

DESIGN MANUAL
ROADS & STREETS

**BALTIMORE COUNTY
DEPARTMENT OF PUBLIC WORKS DESIGN MANUAL**

ROADS AND STREETS (TRAFFIC WAYS)

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**Baltimore County Department of Public Works
Design Manual**

**ROADS AND STREETS (TRAFFIC WAYS)
DESIGN STANDARDS**

I. General

Baltimore County has recently approved new Design Standards and Policies for Rural Roads in Baltimore County. Please note that there now are additional requirements for all roads occurring outside of the Urban Rural Demarcation Line. These new policies may be in addition to or replacements for Design Standards applicable to other County Roads in urbanized areas. We have included this material in this Document in Section V.

A. Definitions

In these Standards, the term “**traffic way**” identifies any highway, thoroughfare, road, street, cul-de-sac, or alley. The term “**highways**” identifies traffic ways under the jurisdiction of the Maryland State Highway Administration (MdSHA). Thoroughfares are traffic ways with large daily rates of vehicular traffic serving as major arterial routes for movement of through traffic.

An **alley** is a secondary traffic way intended for access to the rear of buildings.

A **Cul-de-Sac** Street is a minor street with only one outlet, and having a paved circular turn-around area at the closed end.

Minor Streets are those used primarily for access to abutting properties.

Collector Streets are those which carry traffic between minor streets and the major systems of thoroughfares and highways. When no specific differentiation is made in this Design Manual, they shall apply to both collector and minor streets.

Special Traffic Ways are those for which the BCBEC will provide criteria on request.

See General Instructions Section of this Design Manual regarding **Context-Sensitive Design** and **Sustainable Design** practices. All projects may be subject to review for context-sensitive solutions and sustainable design practices. Context-sensitive solutions may be required for traffic ways that are not depicted in a design standard or plate.

Minimum Stopping Sight Distance, by AASHTO definition, is the sum of two distances: (1) the distance the vehicle travels from the instant the driver sights an object necessitating a stop, to the instant the brakes are applied, plus (2) the distance required to stop the vehicle after the brakes have been applied. The Stopping Sight Distance chart (Design Figures) is based on the longest distance

at which a driver, whose eyes are 3'-6" above the pavement, can see the top of an object 2'-0" high on the traffic way along an over-vertical (crest) curve.

Minimum Passing Sight Distance, by AASHTO definition, is the sum of four distances: (1) the distance traveled during the preliminary delay period, (2) the distance the passing vehicle occupies in the left lane, (3) the distance between the passing vehicle at the end of its maneuver and an opposing vehicle, and (4) the distance traveled by the opposing vehicle for 2/3 of the time the passing vehicle is in the left lane. The Passing Sight Distance Chart is based on the longest distance at which a driver whose eyes are 3'-6" above the pavement can see the top of an object 3'-6" high on the traffic way along an over-vertical curve.

Minimum Headlight Sight Distance conforms with the minimum stopping distance definition. The Headlight Sight Distance Chart is based on the length of roadway along an under-vertical (sag) curve illuminated by headlights 2'-0" above the traffic way with a 1-degree upward divergence of the light beam from the vehicle's longitudinal axis.

A **Rural Road** shall be defined as a county-maintained road within Baltimore County's rural conservation zones located outside of the Urban Rural Demarcation Line (URDL). Design Standards for Rural Roads and for bridges and culverts along Rural Roads are included as a supplementary document following this document. The Design Standards for Rural Roads in this supplementary document shall substitute for or be in addition to design standards outlined in this document for urban roads.

For purposes of using the Design Plates included herein, the term **Rural Area** is applicable to all areas outside of the Urban Rural Demarcation Line (URDL) and to areas within the URDL zoned for rural development. The term **Urban Area** shall apply to those areas within the URDL zoned for urban-type development.

B. Responsibility for Design and Construction

Baltimore County traffic ways in new developments are designed by the developer's consulting engineers. County road improvement projects are designed by the Baltimore County Bureau of Engineering and Construction or by contracted consulting engineers.

Construction of traffic ways in new developments is done by a contractor; County projects are constructed by either a contractor or the Baltimore County Bureau of Highways.

C. Authorization Permits

Where intersections occur with traffic ways under the jurisdiction of the Maryland State Highway Administration, Baltimore City, or other political districts, a permit from the office involved authorizing the proposed construction must be filed with BCBE before plans will be approved.

II. Design

A. Preliminary Considerations

The design of traffic ways includes general layout, alignment, grades, grading, paving widths, paving material, and drainage facilities. Sufficient rights-of-way should be reserved in the early stages of layout to provide for future increases in pavement widths, the addition of sidewalks, bicycle facilities and roadside improvements. When determining alignments and grades of traffic ways, the designer must consider the requirements for utilities, including adequate storm drainage, and he must take into account any unusual aspects of the design such as railroad crossings, etc.

B. Layout of Intersections

Centerlines of traffic ways shall continue through intersections without offsets, and shall intersect as nearly as possible at right angles. Where various conditions make a right angle intersection impracticable, the minimum deflection angle between the centerline of a minor street and the centerline of any other street shall be 70 degrees, and the minimum deflection angle between the centerline of a collector street and the centerline of another collector street of thoroughfare shall be 80 degrees.

Minor and collector streets may intersect state roads at a minimum deflection angle of 80 degrees, but the intersection layout shall be subject to final approval by the State Highway Administration.

Intersections shall be no less than 125' apart between traffic way centerlines. (Minor streets only.)

County traffic ways shall not intersect state roads at intervals less than 750' between centerlines.

C. Horizontal Curves

Where traffic way centerlines change direction by more than 10' (ten minutes), they shall be connected by a horizontal curve with a radius to insure a minimum horizontal sight distance as shown in the following table. Minimum radii of horizontal curves shall be limited as directed by the table's minimum radius column, based on PRA criteria. The minimum length of a horizontal curve shall be 100'.

Property lines which change direction through angles less than one (1) degree need not have a horizontal curve introduced at the break, unless otherwise directed by the Design Division, BCBE.

On minor streets where the centerline deflection angle is greater than 40 degrees and less than 60 degrees, the designer may deviate from the 30 m.p.h. design speed horizontal curvature criteria and use a 200' minimum radius to connect the centerlines.

On minor streets where the centerline deflection angle is 60 degrees or greater, the designer may deviate from the 30 m.p.h. design speed horizontal curvature criteria and use a 100' minimum (125' desirable) radius to connect the centerlines.

