must be approved by the City or NCDOT Traffic Engineer prior to installation.

NCDOT may require developer funding of any warranted traffic signal modifications on State system streets in Asheville.

Developer/Owner must donate easements for traffic signal installations as required by City of Asheville or NCDOT.

END OF SECTION 3.00

FIGURE 1

Horizontal Curve Controls

Vertical Curve Controls

	Minimum Design Speed (MPH)*	Maximum Superelevation (ft/ft)**	Minimum Radii (ft)	Maximum Grade***	Length Crest	Length Sag	Minimum Length
Major thoroughfare limited access	Design standards to be determined for each case individually by a Professional Engineer using AASHTO guidelines.						
Major streets & Highways	50	0.06	400	7%	85A	75A	150'
Marginal access streets	40	normal crown	230	9%	55A	55A	100'
Collector Streets	40	Normal crown	150	9%	28A	35A	100'
Residential Streets	30	normal crown	150	15%	28A	28A	80'
Cul-de-sacs (1,000 feet or less)	25	normal crown	100	15%	18A	18A	50'
Loop Road (1500 feet or less)	25	normal crown	100	15%	18A	18A	50'

A - Algebraic difference in grades.

* - Design speed shall be at least 5 mph greater than posted speed **or as required by the City Traffic Engineer.**

** - The superelevation tables found in "A Policy on Design of Urban Highways and Arterial Streets - 1973" published by the American Association of State Highway Officials will be used for determining the actual "e" various radii.

*** - On roadways less than 500 feet in length, grades may be increased 1%.

Note: The City Engineer may allow a lower design speed on residential streets. Approval must be given on a case by case basis.

**FIGURE 2
RECOMMENDED PARKING LOT STALL DIMENSIONS**

DIMENSIONS FOR 90-DEGREE PARKING

APPLICATION		(S) STALL WIDTH (feet)	(C) STALL LENGTH (feet)	(D) STALL DEPTH (feet)	(L) LINEAR DEPTH (feet)	(A) AISLE WIDTH (feet)	(W) MODULE WIDTH (feet)
CUSTOMER, high turnover	RECOMMENDED	10	10	18	18	24	60
	STANDARD	9	9.5	18	18	25	61
CUSTOMER AND EMPLOYEE, low turnover	RECOMMENDED	10	10	18	18	23	59
	STANDARD	9.5	9.5	18	18	24	60
	MINIMUM	9	9	18	18	25	61

DIMENSIONS FOR 60-DEGREE PARKING

APPLICATION		(S) STALL WIDTH (feet)	(C) STALL LENGTH (feet)	(D) STALL DEPTH (feet)	(L) LINEAR DEPTH (feet)	(A) AISLE WIDTH (feet)	(W) MODULE WIDTH (feet)
CUSTOMER, high turnover	RECOMMENDED	10	11.5	15.6	18	22.8	54
	STANDARD	9	11	15.6	18	23.8	55
CUSTOMER AND EMPLOYEE, low turnover	RECOMMENDED	10	11.5	15.6	18	20.8	52
	STANDARD	9.5	11	15.6	18	21.8	53
	MINIMUM	9	10.4	15.6	18	22.8	54

DIMENSIONS FOR 45-DEGREE PARKING

APPLICATION		(S) STALL WIDTH (feet)	(C) STALL LENGTH (feet)	(D) STALL DEPTH (feet)	(L) LINEAR DEPTH (feet)	(A) AISLE WIDTH (feet)	(W) MODULE WIDTH (feet)
CUSTOMER, high turnover	RECOMMENDED	10	14.1	12.7	18	22.6	48
	STANDARD	9	13.4	12.7	18	22.6	48
CUSTOMER AND EMPLOYEE, low turnover	RECOMMENDED	10	14.1	12.7	18	21.6	47
	STANDARD	9.5	13.4	12.7	18	22.6	48
	MINIMUM	9	12.7	12.7	18	23.6	49

DIMENSIONS FOR PARALLEL PARKING