

Section 2 – Roadways, POD's, Subdivisions, and CIP Standards

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2.01 Continuity of the Public Road System

Standard

A road or street may only be accepted for maintenance into the system if it is the continuation of the network of public streets whose maintenance has been officially accepted by the County or, if appropriate, the Virginia Department of Transportation. The County shall determine if such road or street renders sufficient public service to justify the expenditure of public funds for its subsequent maintenance.

For the purpose of these requirements, public service may include, but is not limited to, one or more of the following situations:

- Provides an extension of a road to the subdivision boundary or parcel to facilitate the continuity of possible adjacent development.
- Serves as access to a public school, a County owned public recreational facility or other similar facility open to public use.
- Provides access to single family lots in a platted subdivision.
- Is identified on the County's Major Thoroughfare Plan.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.02 Establishing a Public Right-of-Way

Standard

Public roadways that are constructed for acceptance into the County road system shall be established through one of two methods:

- Hearing of Necessity before the Board of Supervisors
- Dedication of Right-of-Way with a Subdivision or Plan of Development

Hearing of Necessity before the Board of Supervisors

The establishment of a roadway with the Hearing of Necessity process is one that is normally utilized by the County in the furtherance of its Capital Improvement Program.

The Board of Supervisors initiates the process by requesting the Director of Public Works to prepare a report (i.e. Letter) describing the need (Necessity) for a specific project. This “Letter of Necessity” is filed with the Board who then holds a public hearing on the Letter and the project. Following this public hearing the Board of Supervisors makes a decision based on the merits of the project (See Code of Virginia 33.1-230 *et seq.* for additional details).

While the above indicates the normal process when non-federal funds are used for the construction of roadways in the County, it should be noted that as allowed under 33.1-216 of the Code of Virginia, the County is permitted to fully comply with rules and regulations which may be in conflict with the Letter of Necessity process, when federal-aid funds and contracts are involved. Use of such funds requires a process for public involvement much greater than that provided by the Letter of Necessity.

Dedication of Right-of-Way with a Subdivision or Plan of Development

The establishment of a roadway through right-of-way dedication with a subdivision plat is the process that is used by developers. The development of the plat shall be in accordance with Chapter 19-Subdivisions of the County Code.

Construction plans for the proposed roadway shall be developed in accordance with this Manual and Chapter 19, Article II of the County Code.

The construction plans will be reviewed by the Department of Public Works. If the plans are determined to be in compliance with the standards, the Director of Public Works will authorize the construction of the road through the approval of the plans. After the plans are approved by the Planning Department and the Department of Public Utilities, a pre-construction meeting must be scheduled with the Environmental Division prior to the beginning of any construction.

The Department of Public Works will periodically inspect the roads throughout the construction process. The developer shall request a final inspection at such time that the road construction is complete. See Section 4 of this Manual for additional information concerning the inspection process and the acceptance of the roads into the County System.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.03 Road Functional Classification

Standard

Roadway functional classification is one of the tools used to determine the road design for a County road or road project. The function of a road is determined by the volume of traffic, length of vehicle trips using the road, and whether the road provides service primarily for vehicular movement or access to abutting land uses.

Normally the arterial roadways will carry significantly higher traffic volumes and a variety of traffic types at higher speeds than collector roads. Similarly, collector roads will normally carry higher traffic volumes at higher speeds than local roads.

All roadways within the County are classified as to their function. The Department of Public Works utilizes roadway functional classification, along with the existing and projected traffic volumes, to determine the design features and requirements of the road.

The functional classification for all of the County roadways classified as either a major arterial, minor arterial, major collector, minor collector, or major access road are shown on the County's Major Thoroughfare Plan. Local streets are not included on this plan.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.04 Road Improvements

Standard

For any proposed development, including one single-family house, the developer shall dedicate the right-of-way for the entire cross section of the planned ultimate road width or the portion of the proposed right-of-way that is located within the development.

The developer shall build one half of the proposed roadway cross section, including one half of the median, if applicable, and any related drainage facilities for the ultimate road section if the proposed road is required to provide access to the development on one side of the roadway. If projected traffic volumes warrant additional travel lanes beyond those indicated previously, the additional lanes will be required to be constructed.

The developer (of anything besides on single-family house) shall build the entire ultimate roadway cross section, including the median if applicable, and any related drainage facilities if the road is required to provide access to the development on both sides of the roadway.

If a development, including one single-family house, is proposed that has direct access to a county roadway that is not constructed to current county standards, the developer shall dedicate the right-of-way and improve the roadway to current county standards along the parcel's frontage. This may include the widening of the roadway to its ultimate width. At a minimum, a one single-family residence development shall be required to widen the roadway to create the minimum AASHTO standard of a ten (10) foot travel lane along the parcel where no curb/gutter exists. If curb/gutter exists on an adjacent parcel, then the subject parcel shall widen the road along the parcel to match the existing adjacent cross section, including any drainage facilities. The developer of one single-family residence may be required to improve a direct accessed road from the closest intersection to the parcel being developed and install a turnaround, if required by the Fire Department. If the development is on both sides of an existing roadway, the developer will be required to dedicate the ultimate right-of-way on both sides of the roadway and construct the roadway to its ultimate width.

For any proposed development in which a new roadway, where an ultimate cross section of less than four lanes is planned, the developer shall dedicate the right-of-way and construct the entire roadway and any related drainage facilities.

For any proposed subdivision (defined in Section 19-2 of the County Code) that fronts and/or has direct access to a county roadway that is not constructed to current county standards, the developer shall dedicate the right-of-way and improve the roadway to county standards along the parcel's frontage as outlined in Sections 19-134 and 19-161 of the County Code.

Roads intersecting with unimproved right-of-way shall include the ultimate drainage, pavement design, grade, and traffic control considerations in the design.

The unimproved right-of-way shall be cleared, grubbed, rough graded and seeded as a part of the development. Construction plans for the road shall be prepared for the above grading, to allow the lot layout, dwelling location and orientation of the development to take the ultimate road into consideration and to determine if slope easements need to be dedicated as a part of the development.

Right-of-way dedication, based on the ultimate road right-of-way width, shall be provided along those sides of the lots where road improvements are not required as a part of the development. Construction or Maintenance easements may also be required.

Road improvements, drainage improvements, and/or sidewalk improvements cannot be escrowed.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.05 Road Improvements for Double-Frontage Lots

Standard

Road improvements and right-of-way dedication are required for all double-frontage lots. The County Code defines a double-frontage lot as “a lot, other than a corner lot, which has a frontage on two more or less parallel streets”. Section 19-135 of the Code does not allow lots to front more than one street except to:

- separate a lot from an expressway, toll road, or major street, or;
- make practical use of the land.

Applicability of the Standard

This standard applies to all types of single family development.

Design Requirements

These requirements are applicable to all double-frontage lots.

- Road improvements are required on all sides of the lot where access is permitted.
- Road improvements are not required where there is an easement preventing access if the adjacent roadway is an expressway, toll road, or major street, except for the lot(s) on either side of an entrance road. If the adjacent roadway does not fall into this category, road improvements are required.
- The Developer is responsible for completing all required road improvements adjacent to the lot.
- Right-of-way must be dedicated on all sides of lots that abut at County or State right-of-way (even if no road improvements will be made), based on the ultimate right-of-way width.

2.06 Survey Requirements

Standard

All horizontal and vertical control will be the latest found in the GIS Monumentation Network

All topography surveys will meet the minimum standard from VA Code 18VAC10-20-382.

Plans with topography will include the following:

- Source of the topography
- Date of the survey
- Name of the Surveyor that performed or oversaw the site survey work
- Name of the firm that performed the site survey work

All plans that have improvements, excluding single family driveway culverts and curb cuts, in the existing ROW shall have the following:

A minimum of two benchmarks must be established and shown on the construction plans in areas that will not be disturbed during construction. For linear projects such as road widening, benchmarks must be placed no farther apart than 500 feet and tied into the survey base line.

Horizontal and vertical control must clearly be shown on the plans

Baseline with stations clearly shown.

Geometry of the baseline to include Point of Curvature (PC) and Point of Tangent (PT) must be on the plan.

Baseline must be tied to a minimum of two known points in the field.

If a proposed curb or edge of pavement is not parallel to the baseline, the proposed geometry must be shown. Drainage structures must have stations and offsets to the middle of the chamber. Provide cross-sections, at a minimum of 25 feet intervals, showing the existing and proposed pavement elevations throughout the limits of all road improvements

For roads without curb and gutter, the EP survey point should be taken at the white line or at the point which represents the consistent cross slope of the road.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, and PODs.

Applies to CIP projects as above unless project contract requests different requirements.

Any waivers from the above requirements must be approved by the County Surveyor.

Subdivision Plats are covered by minimum standards and procedures for land boundary surveying practices, VA Code 18VAC10-20-370.

Design Requirements

N/A

2.07 Right-of-Way

Standard

A clear and unencumbered right-of-way shall be dedicated for public use for all proposed roadway additions to the County roadway system. Related easements for drainage, water quality, traffic devices and all others necessary to support the proposed roadway are required to be dedicated for public use in a form acceptable to the County Attorney and the Department of Public Works.

Right-of-Way Radius

Right-of-way radii are required at the beginning of all roadway curves and shall end at the tangent point on all roadways.

Property/Right-of-Way Lines at Street Intersections

Property/right-of-way lines at roadway intersections shall be a tangent, a radius is not allowed. The beginning and ending points of the right-of-way tangent are determined by measuring back from the right-of-way extended PI (point of intersection) along each individual right-of-way tangent no less than 25 feet in residential areas, and 30 feet in non-residential areas. A typical detail of this relationship is identified in Appendix C on Drawings C-14 and C-15. Additional chord length may be required by the Traffic Engineer.

Standard Cul-de-Sac

Cul-de-sacs are required at the end of all dead end streets. Cul-de-sac streets shall terminate in a circular right-of-way. The size of the cul-de-sac is based on the road classification and width of the road that is terminated. Details regarding size of cul-de-sac that is to be used are identified in Section 2.22 and in Appendix C, Drawing C-23.

Widths of Right-of-Way

The minimum right-of-way for streets to be accepted into the County Road System is based on functional classification.

Typical Roadway Sections for these right-of-way are shown on the Typical Section Details, in Appendix B.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs and CIPs.

Design Requirements

Typical Section Details, in Appendix B.

2.08 Right-of-Way Monuments / Property Pins

Standard

Right-of-way monuments shall be installed in conformance with Section 19-160 of the County Code. Monuments must be installed at all breaks in the right-of-way line including angle points, radial points and at the beginning (PC) and end (PT) of curves. In addition, monuments must be installed at intervals on tangents so as to be visible from each monument, but not more than 2,400 feet apart.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

Monuments are to be set in accordance with the County standard detail located in Appendix C, with an accuracy of 1: 20,000 (2nd order, class 2).

The replacement of any monuments removed or destroyed during the development of the subdivision shall be the responsibility of the subdivider.