Horizontal curve data shall be computed by the arc definition of a circular curve. A tangent of at least 100' shall be used between reversed curves except in unusual situations on minor streets. Where horizontal curves are not superelevated or warped, horizontal alignments using compound curves shall be avoided. Where horizontal curves are superelevated, horizontal alignments using circular compound curves or spirals may be used as a means of transition into and from the superelevation.

Design Speed m.p.h.	Horizontal Stopping Sight Distance	Horizontal* Passing Sight Distance	Minimum Radius
30 (Not superelevated)	200'	-	380'
40 (Not superelevated)	275'	-	670'
50 (Superelevated)	475'	1600' Desirable 1400' Absolute	700'

*The design engineer shall attempt to provide passing sight distance at least once in every mile of length for thorough-fares through undeveloped areas.

D. Alleys

The maximum grade on alleys shall be 10 percent. Minimum vertical sight distance shall be 100 feet. Alleys shall follow the general pattern of the adjoining streets. Tangents may be used up to a deflection angle of 20 degrees. When the deflection angle is more than 20 degrees, curves shall be used with a minimum radius of 100 feet or the turn can be made with a series of short chords. At the intersection of an alley and a street, the angle shall be 90 degrees unless approved by BCBE. The elevation of the outside edges of the alley shall be two inches lower than that of the finished grade of the adjoining property.

Drainage design for alleys shall conform with the storm drain criteria outlined in the Storm Drainage Section of this Manual. When the computed quantity of runoff exceeds a flow of 5 cfs in the alley, the developer shall furnish and install satisfactory inlets and storm drains.

E. Superelevations and Warping

Horizontal curves of traffic ways in subdivisions, commercial and industrial areas shall normally not be superelevated or warped except in the following cases:

Where the radius of a horizontal curve is 200' or less, the outside edge of pavement shall be raised above the grade of the inside edge of pavement. On curbed traffic ways, this warping shall be accomplished by cutting back the normal crown slope to form a crown 8' from the outside edge of pavement. The maximum allowable warp shall be such that the slope from the shifted crown to the inside edge of pavement shall not exceed 1/2" per foot.

On non-curbed traffic ways, the normal crown slope rate shall be carried straight across the entire traffic way from the low to the high edge of pavement, the shoulder on a warped non-curbed traffic way will continue at 3/8" per foot for half its width, then down at the normal shoulder slope to conform with the normal drainage cross section.

Transitions to and from this warping shall be at the design engineer's discretion to provide smooth approach and departure, and suitable drainage.

Along horizontal curves, the outside top curb grade or grade along the outside edge of pavement shall not be less than 0.60%; therefore, centerline grades must exceed 0.60% in order that the warping can be accomplished without decreasing the grade along the outside edge of the traffic way below 0.60%. Along horizontal curves, the outside edge of pavements, with berms, shall not be less than 1.0%.

Where a traffic way horizontal curve or tangent is designed along a side slope that has a grade of 15% or more across the proposed traffic way alignment, the paving section may be warped in a manner similar to that outlined in the preceding paragraphs. Warping will not be permitted where it would result in the inside edge of a horizontal curve being higher than the outside edge.

Thoroughfares through undeveloped areas shall be superelevated in accordance with the following table based on the design speed of 50 m.p.h. This table is adapted from AASHTO criteria.

Radius of Curve	Transition Length	Superelevation (per foot of width)
5730' – 2861'	150'	0.02'
2860' – 1911'	150'	0.03'
1910' – 1431'	150'	0.05'
1430' – 1151'	150'	0.06'
1150' – 961'	150'	0.08'
960' – 700'	201'	0.08'

Neither a superelevation rate greater than .08 foot per foot of paving width, nor a curve radius less than 700' shall be used in the design of thoroughfares.

To superelevate, pavements shall be rotated around the centerline, except where such procedure would adversely affect adequate drainage design. To avoid such a situation, the design engineer may rotate the superelevation around the inside or outside edge of pavement, whichever affords the best drainage design.

For superelevation around the centerline, the centerline grade is held, the outside edge of pavement is raised half the total superelevation and the inner edge is lowered that same distance. Whenever possible, two thirds of the transition shall be accomplished on tangent, and the remaining third shall be accomplished on the curve.

Superelevation criteria for horizontal curves of traffic ways in the Special category shall be obtained from the BCBECE.

F. Widening

Horizontal curves with radii of 500' or less shall be widened on the inside edge of pavement, and the adjacent property line shall be cut back correspondingly to maintain the standard edge of pavement or curb to property line relationship.

Maximum widening shall be accomplished at the mid point of the curve, and shall conform with the table and method shown on **Design Plate R-G** for widening computation.

Widening criteria for horizontal curves of traffic ways in the Special category shall be obtained from the BCBECE.

G. Cul-de-Sacs; Tee Turn-Arounds; Alley Entrances; Driveways

1. Cul-de-Sacs – The following criteria are to be used for the determination of the appropriateness of the length of a proposed cul-de-sac. The proposed cul-de-sacs shall:

- a. Function as a local street only.
- b. Be compatible with the circulation pattern objectives of the County both on-site and off-site; as part of that evaluation, the County shall determine if a through road or a loop road would be a better alternative.
- c. Provide adequate access for emergency service vehicles.
- d. Serve dwellings that will generate no more than 600 average daily trips.
- e. Be sensitive to topographic considerations, such as steep slopes, streams and other environmentally sensitive areas.
- f. Be compatible with efficient service and use of public water and sewer facilities.

In developments involving group housing, the design engineer shall give special consideration to parking requirements. See **Design Plates R-D-1 and 2**. Note increased radius requirements for parking within a cul-de-sac. If the design engineer considers a circular turn-around inadequate for parking conditions, he may elect to design a special rectangular parking area. For

criteria regarding special parking areas, the design engineer shall contact BCBEC.

Where group housing is not involved, the radius of the paved circular portion shall be 60' with a right-of-way radius of 71'. This paving radius shall apply to all cul-de-sacs (where group housing is not involved) regardless of street width, since cul-de-sacs shall be initially built to the ultimate section with curb and gutter.

The design engineer shall be guided by the effects of allowable grade criteria upon cul-de-sac locations and alignment and shall avoid excessive use of cul-de-sacs in any one area, particularly in flat terrain.