The replacement of any monuments removed or destroyed during the development of any development shall be the responsibility of the developer.

2.09 GIS Requirements

Standard

All plans and plats, excluding single family building permits, which are submitted for review and approval must include four coordinate points derived from the County Geodetic Control Network (GCN). The plan or plat must identify the location of any GCN monuments that are located on the site. All measurements on the plan must be tied to the four coordinate reference points.

Monuments shall conform to the County standard detail located in Appendix C in this Manual. Specifications for installation and accuracy required for the placement of GPS monuments can be found in the latest edition of the Henrico County GPS Control Network Book.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, CIPs and PODs.

Design Requirements

N/A

2.10 Encroachments and Extrinsic Structures on the Right-of-Way

Standard

Posts, Walls, Signs, Structures

Posts, walls, and signs as permitted in Chapter 24, Section 104 of the Henrico County Code or similar ornamental structures that do not interfere with roadway capacity, traffic safety or sight distance may be permitted within the right-of-way.

Specific authorization by a permit, issued by the Department of Public Works, is a requisite for these devices or any other encroachment to be located within the right-of-way. A Right-of-Way Maintenance Agreement, found in Appendix D, Page D-23, must be entered into with the Department of Public Works before work takes place on the right-of-way.

No permanent or semi-permanent structure will be permitted to be constructed over or directly adjacent to a storm water drainage pipe or structure.

An approved sign permit for the specific sign in question will satisfy authorization for placement of a sign on the right-of-way. A Right-of-Way Maintenance Agreement must accompany all approved sign permits. A written request, providing all necessary details, must be made to the Director of Public Works for all other planned or proposed encroachments.

The maintenance of an approved sign, structure or facility shall be the responsibility of the developer or the permit applicant. The sign or structure will be removed from the right-of-way if it is not maintained in a manner that is satisfactory to the Director of Public Works.

Landscaping, Lighting, and Irrigation

Landscaping on the right-of-way may be permitted provided the landscaping does not interfere with sight distance requirements, introduce safety hazards, and does not introduce potential damage to the road and drainage system infrastructure. Plantings which bear fruit, nuts or seeds that, when dropped, will interfere with or impede storm water drainage flow shall not be permitted.

Irrigation systems may be permitted to be installed on the right-of-way provided that underdrains are installed to keep water from ponding or becoming trapped near or under the roadway.

Plans and specific details outlining proposed landscaping, landscape lighting, irrigation systems and/or private underdrains that are to be installed shall be approved by the Department of Public Works. Specific written authorization by the Director of Public Works shall be obtained and a Right-of-Way Maintenance Agreement must be entered into with the Department of Public Works before work takes place on the right-of-way.

The review and approval of landscaping plans that are part of an overall landscape plan for a development shall be coordinated with the Planning Department.

The County will not be held responsible for damages to irrigation systems, signs, landscaping, and other items placed within the County right-of-way. Such items, within the County right-of-way, shall be the responsibility of the owner, developer, home owners association (HOA) or other entity to maintain or repair.

The owner shall be responsible for removal and/or relocation of encroachments, should it become necessary to relocate for future road improvements or maintenance activities.

Applicability of the Standard

N/A

Design Requirements

N/A

2.11 Spite Strips

Standard

Plans shall not include a reserved strip, or “spite strip” that would prohibit otherwise lawful vehicular access to a public road or right-of-way from an adjacent property.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

Planting strip easements that are required as a part of a development to control access to any street shall not be considered spite strips provided that alternate access is permitted to the parcel or lot in question (see also Section 19-124 of the County Code).

2.12 Typical Road Section Requirements

Standard

All construction will be in accordance with the most recent edition of: (1) VDOT Road and Bridge Specifications and (2) VDOT Road and Bridge Standards, except as noted in this Manual.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

See Appendix B of this Manual for typical road section requirements.

Completion of road widenings to existing road sections will be determined by the County Engineer.

2.13 Design Speed

Standard

Design Speed is the maximum safe speed that can be maintained over a specified section of roadway.

For all roads with a posted speed limit of 35 miles per hour (mph) or less, the design speed shall be equal to or greater than the posted speed.

For roads with a posted speed of 40 mph or greater, the design speed shall be a minimum of 5 mph greater than the posted speed.

Applicability of the Standard

This standard applies to all types of development, including linear projects, CIPs, subdivisions and PODs.

Design Requirements

The vertical and horizontal curves are to be designed using the design speed.

2.14 Sight Distance

Standard

Two types of sight distance exist for the design of roads:

- Stopping Sight Distance
- Intersection Sight Distance

Stopping Sight Distance

Stopping sight distance is the sum of two distances: the brake reaction distance and the braking distance. The brake reaction distance is the distance a vehicle travels from the time a driver sees an object requiring a stop to the moment the brakes are applied. The braking distance is the distance a vehicle travels from the moment the brakes are applied, until it comes to a stop condition. In computing and measuring the stopping sight distance, the 3.5-foot eye height and 2.0-foot object height criteria are used. The following table shows the stopping sight distance for various posted speed limits.

Stopping Sight Distance

	POSTED SPEED LIMIT							
	20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
Stopping Sight Distance	115'	155'	200'	250'	305'	360'	425'	495'

From – *A Policy On Geometric Design Of Highways And Streets*, 2018, Table 3-1, page 3-4, Stopping Sight Distance on Level Roadways

Note: Assumes wet pavement and level roadway. Roadways with a grade of 3 % or more should use equation 3-3 from *A Policy On Geometric Design Of Highways And Streets*.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

- Needs to be measured from a height of 3.5 feet to an object at 2.0 feet
- Needed at all vertical and horizontal curves on public roads

Intersection Sight Distance

Intersection sight distance allows for the safe maneuver of a vehicle from the stopped position at an intersection even though an approaching vehicle comes into view on the intersecting road as the stopped vehicle begins its departure. In computing and measuring the intersection sight distance, the 3.5-foot eye height and 3.5-foot object height criteria are used. The following table shows the minimum intersection sight distance for various speed limits. All obstructions within this line must be no higher than 30 inches above the ground level where the sight distance originates. This line shall remain free of all structures, trees, and light poles. No landscape plantings which obstruct visions between a height of 30 inches and eight feet above the ground level where the sight distance originates shall be permitted within the Sight Distance Line nor within 5 feet of the sight distance line. If a Sight Distance Line is determined to be outside the county right-of-way, a Sight Distance Easement must be provided.

Intersection Sight Distance

ROAD WIDTH (FEET)*	POSTED SPEED LIMIT (mph)							
	20	25	30	35	40	45	50	55
22/24	220'	275'	330'	385'	440'	495'	550'	605'
28/30	225'	280'	335'	390'	450'	505'	560'	615'
34/36	230'	285'	340'	400'	455'	515'	570'	625'
40/41	230'	290'	345'	405'	460'	520'	575'	635'
47	235'	295'	350'	410'	470'	530'	585'	645'
52/53/54	240'	300'	360'	420'	480'	535'	595'	655'
64/67	245'	310'	370'	430'	495'	555'	615'	680'
78/81	255'	320'	385'	445'	510'	575'	640'	700'
86/91	260'	325'	390'	460'	525'	590'	655'	720'
From - <i>A Policy on Geometric Design of Highways and Streets</i> , 2018, Table 9-7, page 9-46, Design Intersection Sight Distance, Case B1, Left Turn From Stop								

Values are rounded. For all road widths greater than 24 feet, the formula from Table 9-5, Page 9-37 of *A Policy on Geometric Design of Highways and Streets*, 2018 was used.

*Road width is measured between face of curbs of the thru lanes or, in absence of curbing, between edge of pavements of thru lanes.

If an intersection is configured for only a right turn in and right turn out of a minor street or access driveway, the sight distances in the following table may be used for looking left only from the stopped vehicle. In computing and measuring the intersection sight distance, the 3.5 foot eye height and 3.5 foot object height criteria are used. No obstructions blocking vision between a height of 30 inches and eight feet above the ground level where the sight distance originates shall be permitted within the sight distance line nor within 5 feet of the Sight Distance Line. This line shall remain free of all structures, trees, and light poles. If a Sight Distance Line is determined to be outside the county right-of-way, a Sight Distance Easement must be provided.

Intersection Sight Distance
(use for right in/right out locations only)

NUMBER OF LANES FROM LEFT	POSTED SPEED LIMIT (mph)							
	20	25	30	35	40	45	50	55
1	200'	240'	290'	340'	390'	430'	480'	530'
2	210'	260'	310'	370'	420'	470'	520'	570'
3	230'	280'	340'	390'	450'	500'	560'	610'
From - <i>A Policy on Geometric Design of Highways and Streets</i> , 2018, Table 9-9, page 9-48, Design Intersection Sight Distance, Case B2, Right Turn From Stop								

Values are rounded up. For road widths greater than one lane, Table 9-8, Page 9-47 of *A Policy on Geometric Design of Highways and Streets, 2018* was used.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

- Should be measured at 14.5 feet from edge of the major roadway through travel lane
- Needs to be measured from a height of 3.5 feet to an object height of 3.5 feet
- Needs to be measured looking left and right
- Needed at all public roads, private roads, and non-single family resident access points that intersect a public road
- Sight Distance Easements will be required when the line of sight is determined to be outside the county right-of-way. This includes offsite easements if necessary. Any obstructions located within a Sight Distance Easement shall not obstruct visions between a height of 30 inches and eight feet above the ground where the sight distance originates.
- Plan and profile details for sight distance lines will be required on all plans.

2.15 Horizontal Curves

Standard

When tangent centerlines deflect from each other more than one degree (1°) and are not forming an intersection, they shall be connected by a curve with a minimum centerline radius of 154 feet and a minimum centerline length of curve of 100 feet for residential roads. Residential roads are not required to have superelevation, but it is required on all Major Thoroughfare roads unless minimum normal crown radii are met. Residential roads intersecting any road shall have a tangent section of centerline at least 60 feet in length measured from the near edge of pavement/face of curb of the thru lane of the intersecting road.

When tangent centerlines on arterial and collector streets deflect from each other more than one degree (1°) and are not forming an intersection, they shall be connected by a curve with a minimum centerline radius of curve based on the data in the following curve table on the next page.

Prior to initiating the design of a road, the engineer should contact the Department of Public Works regarding the degree of superelevation that will be permitted on the specific road. The determination as to whether superelevation will be permitted will be based on the functional classification of the road as well as drainage characteristics and considerations. The maximum superelevation allowable is 0.04 foot/foot.

Degree of Curve and Minimum Radius for Roads

Normal Crown Section

	DESIGN SPEED							
	25	30	35	40	45	50	55	60 mph
	mph	mph	mph	mph	mph	mph	mph	
Radius	2050	2,830'	3730'	4770'	5930'	7220'	8650'	8650'

From – *A Policy On Geometric Design Of Highways And Streets* , 2018, Table 3-8, Page 3-42, Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max} = 4\%$.