2. **Tee Turn-Arounds** – If a street designed as a temporary dead end street is to be extended into a through street at a future date, a tee turn-around shall be used in place of a cul-de-sac. The length of the turn-around, or “T” portion, shall equal the width of the right-of-way. Where the distance between the property line and the edge of the pavement permits, a return radius of 10' shall be used. See Tee Turn-Around, **Design Manual Plates R-N-1 through R-N-4**.
3. **Alley Entrances** – The layout of alley entrances and the top curb grade of returns shall conform with the Alley Entrance, **Standard Detail Plate R-18**.
4. **Driveways** – Driveway entrances shall not be shown on the traffic way plans except in special cases, but shall be provided by the field engineer for all detached houses. When driveways are shown on the traffic way plans, layout shall conform with the Typical Driveway Entrance details, **Standard Detail Plates R-15, R-15A or R-15B** as applicable.

H. Traffic Way Pavement Criteria

Pavement types shall be as shown in the **Standard Details, Plates R-2A and R-2B** for development roads. Design of paving shall be in accordance with **Section 9, Paving Design**, of this **Manual**.

If a subdivision abuts on a street that is partially or completely involved in the subdivision construction, and a public transportation route for free-wheeling vehicles is in operation or planned to be in operation on that street, then a stopping lane 10' wide by 30' long with a 70'± transition to the existing pavement edge shall be provided for on the near side of intersections or where specified by the Office of Planning. Sufficient right-of-way shall be set aside in the vicinity of the stopping lanes so that at the completion of construction, the right-of-way line shall be at least 12' beyond the edge of pavement. Sidewalks adjacent to stopping lanes shall be at least 5' in width.

I. Layout of Curbs, Pavement Edges and Property Lines at Intersections

The radii of traffic curbs and pavement edges at intersections shall be governed by the following criteria:

- At an intersection of collector streets, or of a minor street with a collector street, the radius of the returns shall be 20' to face of curb, or 25' to edge of pavement where no curbs exist.
- At an intersection of collector streets, or of a collector street with a thoroughfare, the radius of the returns shall be 25' to face of curb, and 25' to edge of pavement where no curbs exist.
- When any of the foregoing street intersections involve the intersection of a curbed traffic way with a non-curbed traffic way, the radius of the returns shall be 25'. When any of the foregoing intersections are on bus routes, the radius of returns shall be 30', or as otherwise directed by the BCBECE.
- At an intersection of thoroughfares, the radius of the returns shall be 30, or as otherwise directed by the BCBECE.
- When any of the foregoing thoroughfare intersections involve the intersection of a curbed thoroughfare with a non-curbed thoroughfare, the radius of the returns shall be 35'.
- At an intersection of an alley and a street, the standard radius of the return shall be 10' to face of curb. Where the distance on the street between the face of curb and property line is less than 10', that distance shall become the return radius.
- Where alleys intersect at 90-degree angles, the fillet triangle formed shall have legs of 15'. At intersections other than 90 degrees, the fillet triangles shall be subject to approval by the BCBECE. Fillet triangles shall be paved with concrete.

The cut-back of property lines at intersections shall be governed by the following criteria:

- At an intersection of traffic ways (other than alleys), the cut-back of the property line normally shall be a chord connecting the points on the property lines directly opposite the P.C. and P.T. of the curb return or edge of pavement return. In any case, the minimum distance from the property line PI at an intersection and the property line chord points shall be a minimum of 10'.
- At an intersection of an alley and a street, the property line shall not be cut back.
- At an intersection of alleys, the property line shall conform with the pavement fillet.

J. Grades

- 1. Traffic Ways** – The minimum allowable grade of traffic ways shall be 0.60% except for Special traffic ways where minima shall be established by the BCBECE for individual cases.

The grade of traffic ways shall be 10% maximum (7% preferred) for 30 MPH design speed, 8% maximum (6% preferred) for 40 MPH design speed. For design speeds exceeding 40 MPH, grades shall be as directed by BCBECE.

To meet the criteria for cul-de-sacs, the grades across the circular portions of cul-de-sacs shall be flattened when necessary: the average grade along the centerline extended across the circular portion of any cul-de-sac shall not exceed 6%.

At an intersection of two traffic ways, the normal typical section of the priority traffic way shall continue through the intersection without break. The crown of the other traffic way shall be warped from its normal section to connect to the edge of the priority traffic way. Where two traffic ways of equal importance intersect, one shall be considered as a priority traffic way in order to accomplish the foregoing connection, except where the design engineer is unable to determine satisfactorily either one of the intersecting traffic ways as a priority traffic way. In this case, the four corner intersection connection may be used, as shown on Plate R-H, Design Figures.

When the grade of a non-priority traffic way (other than a minor street) exceeds 6% at an intersection, that grade shall be broken at least 50' in advance of the station opposite the near property line of the priority traffic way. The grade into and out of the intersection shall be flattened to 6% or less. The original grade of the non-priority traffic way may be resumed at least 50' past the station opposite the far property line of the priority traffic way. A 100' minimum vertical curve shall join the tangents at both P.I.s.

Grades of minor streets up to and including 8% may continue into and out of intersections without flattening. Where a minor street grade exceeds 8%, that grade shall be broken and flattened to 8% or less to and from the intersection as outlined in the previous paragraph.

Approaches to tee intersections shall be outlined in Section L., except that tee intersections with state roads shall be outlined in the following section.

- 2. Intersections with State Roads** – Approach grades to Maryland State Highway Administration highways shall be governed by the control points set forth in the following table derived from State Highway Administration intersection limits. The designer shall lay out the most efficient approach profile obtainable and conform to stopping sight distance and headlight sight distance requirements. In addition, the profile of an ascending approach to a state highway shall not fall below the applicable control point, nor shall the profile of a descending approach to a state highway fall above the applicable control point:

Boulevard Type State Highways (Stop Intersections)

Slope of Natural Terrain	Minor Street Control Points		Collector Street and Thoroughfare Control Points	
	Dist. From Ult. Edge of State Highway	Dist. Above or Below Ult. Edge of State Highway	Dist. From Ult. Edge of State Highway	Dist. Above or Below Ult. Edge of State Highway
0% to 4%	300'	6'	350'	7'
4% to 8%	200'	4'	250'	5'
Over 8%	125'	3.75'	175'	5.25'

Non-Boulevard Type State Highways (Caution Intersections)

Slope of Natural Terrain	Minor Street Control Points		Collector Street and Thoroughfare Control Points	
	Dist. From Ult. Edge of State Highway	Dist. Above or Below Ult. Edge of State Highway	Dist. From Ult. Edge of State Highway	Dist. Above or Below Ult. Edge of State Highway
0% to 4%	250'	5'	300'	6'
4% to 8%	175'	5.25'	200'	4'
Over 8%	1 st 50' 2 nd 100/ 150'	1.50' 7.50/ 10.50'	125'	3.75'

- 3. Gutters and Ditches** - The minimum and maximum grades for gutters and ditches shall be governed by the following table:

Type of Facility	Minimum Grade	Maximum Grade
Std. Combination Curb & Gutter	0.60%	Conform to Street Grade
Mountable Curb & Gutter	0.60%	Conform to Street Grade
Sodded Swale	0.50%	4%
Seeded & Fertilized Ditch	0.50%	2%
Sodded Ditch	0.50%	4%
Concrete Paved Ditch	0.60%	Conform to Thorough-Fare Grade

K. Vertical Curves

To avoid an abrupt change in vertical alignment when passing from one grade to another, a vertical curve shall be used at the grade intersection whenever the algebraic difference in the percents of grade is 0.25 or greater.

Elevations on vertical curves shall be computed by the parabolic curve formula except for subdivision and rehabilitated streets when it becomes impractical, due to the use of other curves. The elevations of other curves may be scaled when the profile is plotted on a scale of 1" = 50' horizontal and 1" = 5' vertical.

The minimum length of a vertical curve may include a compound curve, but not a reverse curve, and shall not be less than 100'.

On under-verticals (sags), the minimum vertical curve length is generally determined by the topography, but the curve should not be designed so sharp that it critically reduces the traffic way length illuminated by automobile headlights. The design of under-verticals shall be governed by the criteria set forth in the Headlight Sight Distance Chart. The design engineer shall be governed by the criteria set forth in the Headlight Sight Distance Chart. The design engineer shall note that limits indicated on this chart have been determined as the maximum and minimum curve lengths (allowing for adequate drainage) on vertical curves having a change in sign of tangent grade.

On over-verticals (crests), the minimum vertical curve length is determined by the required sight distance as discussed under Sight Distance. After determining the type of sight distance required, the design engineer shall be governed by the criteria set forth in the Stopping Sight Distance Chart, whichever applies. The limits indicated on these charts have been determined as the maximum and minimum curve lengths (allowing for adequate drainage) on vertical curves having a change in sign of tangent grade. The limits do not apply on vertical curves where there is not a change in sign of tangent grade.

An effort shall be made to avoid the placing of horizontal curves along over-vertical curves. Where such design is unavoidable, the sight distance of the vertical curve shall not be less than the horizontal curve sight distance, and the limits of the horizontal curve shall extend beyond the limits of the vertical curve.

L. Top Curb Grade at Tee Intersections

To facilitate smooth curb rollouts at tee intersections, the tangent top curb grade of the side traffic way shall be pulled into the low curb P.I. of the through traffic way when the side traffic way is on a descending grade into the intersection. When the side traffic way is on an ascending grade into the intersection, the tangent top curb grade of the side traffic way shall be pulled into the high curb P.I. of the through traffic way. The remaining curb of the side traffic way shall be rolled with a smooth curve to meet the remaining curb P.I. of the through traffic way.

The maximum grade into a tee intersection shall be 6%, except for minor streets which may connect to through traffic ways at 8%.

In extreme cases, where the tee street is on a steep grade and distance for flattening as described under Grades, is severely limited, the design engineer may elect to warp both top curb grades into the intersection.

M. Underdrains

To drain free water from subgrades, underdrains shall be incorporated into the design of traffic ways wherever there is a possibility of water undermining the traffic way subgrade. See **Standard Detail Plate R-22**, Typical Underdrain for Paved Streets. The design engineer shall review underdrain location in the field with the BCBECC prior to final submission of contract drawings.

N. Guard Fence

Traffic Barrier W-Beam guard rail or equivalent shall be erected on thoroughfares at points of extreme hazard to a vehicle leaving the traveled portion of the traffic way. Generally, this potential hazard develops at fills over 8' in vertical depth from the edge of the shoulder to the toe of the slope. Guard rail or equivalent shall be placed at the edge of the normal shoulder, and the shoulder shall be widened 3' to provide backing. Refer to MdSHA *Book of Standards for Highway and Incidental Structures* for Standard Detail Plates showing acceptable guard rail structures.

Where traffic way construction ends in fill areas, temporary barricade posts shall be erected. See **Standard Detail Plate R-27**.

O. Sidewalks and Pedestrian Ramps

Sidewalks are required in the urban areas of the County, and may be required in rural centers. Required sidewalks may be waived by DPW upon demonstration that no foot traffic will need to be accommodated by the proposed use, or to connect the proposed use to the surrounding area. However, if the construction

of a required sidewalk is waived, a graded, unobstructed right-of-way area for the sidewalk and street trees must still be provided, in the event the sidewalk is needed in the future. Use of this area for other purposes, including placement of outside utilities and/or County traffic appurtenances shall be subject to review for purposes of maintaining the sidewalk area for its intended purpose.

Areas of sidewalk disturbed by construction shall be repaired by the agency responsible for the disturbance in a timely manner, in accordance with the County Standard Details and Specifications, and applicable permit requirements.

Sidewalks shall usually be detailed to be built “by others,” since they normally are not a part of the traffic way contract. Sidewalk design shall be coordinated with DPW. New sidewalks shall be 5 feet wide, except as otherwise directed by DPW. Replacement for existing 4 foot wide sidewalks shall be 4 feet wide except where additional right-of-way is being acquired by the County to expand sidewalk width to 5 feet. The designer is referred to “Guide for the Planning, Design and Operation of Pedestrian Facilities” published by AASHTO.

All sidewalks that intersect with traffic ways, curbed driveways and crosswalks shall have pedestrian ramps for accessibility in accordance with ADA regulations. Consideration shall be given to the location of existing and proposed power poles, fire hydrants, street light and traffic signal supports and hardware and storm drainage inlets when locating proposed pedestrian ramps. Minimum ADA clearances shall be observed, and DPW shall be advised of the need for any additional right-of-way to provide these clearances at the earliest possible time. See **Design Plate R-T** and **Standard Details R-36A through R-36E**.

P. Cross Sections and Quantities

When required by the BCBEC, cross sections for special traffic ways and thoroughfares shall be taken at least every 25', at all noticeable terrain breaks, at all existing driveways and at private sidewalks. The centerline and profile grade line shall be stationed based upon their respective stationings. BCBEC shall be provided with review copies of the cross-sections with each submittal of plans.

When required by the BCBEC, the design engineer shall provide quantity estimates for special traffic ways and thoroughfares. These estimates shall include all quantities for grading, paving, curb and gutter, etc., and shall be tabulated as directed by the BCBEC.

Q. Valley Gutters

Valley gutters, as shown in the Standard Details shall be used only where approved by BCBEC but will normally be permitted where the approach road is a cul-de-sac or minor street providing access to less than 8 lots.