At Maximum Superelevation ($e_{max} = 0.04$)

	DESIGN SPEED							
	25	30	35	40	45	50	55	60
	mph	mph	mph	mph	mph	mph	mph	mph
Radius	154'	250'	371'	533'	711'	926	1,190'	1,500'

From – *A Policy On Geometric Design Of Highways And Streets* , 2018, Table 3-7, Page 3-34, Minimum Radius Using Limiting Values e and f .

A tangent is not required between reverse curves on residential streets. On all roads with superelevation, a minimum tangent of 200 feet will be required.

A curve with a minimum centerline radius of 154 feet is allowed for a residential street with normal crown.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.16 Vertical Curves

Standard

Vertical curves may be either crest or sag. The maximum vertical grade permitted on a designated arterial or major collector road is 5 percent. On all other roads the maximum grade is 8 percent. The minimum grade for all streets shall be 0.50%. See section 2.24 of this Manual for minimum grades on curb and gutter within cul-de-sacs. The following table provides vertical curve data for each design speed.

DESIGN CONTROLS FOR VERTICAL CURVES

Sag Vertical Curves	DESIGN SPEED							
	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph	60 mph
K	26	37	49	64	79	96	115	136

From – *A Policy On Geometric Design Of Highways And Streets*, 2018, Table 3-37, Page 3-176, Design Controls for Sag Vertical Curves.

Crest Vertical Curves	DESIGN SPEED							
	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph	60 mph
K	12	19	29	44	61	84	114	151

From – *A Policy On Geometric Design Of Highways And Streets*, 2018, Table 3-35, Page 3-170, Design Controls for Crest Vertical Curves Based on Stopping Sight Distance.

Notes: K = Rate of Vertical Curvature

K factor based on minimum sight distance

Sag Vertical Curves sight distance based on headlight sight distance.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, CIP's and PODs.

Design Requirements

N/A

2.17 Tapers

Standard

A taper is required to move traffic into a different travel path, such as when a lane ends and traffic must merge into the adjacent travel lane, or when lanes shift due to road geometrics. The following table specifies minimum taper lengths required on a roadway where a lane drop is proposed.

MINIMUM TAPER LENGTHS (L)							
POSTED SPEED LIMIT (MPH)	WIDTH OF OFFSET						
	6 FT	7 FT	8 FT	9 FT	10 FT	11 FT	12 FT
25	65'	75'	85'	95'	105'	115'	125'
30	90'	105'	120'	135'	150'	165'	180'
35	125'	145'	165'	185'	205'	225'	250'
40	160'	190'	215'	240'	270'	295'	320'
45	270'	315'	360'	405'	450'	500'	540'
50	300'	350'	400'	450'	500'	550'	600'
55	330'	385'	440'	495'	550'	605'	660'

Values are rounded up and are from formulas located in MUTCD (2009 Edition), Table 6C-4, page 557.

Values for Shifting Tapers shall be a minimum of $1/2(L)$. A Shifting Taper is used when a lateral shift is needed.

Tapers located at the end of a road widening section that is not open to traffic shall have a minimum of a 2:1 taper from edge of pavement back to the travel lane, unless otherwise approved by the Traffic Engineer. One foot beyond the end of pavement for these tapers, two OM-3R (black/white) signs shall be placed and mounted on 7' posts located three feet and eight feet from edge of the through travel lane.

Tapers for right and left turn lanes shall be 100 feet and are discussed in Section 2.20.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.18 Points of Access

Standard

Any new subdivision with more than 50 single family lots shall have a minimum of two separate permanent points of access onto public roads. If construction of a subdivision is to be phased, the second point of access must be open to traffic before the total number of issued building permits in the subdivision exceeds 50.

In addition, any new POD consisting of:

1. multi-family development (apartments/town homes) with more than 82 multi-family units, or
2. 200,000 square feet of retail, or
3. 300,000 square feet of office, or
4. 500,000 square feet of industrial/warehousing, or
5. other large PODs as determined by the Traffic Engineer

shall have a minimum of two separate permanent points of access onto public roads.

If construction of a multi-family development is to be phased, the second point of access must be open to traffic before the total number of Certificate of Occupancies in the development exceeds 82.

There shall be no vehicular entrance or exit within 200 feet, along the same side of the street and in the same block, of the premises of any school, public playground, place of worship, hospital, public library, or institution for children or dependents, except where the parking lot is on the same premises (Sect. 24-98 Henrico County Code).

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

The second point of access needs to be a full point of access that handles two-way traffic that is a typical road section for subdivisions or a minimum of 24 feet wide for PODs.

Access points need to meet access management standards as detailed in Section 2.19.

2.19 Intersection Design

Standard

All roads intersecting another road shall do so at an angle of 90 degrees for a minimum distance of 60 feet measured from the near edge of pavement/face of curb of the thru lane of the intersecting road in all directions. In this section, "Road" shall mean public road, private road, multifamily access, alley, and commercial access.

The minimum offset between intersecting roads shall be not less than 150 feet (measured from the near edge of pavement of existing road to centerline of new road) on residential and minor collector roads. For major collector and arterial roads, offsets shall not be less than 250 feet (measured from the near edge of pavement of existing road to centerline of new road). The measurements listed above are to be met if adjacent intersecting roads are either on the same side of the main road or on the opposite side if the road is undivided.

On local roads, a vertical curve equivalent to the superelevation or crown of the intersecting road shall be provided for a distance of 50 feet. For residential roads internal to a subdivision, a vertical curve equivalent to the crown of the intersecting road shall be provided for a distance of 25 feet for a road with curb and gutter, and 35 feet for a road without curb and gutter

The curb radius or radius on the edge of pavement on all public roads intersecting other public roads designated as collector or arterial roads shall be a minimum of 35 feet. The curb radius or radius on the edge of pavement at all intersections of two public roads designated as residential roads shall be a minimum of 30 feet. The minimum curb radius at the intersection of a public road and a private road, multifamily access, or commercial access shall be 15 feet.

If a Sight Distance Line is determined to be outside the county right-of-way, a Sight Distance Easement must be provided. Sight Distance Easements shall be identified and shown for all road intersections and noted on the subdivision plat, plans of developments, and roadway projects. These easements shall remain free of all structures, trees, and light poles. No landscape plantings which obstruct visions between a height of 30 inches and eight feet above the ground level where the sight distance originates shall be permitted within the Sight Distance Line nor within 5 feet of the Sight Distance Line. See Section 2.14 for more information.

The distance between median breaks shall be a minimum of 800 feet. Spacing between signalized intersections shall not be less than 1,320 feet.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.20 Turn Lanes

Standard

Left and right turn lanes shall be required at all entrances and public roads on four or more lane roadways. Turn lanes may be required on all other roads as determined on a case-by-case basis by the Traffic Engineer. This will be based on type of development, anticipated volume of traffic, location, classification of roads, and other factors.

Pavement design of the turn lane shall be the same as the through lanes of the roadway. Left-turn lanes shall have a minimum width of 10 feet if constructed in the median of a divided roadway, and 12 feet at all other locations. Right-turn lanes shall have a width of 12 feet. See Appendix C for additional information concerning turn lane design.

The minimum turn lane size is as follows:

Left turn lane: 200 feet of full storage; 100 feet of taper

Dual left turn lane: 200 feet of full storage; 200 feet of taper

Right turn lane: 200 feet of full storage; 100 feet of taper

Variations in full storage and taper lengths may be approved by the Traffic Engineer.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.21 Raised Median Design

Standard

Raised medians may be placed at subdivision entrances or can be used to create a divided roadway through a subdivision. All medians greater than or equal to six (6) feet in width shall have a raised grass median with pavement edge drains along each side of raised grass median curbs. Additional landscaping may be added to the raised grass median if approved by the Department of Public Works, and a Right-of-Way Maintenance Agreement (see Page D-23) from a homeowner's association or other group is provided. Any median less than 6 feet shall be constructed in accordance with the latest edition of the VDOT Road and Bridge Standards for MS-1 Median. VDOT Standard MS-1A or variations of the same will not be permitted. All sight lines must meet the minimum criteria as stated in Section 2.14 of this Manual.

Raised medians at subdivision entrances designed for the expressed purpose of identifying and/or beautifying a subdivision entrance will be permitted only on a leg of the intersection that is/will be controlled by a stop condition.

See Pavement Edgedrain for Raised Grass Medians and Islands, Appendix C, Drawing C-33

The minimum crossover spacing on a road with a continuous median is 800 feet.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

UD-4 underdrains are required below each raised median or island curb. Solid concrete medians and islands are exempt.

2.22 Cul-de-sac

Standard

Cul-de-sacs are required at the end of all dead end streets.

The size of the cul-de-sac is based on the road classification and width of the road that is being terminated. Details regarding the right-of-way and pavement radius that are to be used are identified in Appendix C.

A shoulder width of 6 feet shall be provided around the cul-de-sac to insure that the roadside ditch remains within the right-of-way where the right-of-way of the cul-de-sac has a 50-foot radius and a roadway with no curb and gutter is proposed.

A modified cul-de-sac may be used if desired on residential streets with a road section identified as classification IV or less. Any deviation from the standard cul-de-sac as stated above must meet the minimum design criteria of the modified design cul-de-sac as shown in Appendix C. Other alternative cul-de-sac designs will be considered on a case-by-case basis. A Right-of-Way Maintenance Agreement, Appendix D, Page D-23, acceptable to the Department of Public Works must be provided between the developer or the homeowner's association and the Department of Public Works for landscaping and maintenance of the island within the modified cul-de-sacs.

If adjacent property is undeveloped and the future continuation of the proposed street is necessary for convenient movement of traffic representing the best overall traffic pattern, then a temporary cul-de-sac shall be provided.

Temporary Turnaround Easements

Construction of a temporary turnaround area is required whenever a stub street extends more than one lot from a corner or more than one lot fronts on the stub street on either side of the road. All temporary turnarounds or temporary cul-de-sacs shall include a temporary turnaround easement. When a temporary cul-de-sac is no longer required because of a road extension, the developer of the road being extended shall be responsible for removing the temporary cul-de-sac and extending the road and property components (curb and gutter, driveways, sidewalks, mailboxes, etc.) to the new road section and re-grading areas to finished contours with acceptable drainage. The developer shall be responsible for providing all necessary documents to vacate the Temporary Cul-de-sac Easement, unless language is provided on the subdivision plat to extinguish the easement upon extension of the road.

When curb and gutter is required on a street, curb and gutter shall also be provided around the perimeter of any temporary cul-de-sacs, unless a subdivision plan has been submitted and approved to extend the street within the next twelve months after completion of the temporary cul-de-sac.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

See Permanent Cul-De-Sac Criteria chart, Appendix C, Drawing C-23.

2.23 Roadway Shoulder Design

Standard

Shoulder slopes and widths shall be in accordance with roadway typical cross-section details for the road classification contained in this Manual. See Appendix B for additional details relating to road shoulders.