R. Bikeways

Bikeways may be designated as Class I (shared use paths separate from the paved roadway), Class II (on-road bike lanes) or Class III (designated bike routes on existing roads, where road width will not allow a Class II bike lane).

On new roads and roads designated in the "Baltimore County Pedestrian and Bicycle Access Plan" (BCPBAP) or other adopted community plan, every effort shall be made for all new construction, major reconstruction and resurfacing projects to incorporate adequate pavement and shoulder widths to accommodate safe, shared use of the road section by pedestrians, bicyclists and motorists. Where such roads are resurfaced but not widened, re-striping of roadways to help accommodate bicycle use should be done where feasible.

Bikeway Standards and Characteristics

	Class I (Shared Use Path)	Class II (Bike Lane)	Class III (designated Bike Route)
Defining Characteristic:	Separate from vehicular traffic; uses sidewalk area on one side of road (a sidepath)	Striped and marked area on the road designated for bicycle use.	Road signs and markings that indicate shared use of the paved roadway (may include sharrows, bicycle boulevards). Designated to provide continuity along bike routes
Relation to vehicular traffic:	Separated by minimum 5' clearance or barrier per GDBF	Adjacent to vehicular traffic; design intersections to encourage cooperation; carry bike lanes across interchanges where possible	Driving lanes shared with motorized vehicles
Width:	8' min. , preferred 10'-12'	5' (preferred)	Existing width
Clearance to obstacles:	2' horizontal adjacent to path; 8' vertical	Highway clearances apply; Place bike-safe drain grates	
Signing & Marking:	MDMUTCD	MDMUTCD	MDMUTCD
Sectional Design:	Open Section	Open or closed section (open preferred)	
Geometrics:	25 mph design speed or per GDBF; avoid steep slopes (ADA criteria); stopping sight distance per GDBF	Road geometry governs	Existing road geometry
Paving:	Adequate section for load; 2% cross-slope for drainage	Std. Road Section; use road shoulder section when shoulders are marked as bike lanes	Standard Road section
Motorized vehicle use:	Banned except for maintenance vehicles; provide barrier posts at access points	Emergency stopping only. Unlicensed motor vehicles banned.	Shared with licensed vehicles; unlicensed motor vehicles banned.
Directions:	2 way	1 way (with motor vehicles only)	
Comments:	Appropriate for traffic ways with limited driveway and road crossings and posted speeds of 35 mph or more. Placement in road median is discouraged.	Typical Application: BCPBAP	

Ref: AASHTO Guide to the Development of Bicycle Facilities, latest edition

Additional miscellaneous criteria applicable as pertinent to Class I, II, and III bikeways:

- Separate highway over-crossing structures shall conform to MdSHA standard over-crossing design loading.
- Drainage grates and frames shall be curved vane (bicycle-safe) design per Standard Detail Plates D-2.09A, D-2.09B D-2.17A, D-2.21A and D-2.21B. Storm drain inlet and utility manhole frames, grates and covers shall be set and maintained flush with the road surface without depression.
- Where right-of-way allows, a bikeway shall be widened sufficiently at rail crossings to allow crossing at a right angle. Where this is not possible, the crossing should be signed as “Skewed Crossing Ahead”. Railroad track flangeway adjustments are acceptable, but must meet the same criteria as inlet grates for bike safety and are subject to the track geometry requirements and to approval of the railroad company involved. New bikeway crossings must also be approved by the railroad company prior to installation.
- Warning signs shall be placed prior to obstructions affecting a bikeway.

III. CONTRACT DRAWINGS & DOCUMENTS TO BE SUBMITTED TO BCBE

Attention is called to the General Instructions Section for additional information.

A. Preliminary Reports

For extensive traffic way projects, the design engineer shall provide a preliminary report that discusses and illustrates the effect of the project upon adjacent property.

B. Contract Drawings. See Sample Drawing.

1. **General** - Traffic way layouts shall be prepared on sheets separate from other utilities. These drawings shall be made on standard size mylar originals with titling as indicated by the Sample Drawing, and shall be rendered in black ink with the exception of the top curb grade lines or centerline grade lines and their elevations. These latter shall be drawn with fine lines in soft black pencil to ensure clear reproduction.

On all Road and Street projects, including improvements to existing roads and where a subdivision abuts on only one side of the road, cross sections shall be taken in the field. Maximum distance between cross sections shall be 50' with intermediate cross sections taken, as needed, to show a true picture of the topography. The cross sections shall extend to a point sufficient to determine the slope and other easements.

The cross sections shall be plotted on standard cross section paper 10 x 10 graduations to the inch. The scale for plotting the cross sections shall be 1" = 5' both vertical and horizontal, except that under very steep slope conditions or extremely wide cross sections a scale of 1" = 10' may be used as required. The original ground line shall be in ink and the proposed road section in pencil.

The plan shall be drawn to a scale of 1" = 50'. The profile shall be drawn to a horizontal scale of 1" = 50', and a vertical scale of 1" = 5'. The profile grid shall be to a corresponding 50 and 5 scale.

Drawing numbers of other utilities (water, storm drainage, etc.) being prepared for the development at the same time shall be shown on the plan portion of the traffic way drawings.

A location map drawn to a scale of 1" = 500' shall appear on the first drawing of the traffic way drawings. In remote areas, an additional location map on a small scale such as 1" = 1 mile shall be required so that existing traffic ways may be used for orientation reference.

Where the location is within the Metropolitan district, the appropriate Baltimore County bench mark and its datum and description, and any local bench marks used for the development shall be specified on the drawings.

2. Plan

Street Names – The names of all traffic ways shall be clearly lettered either along the street centerline or along one property line, whichever location is more convenient; however, all names on each drawing shall be placed in the same relative position.

Widths of Rights-of-way, Pavement and Easements – Widths of existing and proposed rights-of-way and pavements for each traffic way shall be shown with dimensioning. Slope easement where established and utility easements and rights-of-way which intersect traffic way rights-of-way shall be shown with dimensioning.

Topography – The location of all structures above the subgrade shall be shown, and when required, so shall all topography, including poles, trees, fences, hedges, property markers, buildings and other structures. This topography shall be carried at least 100' beyond right-of-way lines, 200' beyond the ends of traffic ways or beyond approval limits, and 200' in each direction from an intersection. When shown, all measurements for utility structures, poles, trees, fences and hedges shall be dimensioned from the traffic way centerline.

Coordinates, Bearings, and Ties – Bearings of traffic way centerlines and coordinates of centerline P.C.s and P.T.s and of intersecting traffic way centerline P.I.s shall be shown along the respective centerlines.

In addition to the above requirement, all P.I.s, P.C.s, P.T.s and other points that are needed to re-establish the centerline of the traffic way shall be referenced to permanent features or guarded hub stakes that will not be disturbed prior to the completion of all work.

The location and description of all reference points and the distance or angles to the centerline control points shall be shown on all Roads and Streets drawings.

Horizontal Curve Information – Centerline curve information for each horizontal curve shall be tabulated on the plan in the following order:

Symbol	Format	Name
Delta	__d__m__s	Angle of Intersection
D	__d__m__s	Degree of Curve
R	___.__'	Centerline Radius
T	___.__'	Tangent Length
L	___.__'	Length of Curve

Stationing - Stationing along the centerlines of tangents shall be in even 100' stations, indicated by a small circle and the station number. Stationing along horizontal curves shall be indicated in like manner.

P.C.s and P.T.s of horizontal curves shall be indicated by a small double circle on the centerline, and their stations shown to the nearest hundredth of a foot.

Stations of P.C.s and P.T.s of curbs on circular portions of cul-de-sacs shall be shown on the plan.

P.I.'s of intersecting traffic way centerlines shall also be indicated by a small double circle at the centerline intersection, and the equality to the nearest hundredth of a foot shall be lettered thereunder.

Centerlines and traverse lines shall be drawn according to the Standard Symbols, Cad Drafting Section.

Match Lines - Traffic way plan portions shall be continued from one sheet to the next with match lines. In addition, the last 200' of each section of a traffic way plan shall be repeated on the next adjacent section.

P.I.'s of Curb Lines - The points of intersection of curb lines shall be indicated by small linked crosses, and shall be identified thereunder as N.E.P.I., N.W.P.I., S.W.P.I., or S.E.P.I.

Direction of Drainage - Arrows approximately ½" long shall be drawn around all curb returns, and at all critical drainage points to indicate the direction of surface water flow in ditches or gutters.

Wherever the slope of a gutter is reversed from the traffic way slope, a note to that effect shall appear on the plan.

When an inlet adjacent to a curb return is to be set to such an elevation that it serves as the low point along the curb return, and the grades of the intersecting traffic ways are such that a true picture of the top curb grade in the inlet area is not feasible on the profile, then a note shall appear on the plan stating that the top curb grades in the inlet area shall be set in the field to locate the sump at the inlet.

Storm Drainage – The design engineer shall indicate on the traffic way plans all of the proposed storm drainage system in the right-of-way. The storm drainage system shall be shown schematically by a single dashed line, with inlets and drainage structures and direction of flow indicated.

If the storm drain system is of minor nature with no other utilities involved, the design engineer may include the storm drain plans on the traffic ways contract drawings, subject to approval of this by BCBEC. For instructions on storm drainage, see **Storm Drainage Section** of this **Manual**.

3. Profiles

Top Curb Grade, Centerline Grade - Top Curb Grade and Centerline Grade submitted for approval shall be shown by a fine line, and designated "TOP CURB GRADE," and "CL GRADE". On profiles where the grades are warped, one grade shall be shown by a solid line, and the other by a dashed line with a note designating each.

Circles or double circles, as shown in the **Design Plate C-A** in the **CAD Drafting Section of this Manual**, shall be used on profile grade lines to designate vertical curve P.V.C.s, P.V.R.C.s, P.V.C.C.s, and P.V.T.s, and P.I.s of intersecting top curb lines or centerlines.

All grades shall be shown as percent to two decimal place accuracy (e.g. 3.07%).

Previously Established Top Curb Grade and Centerline Grade - Where a grade line shown on a drawing is taken from a previously established grade, it shall be designated as "ESTABLISHED TOP CURB GRADE", or "ESTABLISHED CL GRADE." The date established and the design drawing number of such previously established grades shall be noted on the profile. On existing pavement, grades shall be field surveyed.

Existing Ground Profiles at Centerlines and Property Lines - The profile of the existing ground along the centerline of a proposed traffic way and the profile of the existing ground along property lines shall be shown by dashed lines of medium line-weight. The existing ground profiles shall be so labeled, and the date of the field survey shall be indicated.

Vertical Curves - A vertical curve shall be shown on profiles as a smooth curve between tangents. Although vertical curves are parabolic curves with changing radii, these curves may be represented on 50 and 5 scale profiles with a standard circular curve template. The correct templates for given vertical curves will be tangent at the P.V.C. and P.V.T., and will pass through the computed middle ordinate elevation at the P.I. Computation of the middle ordinate will be required except where difficult to compute at unusual intersection situations.

Top Curb Grades for Cul-de-Sacs - Top curb grades for cul-de-sacs shall be shown independently as profiles running linearly around the perimeter of

the cul-de-sac including the approach returns. An additional 100' overlap on each end of the linear profile shall be shown.

Top Curb Grade of Intersecting Streets - Top curb grades for standard curb returns of intersecting streets normally need not be shown as linear profiles around the curb circumference, but shall be shown as profiles along the horizontal tangents from the P.C.s of the curb lines to the P.I.s of the curb lines. However, where returns exceed a 35' radius, or when a drainage problem is evident, top curb grades shall be shown independently as profiles running linearly around the circumference of the curb line as directed by the BCBE.

Stationing and Elevations - Stations of all points of intersection of curb lines and pavement edges shall be determined at right angles to the centerline. Therefore, a face of curb line shall not be extended to intersect a centerline at a skew in order to establish a station.

Throughout profiles, elevations shall usually be shown for each 50' station with additional elevations every 25' throughout vertical curves. Stationing shall be shown at these points on the profile.

Elevations on tangents shall be computed; elevations on vertical curves shall be scaled, or computed (See **Section II-K**). Elevations shall be shown to the nearest hundredth of a foot.

Where curbs are warped, separate elevations shall be given for each curb and shall be identified as N.T.C., S.T.C., E.T.C. and W.T.C.

Stationing and elevations shall be shown for all curb return P.I.s and vertical curve P.C.s and P.T.s. Points of intersection of curb lines shall be designated N.E.P.I., N.W.P.I., S.E.P.I., and S.W.P.I. to correspond with the plan.

Extension of Profiles - At any point where a proposed traffic way is an extension of an existing traffic way, the profile of the existing centerline or top curb shall be shown for at least another 200' and the heights of the curb face noted. All traffic way profiles shall be extended a sufficient distance to define clearly the situation and this distance shall never be less than 200' beyond the approval limits requested, except in the case of a profile terminating at a tee intersection. These profiles shall be independent and shown apart from the proposed top curb profile or profiles.