Grassed Shoulders

Topsoil shall be provided on grassed shoulders to a minimum depth of 2 inches. Shoulders shall be seeded and fertilized in accordance with VDOT Road & Bridge Specifications and VDOT Road and Bridge Standards.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

- Shoulders shall be widened for guardrail in accordance with Henrico County Design Manual.

2.24 Curb and Gutter

Standard

General

All curb and gutter shall be constructed in accordance with the County of Henrico standard details located in Appendix C in this Manual.

Accessibility Requirements

All roadway construction shall incorporate a means of access for persons with mobility impairments. See Section 2.47 Curb Ramps in this manual.

New Development

Curb and gutter shall be installed on both sides of each road in a new subdivision in accordance with Section 19-162 of the County Code and with County design standards and specifications. Curb and gutter shall be installed on both sides of each street in a subdivision if any of the following conditions apply:

- any block of any street is constructed with a grade of 0.5% or less within the block
- 25% of the streets within a subdivision have a grade of 1.0% or less
- 25% of the lots in the subdivision have a street frontage of less than 80 feet.

Either standard curb and gutter or roll face curb and gutter may be used on residential roadways (Typical Road Sections I, II, III, IV). The type of curb and gutter that is used must remain the same for the entire length of the street. Standard curb and gutter shall be installed on collector and arterial roadways where curb and gutter is required.

Construction Staking

Curb and gutter, storm sewer and related drainage structures installed on existing County maintained roads will not be staked by the County. The developer shall be responsible for all staking in the public right-of-way. POD's started before September 1, 2021 can be staked by the Department of Public Works upon request. Curb and gutter shall not be staked until all conflicts are resolved within the right-of-way. If the developer requests staking by the Department of Public Works, the developer shall provide, alignment data and pertinent information sufficient to facilitate the construction staking of curb and gutter, storm sewer, and related drainage structures to the County Surveyor. Utility poles must not be located in conflict with existing or future sidewalk shelf areas or sidewalk locations.

Curb and gutter and related drainage facilities on new subdivision roads will not be staked by the County. The developer shall be responsible for staking the curb and gutter for the new road in conformance with the approved plans. The Department of Public Works will

perform inspections of the curb and gutter and road construction as the staking and construction proceeds.

The minimum allowable grade for County roadways is 0.5 % on continuous grade. The minimum allowable grade on curb and gutter within a cul-de-sac is 1.0%. Curb and gutter, storm sewer and related improvements installed on VDOT maintained roads will not be staked by the County.

An as built survey is required on all POD's and Subdivision. See **Appendix A** for right-of-way survey "As-Built" requirements.

Pavement Widening with Curb and Gutter Installation on Existing Roadways

If a property owner wishes to install curb and gutter along the road frontage, the installation location must be approved based on the road functional classification. The County will provide the necessary pavement widening to tie the new curb and gutter to the existing roadway. The County will not provide pavement widening to the new curb and gutter for Plans of Development, subdivisions or building permits.

The minimum pavement design shall be based on the classification of that roadway as defined by the Department of Public Works and the County Code. The new pavement structure depth shall be equal to or greater than the existing pavement.

Concrete Driveway Apron Requirements with Curb and Gutter

Concrete driveway aprons are required with curb and gutter where the following conditions apply:

- Within 25 feet of a drainage inlet.
- When the driveway is lower than the crown of the road.
- In the sag of a vertical curve.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.25 Sidewalk

Standard

A sidewalk shall be installed on both sides of all major thoroughfare roads.

All other roads (including Class I – IV roads and cul-de-sac roads) shall have sidewalk installed on one side of the road at a minimum. The sidewalk will be placed on the side of the road which is most beneficial to pedestrians. This will be determined by the Department of Public Works.

All sidewalks shall be constructed of concrete and have a minimum width of 5 feet. A 4-foot grass utility strip shall be provided between the back of curb and the sidewalk. Appendix B and C provide additional details regarding sidewalk design.

For all pedestrian facilities in the Right-of-Way, Henrico follows these Federal guidelines: **Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way** (PROWAG). See this guideline for standards for public right of way accessibility.

Additional right-of-way shall be dedicated to incorporate the entire sidewalk plus a minimum one-foot shelf outside of the sidewalk should insufficient right-of-way exist. For road classes I-IV, a permanent easement will be needed in addition to the proposed right-of-way to incorporate the entire sidewalk, plus a minimum one-foot shelf outside of the sidewalk. Additional right-of-way can be dedicated in lieu of a permanent easement.

See Section 2.47 of this Manual for information regarding accessibility requirements for pedestrians at intersections.

Applicability of the Standard

This standard applies to all types of development, including subdivision, PODs and CIPs.

Design Requirements

See Sidewalk, Appendix C, Drawing C-11

2.26 Pavement Design

Standard

The pavement design for all streets and commercial / industrial access roads shall be in accordance with the appropriate road classifications shown in the Typical Sections. Pavement Design Standards are included in Appendix B of this Manual. The pavement designs are based on a minimum CBR value of 10 and set forth the minimum pavement design requirements for each road classification. The pavement designs shall be considered preliminary designs and are **not approved for construction** until substantiated by acceptable test results of the actual subgrade soil. Approval of the final pavement design shall be obtained prior to the construction of the pavement.

Field sampling of the subgrade soil shall be required to determine the actual CBR value, resiliency factor and other characteristics to verify the adequacy of the pavement design in relationship to the existing soil. If the test results reveal that the pavement design is less than adequate, adjustments to the pavement design shall be required.

Adjustments to the minimum required pavement designs shall be made in accordance with the latest edition of the VDOT Manual Pavement Design Guide for Subdivision and Secondary Roads in Virginia. The maximum vehicles per day, as shown for the appropriate road classification, shall be used as the Design ADT in the nomograph to determine the Thickness Index for the pavement and for any adjustments to the minimum pavement design requirements. Reductions to the minimum required pavement designs will not be considered. All CBR values are to be determined in accordance with "The Virginia Test Method for Conducting California Bearing Ratio Tests" (Designation VTM-8).

The developer needs to obtain the services of an independent testing firm to perform the tests and submit certified results and pavement recommendations to the County for review. Soil samples should be taken when the earthwork is within 0.1' from finished subgrade.

The pavement design determination process assumes that the properly compacted subgrade soil will produce a stable platform for pavement construction. If an unsuitable subgrade (wet, soft, unstable or unsuitable material) is encountered, it must be undercut to a firm foundation and replaced with adequately compacted material of suitable quality. Prior to the placement of the subbase / base layer, the subgrade must be inspected by the Department of Public Works, or it's representative, for grade and compaction and then proof-rolled. Additional inspections shall be required on each subsequent pavement course.

The use of soil stabilization fabrics in County roadways must be approved by the Construction Engineer. The soil stabilization fabric will not be considered as a substitute for undercut needs, nor will it be considered as added structural value in the pavement design.

In the preliminary design phase of development, the engineer shall take into consideration all possible road extensions, "Growth Rates," where applicable, and the percent of, "Heavy Commercial Vehicles," to determine appropriate adjustments in the design ADT to calculate the road design as required in the VDOT Manual.

In addition to the underdrains that are required in the road construction as detailed in Section 3.11 of this Manual, Standard UD-4 pavement edgedrains with outlets are required along each raised grass median and island curb line to prevent water infiltration through or under the pavement structure. See "Pavement Edgedrain for Raised Grass Medians and Islands", Appendix C, Drawing C-33. Longitudinal pavement edgedrains, Standard UD-4 with outlets to provide for lateral drainage, are also required in all road classifications.

Note: Changes have been made in the pavement designs for road classifications I through IV to provide two (2) asphalt layers of pavement. See Typical Sections - Pavement Design Standards included in Appendix B of this Manual.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

County Road Classifications for each roadway shall be clearly identified on plan typical sections

Changes in Pavement Structure Depth

Changes in pavement structure depth shall only take place at intersecting roadways. The pavement structure depth of the larger ADT volume shall control and be extended around the intersection return before changing to a lesser approved ADT pavement structure design depth. The pavement structure depth change location shall be perpendicular to the roadway. At no time shall a change in pavement structure depth be allowed between intersecting roadways or cul-de-sacs.

Location of changes in pavement structure depth shall be investigated to ensure that differences in subgrade elevation will not create a trapped water scenario. UD-4 underdrain will be required at all such locations to ensure any trapped water will be removed from subgrade. UD-4 shall be outfalled to a drainage structure or roadside ditch and an EW-12 outfall structure.

2.27 Vertical Clearances

Standard

All overhead lines within the public right-of-way must be in accordance with the latest edition of the National Electrical Code.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs

Design Requirements

All roadways must have at least 15 feet of vertical clearance over the entire roadway width and clearances must be clearly marked on plan sheets.

2.28 Guardrail

Standard

Guardrail shall be provided and installed by the developer where necessary for the safety of the traveling public, as well as protection for adjacent properties. The need for guardrail should be determined at the early stages of design to ensure that road sections are designed with enough width to facilitate the guardrail installation and that drainage pipes have sufficient cover for the installation of posts and are extended to accommodate the necessary adjustments in the embankments and slopes. Right-of-way adjustments or guardrail easements may be necessary to accommodate the installation and maintenance of guardrail. All new guardrail installed after September 12, 2017 must meet Manual for Assessing Safety Hardware (MASH) testing criteria.

Warrants

A traversable recovery area for vehicles should be provided beyond the traveled way (edge of pavement) whenever possible. Ideally, this recovery area or “clear zone” should be free of obstacles such as non-traversable drainage structures, steep slopes, and unyielding fixed objects that can cause accidents and result in injuries to motorists. In locations where it is not feasible to remove these obstacles from the clear zone, guardrail may be required to adequately protect motorists.

The following minimum guidelines for guardrail installation are based on AASHTO Roadside Design Guide, VDOT Road Design Manual, and VDOT Guardrail Installation Training Manual. However, it should be noted that guardrail may be required in some locations that do not necessarily meet these criteria based on the judgment of the Traffic Engineer. Such factors as traffic volumes, speed of traffic, crash history, road curvature, slopes of recovery area, presence of curb and gutter, location of trees, utility poles, etc. must all be taken into consideration when determining if guardrail is warranted in a particular location.

Guardrail is typically required on sections of roadway when any of the following conditions exist within the clear zone:

- A roadside parallel embankment (fill slope) of 3:1 or steeper and a depth of 4 feet or more.
- A water hazard with a depth of 2 feet or more.
- A ditch section with a depth of 3 feet or more (as measured from the near edge of pavement).
- A fixed object (such as a culvert, pipe, headwall, retaining wall, bridge pier, or abutment).
- Other hazards as determined by the Traffic Engineer.

The clear zone is measured from either the face of curb or the near edge of pavement (on a road with no curb). For public roads with a design speed of 30 miles per hour or less, private roads, or parking lots, the minimum clear zone is 7.5 feet. When there is a water hazard with a depth of 2 feet or more, the minimum clear zone is increased to 10.0 feet. The width of the clear zone increases as the design speed of the road increases and can be found in the following table.

DESIGN SPEED OF ROADWAY (MPH)	30 or less	35 - 40	45 - 50	55
CLEAR ZONE WIDTH (FEET)	7.5	14	20	24

These dimensions are based on the clear zone having an average slope of 6:1 or flatter. If the average slope is steeper than 6:1 or a water hazard is present, the Traffic Engineer will determine the adequate clear zone requirement.

The Traffic Engineer shall make the final determination as to whether guardrail is warranted along a section of roadway based on a review of the plans, a field inspection after rough grading has been completed and/or prior to final acceptance. To avoid untimely adjustments to roadway features to facilitate guardrail, it shall be the responsibility of the developer to notify the Traffic Engineer of potential guardrail needs at the earliest possible stage of construction and prior to the installation of guardrail to ensure that the limits of the potential hazards are adequately protected.

Acceptable Types

Except as noted herein, all guardrail materials, types and installation requirements shall be in accordance with the latest edition of the VDOT Road and Bridge Specifications, VDOT Road and Bridge Standards and the VDOT Guardrail Installation Training Manual. Non-standard guardrail will not be permitted in the County right-of-way but may be acceptable along privately maintained roadways and within parking areas. All new guardrail installed after September 12, 2017 must meet Manual for Assessing Safety Hardware (MASH) testing criteria. NCHRP Guardrail Standards shall only be used for maintenance and repair work. When repair work requires an entire length of guardrail to be replaced, the new guardrail must meet MASH standards.

Guardrail shall be the galvanized strong post system, standard GR-MGS1. GR-2 shall only be used for Maintenance and Repair. Guardrail terminal treatments are required on both the run-on and run-off ends of guardrail. The standard run-on terminal treatment shall be the GR-MGS2. Run-off end terminal treatments shall be the GR-

MGS2. GR-MGS3 terminal treatment is restricted to runoff conditions on divided highways only.

The standard GR-7 or GR-9 Terminal Treatment are no longer approved for use or repair, unless a design waiver is issued.

Guardrail should be installed flush with the face of curb or a minimum of 6 feet behind the curb for roadways with a Design or Posted Speed of 45 mph or less as shown in the table below. The minimum offsets from the edge of pavement or face of curb to the face of the guardrail are shown in the following table. Additional information is shown on the typical road section details in Appendix B.

Guardrail Offsets

Road Classification		Minimum Offset (In Feet) from Edge of Pavement or Face of Curb to Face of Rail
Class I – IV	Shoulders	6.0
	Curb & Gutter without Sidewalk	6.5
	Curb & Gutter with Sidewalk	10.0
Class V – VIII	Shoulders	6.0
	Curb & Gutter without Sidewalk	6.5
	Curb & Gutter with Sidewalk	10.0

Guardrail installed on roadways with a Design or Posted Speed greater than 45 mph shall be constructed so that the face of rail is flush with the face of curb.

In addition, it may be necessary to dedicate additional right-of-way or dedicate permanent guardrail easements to encompass the guardrail installation, if sufficient right-of-way does not exist for the placement and maintenance of the facility.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.29 Alleys

Standard

Public alleys, as part of developments or subdivisions, are discouraged and shall be minimized as much as possible. The construction of public alleys will only be allowed when the Director of Public Works has determined that no other practical alternatives are available for the proposed development.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

The Director of Public Works will stipulate the alley design at the time the approval for alley use is granted.

Alleys shall not be constructed with the intent of meeting public road standards.

Henrico County will not maintain any alley.

A maintenance agreement (that is acceptable to the Director of Public Works and the County Attorney) is required for any improvements made to existing alleys.

Improvements (clearing, grading, and/or paving) to existing alleys may be completed by an adjacent property owner or other interested party.

Any alley improvements must be approved and authorized by the Director of Public Works.

Improvements will not be authorized on an existing alley without written agreement from all adjacent property owners.

2.30 Bicycle Lanes and Shared Use Paths

Standard

Bicycle lanes and shared use paths shall be designed per the latest version of AASHTO's Guide for the Development of Bicycle Facilities and/or the VDOT Road & Bridge Standards. All signs shall be in accordance with the MUTCD. Appendix B of this Manual provides details of typical road sections that include these facilities within the county's right-of-way.

The developer, or subsequent legal entity responsible for the maintenance within a development (i.e., homeowners association, community association, etc.), shall be responsible for maintaining any shared use paths constructed outside of the right-of-way and within the development. A written acknowledgement of this requirement, satisfactory in form and substance to the county attorney shall be submitted to the Director of Public Works.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs and CIPs.

Design Requirements

AASHTO's Guide for the Development of Bicycle Facilities and/or the VDOT Road & Bridge Standards. All signs shall be in accordance with the MUTCD

2.31 Street Lighting

Standard

Street lighting is not required to be provided on County public roads except as a part of the installation of a new traffic signal, a roundabout, or a UMU District. See Section 2.37 Traffic Signals or Section 2.43 Roundabouts of this Manual for additional information.

Street lighting will be considered as part of the development of new neighborhoods or subdivisions. A comprehensive plan for the entire area or subdivision shall be developed and submitted as a part of the development plans for review by both the Department of Public Works and the Planning Department. Any proposed street lighting shall be included with the road construction plan package for approval consideration. Landscaping plan approval does not constitute approval of the placement of street lighting on the right-of-way.

On existing roadways, street lighting is installed by the County upon request within some existing sanitary districts. Street light installation requests within sanitary districts should be directed to and coordinated with the Department of Public Utilities.

A permit must be obtained from the Department of Public Works for any proposed lighting which will be on or overhanging the right-of-way prior to the installation of the lighting. The lighting shall be designed in a manner that is acceptable to the Director of Public Works and the Director of Planning (if in a UMU District) and be compatible with the surrounding environment and intended use. Any street lighting, poles or fixtures which create a hazard to pedestrian or motor vehicle traffic using the right-of-way will not be permitted. Street lighting shall only be installed in accordance with an approved Permit to Work in the Right-of-Way, Appendix E, Page E-2.

Applications for street lighting permits shall include plans and/or a sketch indicating the exact location of poles with reference to the right-of-way and the edge of pavement, spacing of poles, width of right-of-way, width of pavement, all photometric data, location of electric service, existing facilities (drainage structures, utilities, etc.) in the right-of-way and any other pertinent data.

The permit applicant should provide a written acknowledgement from the adjacent property owners that indicate they have no objection or are in favor of the street lighting proposal as a part of the application information provided.

Street lighting will only be considered for approval if all costs associated with the street lighting, including energy costs, are not borne by the County. A Right-of-Way Maintenance Agreement acceptable to the Director of Public Works and the County Attorney for the street lighting will be required prior to the approval of the street lighting plan.

Street lighting that is proposed along the outside of a roadway shall be placed either behind the curb and gutter and sidewalk shelf area or behind the roadway shoulder and roadside ditch. Street lighting that is proposed to be placed in a roadway median or island will be reviewed and considered on a case by case basis considering the type of lighting proposed, pole locations, the median or island dimensions, traffic safety, and lighting needs.

Installation of the street lighting shall be in conformance with the approved plans, the National Electrical Code, and all other applicable standards.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

- Lighting Plans shall be prepared, sealed, and signed by an appropriately licensed professional in the Commonwealth of Virginia, except plans in a UMU District as dictated by the Planning Department.

2.32 Speed Bumps/ Speed Humps / Speed Cushions / Bump Outs

Standard

The installation of speed bumps in a public road to attempt to control vehicle speeds, the volume of vehicles using the road, drainage, or for any other purpose shall not be permitted.

Speed humps/cushions are installed as part of traffic calming measures implemented in conjunction with the Henrico County Traffic Calming Program. Speed humps/cushions may also be installed by developers in new subdivisions to discourage higher speeds. The developer/engineer shall work with Traffic Engineering on the location of the speed humps/cushions during the Plan of Development process.

In new subdivision designs, bump outs shall be installed on all main roads to reduce the travel lane widths at intersections and serve as a traffic calming device. Bump outs may also be installed at other key intersections within subdivisions. The developer/engineer shall work with Traffic Engineering on the location of the bump outs. Bump outs are predominantly located at intersections to reduce pedestrian crossing distances but may be installed at a midblock section of roadway. An example of bump outs can be found in Appendix B, Pages B-4 and B-5.

Speed humps, speed cushions, or bump outs shall not be permitted on any roadway shown as a Minor Collector, Major Collector or Arterial on the Henrico County Major Thoroughfare Plan. Speed humps, speed cushions, and bump outs shall only be installed on roadways with a speed limit of 25 mph or less.

Any proposed installation of speed humps, speed cushions, or bump outs on private roadways shall be coordinated with the Fire Marshall's office.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.33 Railroad Crossings

Standard

Full grade crossing protection with flashing signals shall be provided at all new public highway-railroad grade crossings. Design of the grade crossing shall be in accordance with the latest edition of the Railroad Highway Grade Crossing Handbook published by the Federal Highway Administration.

Pedestrian and bicycle crossing safety should be considered as a part of all new highway-railroad grade crossings.

The developer is responsible for obtaining all permits as well as the cost of the installation of the grade crossing and grade crossing protection, including maintenance of rail traffic and vehicular traffic during the construction. The cost of future maintenance of the grade crossing and grade crossing protection shall be borne by the County and the railroad as specified in the Maintenance Agreement between the County and the railroad.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs and CIPs.

Design Requirements

N/A

2.34 Pavement Markings

Standard

The developer of subdivisions, plans of development, and roadway projects is responsible for the installation of pavement markings for the proposed road improvements. The developer is also responsible for any necessary pavement marking changes, including eradication, to existing conditions as a result of his project. Any existing pavement markings disturbed during construction shall be replaced by the developer. If one line of a double yellow centerline is disturbed, both lines shall be reinstalled.

The pavement marking material used for new installations or the replacement of disturbed markings shall be Thermoplastic and shall have a minimum thickness of 90 mil. The thermoplastic shall be reflectorized with glass beads at a rate outlined in the manufacturer's installation manual.

All pavement markings shall be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).

Installation shall be in accordance with County or VDOT specifications.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.35 Parking

Parking on the Public Right-of-Way

Standard

The availability of on street parking shall not be considered or counted as a part of meeting the minimum parking space requirements of any development, except in a UMU District. Parking may be permitted to take place on the right-of-way. Such on street parking shall be in accordance with Chapter 22, Article IV of the Henrico County Code.

Parking may be removed from the right-of-way at any time, by the Traffic Engineer, if it is determined that such parking is creating a traffic safety problem, is impeding normal traffic flow or if the area that is used for parking is needed for another purpose.

Private parking lots shall not encroach into the public right-of-way.