Where profiles must be broken and continued on the same or other sheets, a minimum of 200' of profile shall be repeated.

Where a new street is proposed to intersect an existing street, a profile of the existing street must be provided. The profile of the existing street should extend at least 200 feet beyond each side of the proposed intersection and show elevations at all points described in the previous section entitled "**Stationing and Elevations**".

Profiles of Alleys and Entrances to Parking Areas - Where such profiles are required by BCBEC, these profiles shall show the finished centerline grade for all alleys and entrances to parking areas independently and apart from the profiles of proposed streets and thoroughfares and they shall be clearly labeled.

4. Typical Sections

Typical sections of each type of proposed traffic way (i.e., paving width and/or right-of-way width) to be constructed shall be shown at least once on each set of construction drawings. These sections shall conform with the typical sections shown in this Section of the Design Manual, unless otherwise directed by the BCBEC.

5. Check List

The design engineer shall use the checklist as an aid in determining whether or not the listed items have been properly completed on the plan, and one copy shall be submitted by the design engineer with final Contract Plans.

6. Stakeouts and Grade Sheets

All construction work in developments to be done under Baltimore County contracts shall be completely staked out by the Developer's Engineer or Surveyor.

Grade sheets shall be submitted to the BCBEC to meet the following requirements:

- a. Where there is curb and gutter, or mountable curb, separate grade sheets shall be submitted for each curb.
- b. Where there is no curb and gutter or mountable curb, a grade sheet for the centerline grade shall be submitted.
- c. When storm drainage is included under the traffic ways contract, a separate grade sheet for storm drainage shall be submitted.

Stakeouts shall conform to stationing shown on the plans and profiles. Horizontal curve points and radius points of returns shall be staked, and stakes shall be required at 50' stations on tangents and 25' stations on horizontal and vertical curves.

All hubs shall be offset no further than 6' – 0" from the line of construction. Line and grade shall be staked 100' beyond construction limits in areas where there is no existing curb or paving.

Grade sheets shall be 8 ½" x 11", either typewritten or prints from a tracing, and shall comply with the Standard Form for Grade Sheet.

A separate grade sheet shall be submitted for each curb or other line of construction. Grade sheets shall show stations, elevations of both grade

stake and finished construction, and offsets to construction lines as well as cuts and fills.

C. Contract Specifications

Proposed work not covered by Baltimore County Standard Specifications for Construction shall be covered by supplementary contract specifications (Special Provisions). See Section VI Special Provisions in the General Instructions section of this Manual for additional information.

D. Estimate of Quantities

The design engineer shall furnish estimates of quantities including fixed price items.

E. Design Calculations

The design engineer shall submit design calculations made in connection with the project. The calculations shall be submitted along with the contract drawings and shall be as specified in the General Instructions Section.

IV. REFERENCE SOURCES USED FOR DESIGN CRITERIA

A Policy on Geometric Design of Rural Highways – AASHTO, Latest Edition

Data Book For Civil Engineers; Design, Second Edition – Elwyn E. Seelye; John Wiley and Sons, Inc., N.Y.

Highway Design and Construction – Arthur G. Bruce and John Clarkeson; International Textbook Company, Scranton, Pennsylvania

Transition Curves For Highways – Joseph Barnett; Public Roads Administration, Government Printing Office

Manual On Uniform Traffic Control Devices (MUTCD) – FHWA / ATSSA / AASHTO / ITE, Latest Edition

Maryland Supplement to the Manual On Uniform Traffic Control Devices (MD-MUTCD) – Maryland Department of Transportation, State Highway Administration (MdSHA), Latest Edition

Guide for the Planning, Design and Operation of Pedestrian Facilities (GPDOPF)-AASHTO, Latest Edition

Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG), Latest Edition

Baltimore County Pedestrian and Bicycle Access Plan (BCPBAP), Eastern and Western Editions – Baltimore County Office of Planning, Latest Editions

Guide to the Development of Bicycle Facilities (GDBF)– AASHTO, Latest Edition

V. APPENDIX 1 - RURAL ROADS

A. Introduction

The purpose of this guide is to provide design standards for county roads and bridges within Baltimore County's rural conservation zones. Development of design standards tailored for roads outside the Urban Rural Demarcation Line (URDL) is called for in several sections of the county's *Master Plan 2010*, most notably in the Transportation section for the Rural County.

Since the road network, like water and sewer service, plays an essential role in shaping and containing growth, it is important that road planning and design be compatible with land use and zoning. All land outside the URDL has a rural conservation zoning classification, and within this area lies more than 50,000 acres of agricultural and resource land protected from development through a variety of preservation easements. It is essential that transportation needs be addressed on the major roads and that special care be taken in the design of roads outside the URDL to preserve the rural character of both the roads and the communities. In keeping with this change in the public's philosophy from the 1900's when it was desired that unpaved roads be paved and widened, it is no longer the intention of Public Works to widen roads. Emphasis is placed on maintaining roads and retaining their existing character and design. Over the last 30 years only 8 capital projects have been completed for safety improvements. If a capital road

The transportation system within the rural county largely consists of a road network that was developed at a time when all of Baltimore County was rural. In keeping with the rural tradition, these roads are usually narrow two lane roads without shoulders. They have not been engineered to improve sight distance or capacity, but rather hug the natural terrain. The rural quality of the road network reinforces and contributes to the rural character of the landscape. Newer rural residential development has resulted in the creation of subdivision roads, which are frequently wider than the rural road they feed into. In addition, commuters living in neighboring jurisdictions overburden roads that were never designed for such intensive use.

The county's rural areas are subject to increased traffic due to development beyond the county's jurisdiction and its location between urban areas. Increasing the capacity of the existing local road network would result in erosion of rural character and could increase development pressure. Alternate solutions to this situation should be investigated.

Ref: Baltimore County Master Plan 2010

project is necessary, the Department of Public Works will follow the procedures for community involvement listed in these standards.

B. Community Involvement

The process for public involvement for a full replacement bridge or road project (such as repaving, widening, or new construction) will include the following measures:

- In the concept phase and the early stages of planning the County will provide notification of the project to the district councilman, the Planning Board, relevant community groups, as well as press releases to newspapers;
- Consult with the appropriate council member and set a public hearing, if requested;
- One or more signs will be posted at bridges for major rehabilitation or replacement projects;
- The County will notify the property owners adjacent to the project by certified mail;
- The County will include information in its e-newsletter which is available to anyone by subscribing on the County's website; and,
- An annual informational meeting will be held in one of several different rural communities, on a rotating basis, to discuss upcoming projects.