Parking in Private Developments

Standard

Parking shall be perpendicular (90 degrees) or parallel to a two-way drive aisle. When a one-way drive aisle is proposed, parking shall be at a 60-degree angle with the drive aisle. When a two-way drive aisle is proposed with angled parking, a minimum four (4) foot raised median separating traffic is required and parking shall be at a 60 degree angle with the drive aisle. Parking stalls perpendicular with the drive aisle shall be 9' wide by 18' long. These dimensions shall be used to design the angled parking spaces. Parking stalls parallel with the drive aisle shall be 8' wide by 22' long.

Drive aisles shall be between 18 feet and 20 feet in width for one-way traffic and a minimum of 24 feet wide for two-way traffic. Where the one-way drive aisle is adjacent to parking stalls, the width of the drive aisle may be reduced to 15 feet depending on the length of the drive aisle and the surrounding development.

The minimum curb radii adjacent to 90 degree parking stalls shall be 4.5 feet. Raised islands with a minimum width of 9 feet shall be installed at the end of all rows of parking.

Buildings without a loading dock that will have deliveries shall have designated Loading/Unloading stalls near the building access point. These stalls shall allow for the safe loading and unloading of vehicles without conflicting with vehicles within the drive aisles. Delivery points and dumpster placement shall be designed so that trucks shall not have to back out for longer than five (5) parking stalls.

A turn around space (9' x 18') shall be installed at the dead end of drive aisles greater than five (5) spaces deep. This space shall be on the left side of the dead end (as you approach the dead end) and shall be striped and signed to indicate No Parking. At the dead end of the drive aisle, there shall be a backing area five (5) feet deep.

Wheel stops or bollards shall be placed within handicap parking stalls and any regular stall adjacent to ADA ramps. Wheel stops shall also be placed within 90 degree parking with a sidewalk running along the end of the space unless the sidewalk is a minimum of 5 feet in width. The bollards shall be placed so that they do not interfere with the minimum parking space requirements. Bollards shall be placed between parking stalls and buildings where there is no raised sidewalk or curb. Bollards shall also be placed adjacent to and three (3) feet from any door that opens into a drive aisle to protect pedestrians using the door.

Parking In Private Developments - Maintenance

Asphalt Pavement requires periodic inspection and evaluation to determine when maintenance is necessary.

The County's Planning Office Zoning Ordinance Sec. 24-5101 Off-Street Parking and Marking – Paragraph A. Surfacing: requires “...*all off-street vehicular parking and loading areas must be surfaced in accordance with one of the following methods: A hard, durable, and bonded surface material such as asphalt, concrete, brick, cobblestone, pavers, or recycled glass, rubber, asphalt, or other materials, maintained in a smooth, well-graded, clean, and orderly condition that meets County specifications*”.

To facilitate when maintenance is required on asphalt pavement the **PASER** (Pavement Surface Evaluation and Rating) system, [<https://www.apa-mi.org/docs/Asphalt-PASERManual.pdf>], developed by the Transportation Information Center/University of Wisconsin-Madison, or an approved equivalent, shall be used.

Using the **PASER** system, a Score of 1-4 shall require appropriate maintenance/rehabilitation of the pavement to be performed. A PASER score of 5-6 may also require appropriate maintenance/rehabilitation of the pavement to be performed.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.36 Private Access Design at the Intersection of a Public Road

Standard

The connection of a private driveway or private road to a public road must provide a safe and efficient intersection for motorists and pedestrians and must comply with applicable standards.

The following criteria shall be used as a general guide for private access design at the intersection of a County public road.

Nonresidential and Multi-Family Dwelling Access

All access points shall intersect with the public road at 90 degrees for a minimum distance of 60 feet as measured from the near edge of pavement/face of curb of the thru lane of the intersecting road.

For Minor Collectors and Major Access Roads, no access point shall be located closer than 150 feet from another access point or road (as measured from the near edge of pavement of the existing access point or road to the centerline of the new access point).

For Major Collectors and Arterials, no access point should be located closer than 250 feet from another access point or road (as measured from the near edge of pavement of the existing access point or road to the centerline of the new access point).

No access point should be located within 12.5 feet of a property line (as measured along the right-of-way line between the property line and the near edge of pavement of the driveway apron). Reference: Henrico County Code Sec. 24-5104.

On undivided roadways, the centerline of an access point shall align with the centerline of an access point or road located across the street if the driveways are planned to be within 150 feet of each other (as measured from the near edge of pavement of the existing access point or road to the centerline of the new access point) on Minor Collectors and Major Access Roads or 250 feet on Major Collectors or Arterials.

Access points intended for two-way traffic flow shall have a minimum width of 24 feet. A wider driveway may be required to accommodate proper lane alignment, truck access, a raised median is provided to separate opposing traffic flows, or if additional lanes are needed to satisfy recommendations of the Traffic Engineer. Truck turning movements shall be provided with each Plan of Development. The size of the truck used for the turning movements shall be the largest truck that will have access to the development.

A median may be permitted to separate opposing traffic flows on two-way access points. Medians which are provided should have a minimum width of 4 feet and a maximum width of 16 feet. The minimum length of the median shall be 50 feet.

Access points intended for a single one-way travel lane shall have a minimum width of 18 feet and a maximum width of 20 feet.

A minimum radius of 15 feet shall be provided at the intersection of the access point and the public roadway. Larger radii may be permitted depending on the use, design and location of the access point.

Along the private access drive, the first conflict point shall be a minimum of 150 feet from the public roadway for developments with more than one business, or more than one office building, or greater than 82 housing units and 30 feet for developments with a single business, single office building, or less than or equal to 82 housing units. This point shall be measured from the near edge of pavement of the thru travel lane of the public road. These distances may be adjusted by the Traffic Engineer based on the type of development proposed.

Adequate sight distance, as specified in Section 2.14 of this Manual, shall be provided at all access points. Left turn and/or right turn lanes on the public road at the access point may be required. Refer to Section 2.20 of this Manual for additional information about turn lanes.

Access to properties that are considered out parcels to other developments (such as shopping centers, office complexes, etc.) shall be internal to the overall development. Separate and/or exclusive access points will not be permitted for the out parcels.

Single Family Dwelling Driveways

The width of the driveway at the right-of-way line shall be 12 feet. Wider driveways will be considered on a case-by-case basis considering need, physical conditions of the area and safety. On roadways with speed limits of 35 mph or greater, the driveway at the right-of-way line shall be 16 feet.

No driveway shall be permitted to be placed within the radius of a public road intersection and shall be a minimum of 50 feet from an adjacent public or private street travel lane.

All driveways shall intersect with the public road at 90 degrees. The maximum slope of driveways shall be 12%.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.37 Traffic Signals

Standard

The developer shall pay for the design and installation of any new traffic signal or modification to an existing traffic signal, if warranted by their development. Prior to a new traffic signal design or modifications to an existing traffic signal being designed, a new roundabout design at the subject intersection shall be investigated. **Roundabouts are the preferred intersection traffic control.** New traffic signal installations shall be determined by the warrants outlined in the MUTCD. The traffic signal design shall be reviewed and approved by the Traffic Engineer before any construction shall take place. If no traffic signal exists, but one is anticipated in the future, the developer shall install all underground infrastructure (i.e. junction boxes, conduit, and pole and cabinet foundations), as determined by the Traffic Engineer, at the time of construction of the new subdivision street or plan of development entrance. Pole foundations require soil testing and shall be designed by a Professional Engineer licensed in the Commonwealth of Virginia.

LED Street lighting (250W equivalent) shall be on all mast arm poles unless there is an overhead utility conflict. The proposed LED lighting shall match existing street lighting in the area.

The need for pedestrian accommodations, including pedestrian heads and push buttons, shall be determined by the Traffic Engineer during the design stage. Poles should be located to meet ADA requirements. If mast arm poles cannot be placed with the maximum reach for ADA requirements, auxiliary poles designed to accommodate pedestrian heads and push buttons shall be installed adjacent to ADA ramps.

Street name signs for public streets shall be fabricated and installed on the appropriate mast arms between the pole and the first signal head. The cost of these signs shall be paid for by the developer and included in the design of the traffic signal. See Section 2.38 for information about street name signs on traffic signals.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs

Design Requirements

N/A

2.38 Street Name Signs and Posts

Standard

Roads within the Public Rights-of-Way

Street name signs for all roads located within public rights-of-way shall be fabricated using #086054 extruded aluminum with a minimum height of 9 inches. The signs shall be fully reflective, double faced and covered with prismatic lens sheeting (3M product #4090 or approved equivalent). The signs shall display a green background (3M product #1177C) with white upper and lower case FHWA Series C-stroke letters. The name of the street shall consist of an initial 5.25-inch upper case letter with corresponding lower case letters. The suffix shall be 2.5-inch upper case letters and top aligned with the street name.

Street name signs located within public right-of-way should be installed on 2" x 2" x 10' Brown powder coated metal posts and anchored in the ground by a 2.25" x 2.25" x 30" anchor. The street name blades shall be attached to the post in a cantilever fashion using aluminum brackets and shall be offset so that the top of the lower sign is equal in height to the bottom of the upper sign and at 90 degrees to each other pointing away from the intersection. The minimum mounting height of the street name signs shall be 8 feet as measured from the surrounding finished grade to the bottom of the lowest blade.

The cost of all street name signs shall be bonded by the developer, as a part of the subdivision performance bond. All street name signs for roads located within public rights-of-way shall be installed by Henrico County, unless otherwise approved by the Traffic Engineer.

Roads within Non-Maintained Rights-of-Way

Street name signs for all roads located along a non-maintained right of way shall follow the same standards listed above, except for color. The signs for non-maintained rights-of-way shall have a blue background (3M product #1175C or approved equivalent) with white letters (#4090 or approved equivalent).

Private Roads

Street name signs for all private roads shall follow the same standards listed above, except for color. The signs for private roads shall have a white background (3M product #4090 or approved equivalent) with black letters (#1178C or approved equivalent).

The developer shall install street name signs for private roads internal to a development.

Traffic Signals

Public streets located at signalized intersections shall have overhead street name signs made with a minimum of .100-inch aluminum with a height of 18" for a single street name and 30" for dual street names. The signs shall be fully reflective, single faced and fabricated with Diamond Grade sheeting (3M product #4090 or approved equivalent). The signs shall display a green background (3M product #1177C) with white upper and lower case FHWA Series C-stroke letters (T2000HWYC or equivalent). The name of the street shall consist of an initial 8.5-inch upper case letter with corresponding lower case letters. The suffix shall be 4-inch upper case letters and top aligned with the street name. Street block numbers shall be located at the bottom of the sign and shall be 3.5 inches in height.

The signs shall be installed on the appropriate mast arms between the pole and first traffic signal. If the sign cannot be placed between the pole and first traffic signal, it shall be placed on the pole at its highest point below the mast arm. The design of the overhead street name signs shall be submitted to the County for approval prior to fabrication.

Overhead street name signs shall not be installed for private roads nor for roads in an unmaintained right-of-way. Overhead street name signs shall not face private roads, private access points, nor roads in an unmaintained right-of-way.

Installation of Signs in New Subdivisions

Street name signs will be installed by Henrico County in a new subdivision after either of the following criteria is met:

- The developer has paid for the street name signs and the roads have formally been accepted into the County road system by the Board of Supervisors **or**;
- The developer has paid for the street name signs and the developer provides the Department of Public Works with a letter indicating that he will bear the cost of any maintenance which is needed for the street name signs until such time the roads in the subdivision have formally been accepted into the County road system by the Board of Supervisors.

Street name signs may be installed by the developer at his expense as approved by the Traffic Engineer. In this case, the developer will be responsible for the maintenance of the signs and posts until the roads are accepted into the County road system.

Decorative Street Name Sign Posts

Developers may, at their expense, install decorative street name sign posts instead of the County's standard posts. The decorative posts shall hold the standard County street name sign without the use of special tools. The mounting heights of the signs shall be the same as described above. All decorative posts shall be breakaway and shall be approved by the Traffic Engineer. The developer assumes responsibility for the posts and shall maintain them until the roads are accepted into the County system, at which time the maintenance shall be handled by the HOA or Community Association responsible for the neighborhood. A Right-of-Way Maintenance Agreement must be submitted to the County prior to the installation of the private street name sign posts or prior to the acceptance of the roads into the County system. The County will not maintain decorative street name sign posts.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.39 Traffic Control Signs

Standard

Public Right-of-Way

The developer shall be responsible for providing, installing, and maintaining all Stop, Yield, Speed Limit, Keep Right and Object Marker signs within the subdivision or project limits prior to final acceptance into the County road system. These signs shall be installed on 2" x 2" square Telespar (or equivalent) galvanized posts, with the length dependent on the sign. All signs and posts shall be turned over to the County for maintenance after the roadway has been accepted. All signs installed shall be made in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and the Standard Highway Signs and Markings manual and shall be constructed using .080-inch aluminum with 3M Product #4090 white or #4081 yellow (or approved equivalent) background sheeting as specified in the MUTCD.

The developer shall coordinate the installation of the traffic control signs with the Traffic Engineer to insure correct and proper signing will be used in terms of sign type, post type, and location. All signs installed by the developer will be turned over for maintenance by the County when the roads are accepted in the County road system.

Private Roads

Traffic control signs installed on private roads open to public travel shall meet the same requirements as public roads as outlined in the MUTCD, Chapter 2.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.40 Road Extension Sign

Standard

Signs indicating that a stub roadway, within a subdivision, will be extended in the future shall be installed by the developer at the end of stub roads as a part of the subdivision development. The sign shall have a message that indicates the following:

“This Road is to be Extended with Future Development. For More Information, Contact the County of Henrico Planning Department at 501-4602”.

A detail for the design of the road extension sign is identified in Appendix C. The sign is to be provided and installed by the developer and fabricated using a 0.080-inch gauge aluminum sign blank and fully reflective (minimum Type 1 material) sheeting. The sign shall be mounted on an End of Road Barricade, as shown in Appendix C, Drawing C-27, if it is a stub road, or on a 2” x 2” x 10’ Telespar (or equivalent) galvanized post with associated anchor if the sign is located in a temporary cul-de-sac.

The cost of all road extension signs shall be bonded by the developer, as a part of the subdivision performance bond. Road extension signs shall be installed prior to the issuance of the first building permit in the subdivision.

The developer shall bear the cost of the Road Extension signs and either the End of Road Barricade or post, whichever is used, and shall maintain the Road Extension signs and supports until such time the roads in the subdivision have formally been accepted into County road system by the Board of Supervisors.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.41 End of Road Barricade

Standard

A developer shall provide a wooden barricade at the end of all stub streets, unless otherwise determined by the Traffic Engineer. End of Road Markers (OM4-2) shall be provided by and installed on the barricade by the developer. A description of the sign and barricade can be found in Appendix C, Drawing C-27. If access to the adjacent property is needed from the end of the stub street, an alternative design may be approved by the Traffic Engineer.

The developer or HOA (if common area where sign is located has been turned over to the HOA) shall maintain the End of Road Barricade and Markers until such time the roads in the subdivision have formally been accepted into County road system by the Board of Supervisors.

The cost of all End of Road Barricades and End of Road Markers shall be bonded by the developer as a part of the subdivision performance bond.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.42 Unmaintained Road Sign

Standard

When roadways are constructed as part of a subdivision or other development, it sometimes becomes necessary to permit public traffic to use the road prior to the acceptance of the road into the County road system. In such instances, or when determined by the Traffic Engineer, signs with the following message shall be installed:

“This Roadway Not Maintained by the County”

The above sign shall be installed at locations determined by the Traffic Engineer.

A detail for the design of the unmaintained road sign is identified in Appendix C, Drawing C-26. The sign shall be mounted on a 2” x 2” x 10’ Telespar (or equivalent) galvanized post with associated anchor.

The cost of all “Unmaintained Road” signs and posts shall be bonded by the developer, as a part of the subdivision performance bond.

The developer shall bear the cost of initial installation and shall maintain the Unmaintained Road signs and posts until such time the road has formally been accepted into the County road system by the Board of Supervisors and the sign has been removed. The developer shall remove and take possession of the signs and posts after the roads have been accepted into the County system.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

N/A

2.43 Roundabouts

Standard

Roundabouts are an acceptable form of intersection design. Roundabouts may be designed to be a single-lane roundabout or double-lane roundabout. The design of roundabouts, to include landscaping and lighting, shall be in accordance with the latest edition of the Federal Highway Administration publication Roundabouts: An Informational Guide.

Modern roundabouts have demonstrated safety and operational benefits and are the **primary design** for intersection improvement projects. They can offer several advantages over signalized and stop controlled alternatives, including better overall safety performance, shorter delays, and shorter queues (particularly during off-peak periods), better management of speeds, and opportunities for community enhancement or aesthetic features.

Parallel or perpendicular parking shall not be allowed within the circulatory roadway of the roundabout, whether the roundabout is public or private. On any roadway extending from the roundabout, parking shall not be allowed on either side within 75 feet of the circulatory roadway.

Lighting shall be incorporated into the design of the roundabout and consist of the recommendations found in the latest edition of the Roundabouts: An Informational Guide, IES Design Guide for Roundabout Lighting, and Section 2.31 of this Manual. Lighting shall be incorporated in the roundabout even if the approach lanes are not illuminated.

In determining the Intersection Sight Distance, the length of the approach leg of the sight triangle shall be 50 feet from the circulatory roadway. The sight distance shall assume a driver's height of 3.5 feet and an object height of 3.5 feet above ground.

The maintenance costs associated with the landscaping and the illumination shall be borne by the developer or HOA, as applicable.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

Must use the Roundabouts: An Informational Guide to design the roundabout.

2.44 Urban Mixed Use/Traditional Neighborhood Design Developments

Standard

Urban Mixed Use (UMU) or Traditional Neighborhood Design (TND) Developments are multi-use, walkable communities with moderate to high residential densities and a mixed-use core. They are designed to be a more pedestrian and bike friendly community with slower speeds. These developments typically have a dense network of roadways, tighter centerline radii, and more narrow street widths. Streets are designed to only be as wide as needed to accommodate the usual vehicular mix for that street while providing adequate access for moving vans, garbage trucks, emergency vehicles, and school buses.

The actual road widths will need to be worked out with Fire, Public Works and Planning at the time of development review and approval based on the actual design of the development in regard to road network, height of buildings, and types of buildings.

The maintenance costs associated with any landscaping, irrigation, and lighting in the county right-of-way shall be borne by the developer or HOA, as applicable.

Applicability of the Standard

This standard applies to UMU and TND type developments

Design Requirements for Public Streets

- Minimum posted speed limit - 20 MPH
- Minimum centerline radius - 107 feet
- The minimum offset between centerlines of intersecting roads, alleys or commercial entrances shall be 100 feet.
- Minimum required sight distance of streets that are posted at 20 MPH shall be 230 feet.
- The installation of all-way stops shall not be permitted.

2.45 Queue Lengths and Drive Thru Lanes

Standard

Drive thru lanes allow customers to do business without leaving their vehicles. Proper queue lengths for drive up windows are an important part of plans of development. The parking lots shall be designed to provide the minimum queue lengths outlined below without blocking access points, dumpster enclosures, crosswalks, or parking stalls. Below are the minimum queue lengths for different types of developments:

75' queue length

- Standalone ATM

100' queue length

- Pharmacy
- Car wash at a gas station
- Call Box/Access Box – Gated Community, Mini-Storage, etc.

150' queue length

- Dry Cleaners

250' queue length

- Drive thru oil change facility
- Drive thru restaurant
- Coffee shop
- Donut Shop
- Banks, to include ATM lanes

300' queue length

- Standalone car wash

All queue lengths shall be measured from the center of the last window for the drive thru service. For car washes, the length shall be measured from the stop line prior to the car wash building. For ATMs, and Access Boxes, the length shall be measured from the actual ATM or Access Box. The queue length of an Oil Change Facility shall include the work bay. The queue lengths can be divided among multiple drive thru lanes.

Drive thru lanes shall have a minimum width of 10 feet. In addition, a bypass lane with a minimum width of 12' shall be provided to allow motorists an opportunity to exit the drive thru lane and re-enter the parking lot.

Applicability of the Standard

This standard applies to all Plans of Development.

Design Requirements

- Needs to be measured from the center of the last window in the drive thru lane

2.46 Bus Pads

Standard

Bus pads shall be provided adjacent to all existing and proposed public transit stops. The pad shall be constructed of concrete and built to the same standards as sidewalk. The location and dimensions of the pad shall be determined by the Department of Public Works in consultation with GRTC. Such factors as the width and location of the adjacent sidewalk, anticipated number of passenger boardings and disembarkings, anticipated amenities to be installed (benches, shelters) are considered when determining the minimum size of the concrete pad.

Additional right-of-way shall be dedicated to incorporate the entire bus pad should insufficient right-of-way exist.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs and CIPs.

Design Requirements

N/A

2.47 Curb Ramps

Standard

General

All curb ramps and detectable warnings within County Right of Way shall be constructed in accordance with CG-12 details shown in the VDOT Road and Bridge Standard.

All curb ramps and adjacent concrete sidewalks subject to traffic shall be 7" in depth.

All detectable warnings shall be from the VDOT materials approved list for detectable warning surfaces.

Accessibility Requirements

All roadway construction shall incorporate a means of access for persons with mobility impairments as outlined in Sections 6D.01 and 6D.02 in the Virginia Work Area Protection Manual.

Curb ramps shall be provided at all locations where an existing or proposed pedestrian access route intersects a curb. The pedestrian access route is not required to be improved (i.e.: concrete sidewalk or paved path) for a curb ramp to be required.

When curb ramps are required, a ramp is to be provided for each intended direction of travel, at each pedestrian crossing of the intersection. Curb ramps are to be installed as depicted in the guidance documents listed below or as approved by the Director of Public Works, where conditions do not reflect standard configurations. The bottom of the ramp run, exclusive of the flared sides, shall be aligned with the existing or planned crosswalk or at the point where pedestrian crossings are expected to occur. Color for detectable warnings shall be, 'Federal Yellow.' Federal color No. 33538.

In general, the following design constraints apply:

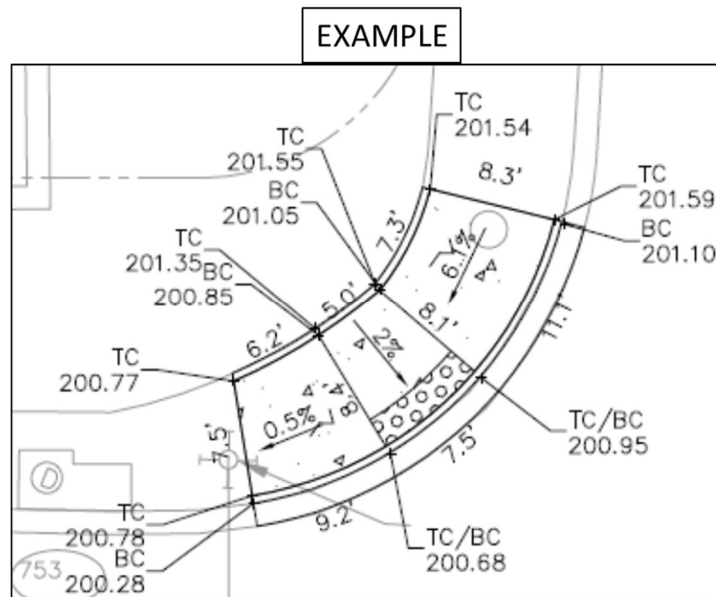
- Diagonal curb ramps are only to be used when certain conditions apply and are generally not permitted for new construction.
- Curb ramps are to be provided where accessible pedestrian routes are present, regardless of whether or not the route is an improved route (i.e.: sidewalk present).
- Curb ramps shall be provided for each intended direction of pedestrian travel.
- Detectable warnings are required at all entrances and intersections with the exception of private residential entrances.
- Detectable warning surfaces shall be truncated domes.
- Vehicle stop bar shall be located prior to the curb ramp.
- Curb wipe downs without ramps are not permitted.

- Acceptable cross slope of improved pedestrian facilities (sidewalk, path) must be maintained across all entrances.
- Where pedestrian facilities constructed of asphalt concrete (i.e.: shared use path) intersect a curb, the CG-12 curb ramp shall be constructed of hydraulic cement concrete and shall be the same width as the shared use path.

Curb ramps shall be designed and constructed in accordance VDOT Road and Bridge Standard CG-12 and Section 502 and 504 of the VDOT Road and Bridge Specifications. In addition, the most recent edition of the following guiding documents shall apply to the design of curb ramps:

- VDOT Location and Design IIM-LD-55.16
- VDOT Road Design Manual, Appendix A, Sect. 5
- Title II of the Americans with Disabilities Act (ADA) – 2010 ADA Standards for Accessible Design
- Public Rights-of-Way Accessibility Guidelines (PROWAG) – proposed version

Each CG-12 shall be designed to ensure proposed CG-12 geometrics will work with adjacent roadway design elements to meet current ADA requirements as published by VDOT. See example detail below:



Alterations:

Alteration of existing roadways and intersections is defined in The Department of Justice/Department of Transportation Joint Technical Assistance document.

In general:

- Curb ramps are required to be provided wherever an improved pedestrian access route intersects a curb.
- Where diagonal ramps are allowed, the required 48”x48” landing area shall be located entirely outside of the travel way.
- Existing, non-compliant curb ramps that are adjacent to improved pedestrian corridors will need to be considered on a case by case basis.*

*Note: It may be possible to remove a detectable warning that is no longer acceptable (i.e., exposed aggregate replaced with truncated domes); however, other elements such as ramp width and grade may also be out of compliance under the current design guidelines.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, CIPs and eligible maintenance activities.

Design Requirements

N/A

2.48 Compaction Testing

General

Where open cutting of existing roadways is allowed or installation of infrastructure within roads intended to be accepted into the County system is completed via open trench excavation following grading of the roadway subgrade course, the material required for backfill of the excavated trench area shall be No. 21B aggregate stone, or an approved equal.

Restoration of utility trenches within existing roadways shall be performed in accordance with Henrico standard detail C-28, “Pavement replacement, bedding and backfill for pipe trench” and C-30, “Pipe bedding & backfill.” (Appendix C)

Compaction testing for backfill material shall be performed in accordance with Virginia Test Methods, VTM-1 and VTM-10. All testing shall be completed by a licensed geotechnical engineer or by authorized personnel certified by VDOT to perform testing of the respective material.

The following conditions shall apply to aggregate backfill material placed above a bedded utility installation:

- Contractor shall achieve at least 95% of maximum density within optimum moisture range for the approved material. This compactive effort shall be achieved in all areas of trench backfill within the roadway prism, including shoulders.
- Target density of material (maximum density at theoretical optimum moisture) shall be provided by producer of aggregate material approved for backfill.
- Contractor shall provide for compaction testing within areas of backfill in order to provide evidence that required level of compactive effort has been met.
- Test results shall be provided to the Department of Public Works within 3 working days of material placement and completion of testing.
- Any failing material shall be addressed immediately under the guidance of the geotechnical engineer in consultation with the Construction Division of DPW.

The following frequencies are based on the use of No. 21B aggregate backfill as required by the Department of Public Works:

- One test location shall be taken for every 400 linear feet of trench. A minimum of one test location shall be taken per day. Additional tests are required upon any change in compaction methods, source of material, or compaction equipment.
- For each test location, density testing shall be performed at a minimum rate of one test per 12 inches of compacted backfill and taken on alternating sides of the excavated trench.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.49 Pavement Depth Verification

General

The depth of surface course asphalt concrete shall be verified for all newly constructed streets prior to acceptance by the County into the maintenance inventory. Verification that depth meeting or exceeding the plan specified thickness shall be confirmed as outlined below.

Testing Requirements

The location of the core samples shall be determined by a randomization procedure similar to the suggested randomization procedure shown in VTM-32, Depth Test of Bituminous Concrete Base Course.

A) General

Acceptance testing of asphalt concrete pavement depth shall be completed by the contractor for all roadways consisting of a singular layer of bituminous asphalt concrete.

B) Frequency of Depth Tests

For the purpose of determining depth, the project shall be divided into lots, with each lot stratified, and the location of each test within the stratified section determined randomly. Lot sizes will be generated for each individual street proposed for acceptance. A lot of material is defined as the quantity being tested for acceptance, except that the maximum lot size will be one mile of 24 ft. width surface course. The randomization procedure used will be at the discretion of the Engineer. (See VTM-32(B) for example.) Samples will be taken from the lot at the following rate:

<u>Lot Size (per roadway)</u>	<u>No. of Samples Required</u>
0 - 1/2 Mile	2
1/2 - 3/4 Mile	3
3/4 - 1 Mile	4

A separate boring will be taken from each intersection, entrance, crossover, storage lane, or ramp having an area of 50 yds² or more. This boring will not be taken at random; however, care is to be taken not to set up a uniform pattern of testing. The tolerance for an individual test result shall apply for these miscellaneous borings.

The same frequency of testing as used on the mainline will be used for asphalt concrete shoulders requiring specific plan depths, except that the tests will be alternated from one shoulder to the other.

It is not the intent of the test procedure to prohibit sampling and testing of the material at any location which is visually determined to be out of specification tolerance for an individual test.

C) Reports

Results of depth testing shall be submitted to DPW prior to posting of defect bond and recommendation by DPW for road acceptance. The data should be submitted in the form of a worksheet including all relevant core data as well as stationing and offset for each respective test location. Those depth tests that fail to meet plan specification requirements shall be identified in the submittal and include a plan of resolution submitted by the developer to DPW.

Applicability of the Standard

This standard applies to all types of development, including subdivisions, PODs, and CIPs.

Design Requirements

N/A

2.50 Temporary Ingress/Egress Gate and Emergency Access Gate

Standard

When a point of temporary ingress / egress is to be gated, or an emergency point of ingress / egress is required, the developer shall provide an access gate at the location determined by the Traffic Engineer, or by the Division of Fire. A description of the gate can be found in Appendix C, Drawing C-36.

The developer or HOA (if the common area where the gate is located has been turned over to the HOA) shall maintain the gate until such time the roads in the subdivision have formally been accepted into County road system by the Board of Supervisors.

The cost of all gates shall be bonded by the developer as a part of the subdivision performance bond.

Applicability of the Standard

This standard applies to all types of development, including subdivisions and PODs.

Design Requirements

- Gate components shall be maintained in an operative condition at all times and replaced or repaired when damaged or defective.
- The gate(s) shall be located a minimum of 30-feet off the return on the roadway to be gated, (or as determined by the Traffic Engineer), to allow for a vehicle to be parked while the gate(s) is being opened or closed.
- If the gate is to be opened or closed with a Call Box / Key Swiping Device, it shall be located a minimum of 100-feet off the return on the roadway to be gated to allow for a vehicle to be parked while the gate(s) is being opened or closed.
- Electric gates shall be equipped with a means of opening the gate by fire department personnel for emergency access. Emergency opening devices shall be approved by the Division of Fire.
- Method of locking shall be submitted for approval to the Division of Fire.
- Emergency Access gates shall be signed, "Emergency Access Only", or "Emergency Access Do Not Block", as appropriate.
- Gates shall have STOP signs, (R1-1, 30"x30" min. size), mounted to the gate arms on both sides where vehicles approach the gate, (single gate shall have two STOP signs, double gates shall have four STOP signs).
- When a gate is to be provided on a "single" lane access road, the minimum width of the gate shall be 20-feet.
- Gates shall be painted a safety yellow color.
- When the gate arm is in the open position, the closest part of the gate arm and support shall have a lateral offset at least 2-foot from the edge of pavement or the face of curb.

- When a gate arm is in the opened position, it shall be restrained, tied, chained, or locked by some mechanical means to keep the gate arm in the opened position.
- If a pedestrian route is present, (and it is not intended for the gate to control the pedestrian traffic), there shall be a minimum of 2-foot between the gate post and the edge of the pedestrian route.
- The gate(s) and posts shall be constructed out of Schedule 40 steel pipe.
- The gate rails shall be 2.5-inches minimum in diameter.
- The gate posts shall be 4-inches minimum in diameter and filled with concrete, and shall be crashworthy, (the post must be designed to not cause injury/death to occupants of a vehicle that may strike it).
- The concrete footing for the gate posts shall be 2-foot in diameter, 3.5-foot in depth, with the post set 3-foot into the concrete, with a 3000-psi mix.