C. Design Considerations for Rural Roads

The design considerations of roadways are based on many factors including design speed, functional classification, vehicular volumes, types of vehicles, existing terrain and natural features, community impacts, environmental effects, cost considerations, right-of-way needed, etc. Road design is accomplished through the

A central theme in both recent legislation and publications is the encouragement of meaningful involvement of the public and others as a project is being developed....A primary goal of those within the transportation agency involved in project development should be to understand the context of the project area.

A Guide for Achieving Flexibility in Highway Design, AASHTO, May 2004

application of these design criteria and guidelines. It is critical to establish a set of design criteria and guidelines, which provide for a uniform approach that result in a system of roadways with "consistent driver expectations" with regard to appearance, operational performance, and quality of roadways. Accurate and consistent driver expectation is an important component in roadway safety.

1. Design Speeds

Design speed is a selected speed used to determine the various geometric features of the roadway. The assumed design speed should be a logical one with respect to the topography, anticipated operating speed, the adjacent land use, and the functional classification of the highway.

A Guide for Achieving Flexibility in Highway Design, AASHTO, May 2004

To keep travel speeds and rural roads safe for *all* users, design speeds in the rural area should be the same as or slightly higher than the posted speed. However, in no case should the design speed be greater than 10 mph over the posted speed limit. In keeping with design standards recommended in this report, design speeds should never exceed 50 mph, and for most roads design speeds should fall within 25-40 mph. This is in keeping with the federal standards for design speeds for Collector and Local roads, the federal classification that most closely matches the roadway conditions in rural Baltimore County.

For all construction on rural roads the following criteria apply:

Rural Classification	Design Speed	
	Min	Max
Rural Local (Fed Class)	25	35
Rural Minor Collector (By Use)	30	40
Rural Minor Collector (Fed Class)	30	40
Rural Major Collector (Fed Class)	40	50
Rural Minor Arterial (Fed Class)	40	50

In rural Baltimore County, great care should be exercised in selecting a design speed that is reflective of local conditions and driver expectations. In general, roads should not be designed to increase speeds.

The following factors should be considered in establishing the roadway's design speed:

- Avoid and/or minimize impacts to historical, architectural, scenic, natural or other resources;
- Comply with the county's master plan;
- Maintain the existing alignments, dimensions, and character;
- Account for land uses and activities that border the road;

- Consider the use of the road by pedestrians, cyclists, and equestrians;
- Reduce accidents;
- Allow for use by farmers moving large equipment;
- Provide rural residents reasonable access to and from their driveways;
- Develop low cost techniques that slow traffic down and allow the retention of existing dimensions and characteristics; and,
- Avoid excessive construction costs.

The Maryland SHA's *Interim Design Guide for Minor System Preservation Projects off the NHS* states:

“Because most system preservation projects follow the alignment of the existing road, generally, the design will be the anticipated posted speed. The system preservation design speed should provide reasonable continuity with adjacent roadway sections where the character of the roadway and roadside is similar. Achieving higher design speed for short roadway sections is not desirable. In some cases, this might necessitate lowering a speed limit if achieving the desired speed is not practical. It is important to provide consistency on the route with the system preservation design speed.”

Special care should be taken to achieve low speeds on rural roads with special designations (i.e., scenic roads, roads within rural legacy areas, and roads within historic districts), as well as roads bordered by significant properties under historic or conservation easements.

2. Sight Distances

The designer shall make a reasonable effort to provide sight distances for road and bridge projects equal to or exceeding those in accordance with the most current applicable AASHTO publications, while maintaining existing topography to the maximum extent possible.

3. Horizontal and Vertical Alignment

Any improved roadway section should follow the existing horizontal and vertical alignment to the maximum extent practical. This is necessary in order not to create false driver expectations about safe travel speeds.

The natural topographic characteristics of the views should be preserved and enhanced whenever possible. Without sacrificing safety

and maintenance concerns, grading should retain the natural contours of the land whenever possible while maintaining positive drainage away from the roadway to approved drainage facilities. Reconstructed sections of roadways should match the cross section of the existing road sections in order not to create false driver expectations about safe travel speeds.

The natural topographic characteristics of the roadway and how it fits into the landscape - its alignment and geometry - should be preserved to the maximum extent practical.

Context Sensitive Solutions for Work on Scenic Byways, MDSHA, 2004, page 9

When curvature sharper than the AASHTO recommended values is used, a post-construction test should be conducted, and the road posted accordingly. Refer to the Design Manual for the horizontal and vertical design requirements for the specific design speed.

4. Roadway and Right-of-Way Widths

a. New Roads

For new subdivision roads (or new construction for extensions or connections to existing roads), it is recommended that design standards match the dimensions of the existing road with which the new road will connect. Standards should also help limit the amount of new impervious surface cover.

In the rural area, new subdivision roads should have road and right-of-way widths in accordance with **Standard Plate R-1** for minor rural streets. The addition of acceleration/deceleration lanes and bypass lanes should be avoided on rural roads and especially on roads designated as scenic or within a historic district or rural legacy area except as required below. Where they are absolutely necessary, the length and width of an additional lane should be minimized to the greatest extent possible, and waivers requested from SHA as appropriate.

For all road improvements required for a development, the developer is responsible for the engineering, rights-of-way, grading, paving, signage, curb and gutter, and lighting costs. In addition, where a new street intersects an existing street without curb and gutter, and the traffic volume is 5,000 or more vehicles per day, an acceleration/deceleration lane is required. Also the need for a bypass lane/shoulder adjacent to the lane across from the intersection street should be evaluated.

b. Existing Roads

Where a new development has frontage along an existing road, the right-of-way to be dedicated shall be 10 feet beyond the edge of the existing bound macadam paving.

The addition of acceleration/deceleration lanes and bypass lanes should be avoided on rural roads and especially on roads designated as scenic or within a historic district or rural legacy area, except where a new street intersects an existing street without curb and gutter, and the traffic volume is 5,000 or more vehicles per day. Where they are absolutely necessary, the length and width of an additional lane should be minimized to the greatest extent possible and waivers requested from SHA as appropriate.

County easement agreements should not have a right-of-way requirement in excess of 10 feet on either side of the pavement or 50 feet from any bridges, crossings, culverts or other drainage structures existing at the time of signing of the easement. In most cases the county is not given right-of-way in-fee but rather the right to enter. To comply with the goals of the easement, the right-of-way or right of entry should be limited to road maintenance and service, etc.

5. Driveways and Access Points

Requirements for driveway and panhandle widths should also be evaluated in an effort to avoid increasing impervious surface cover beyond what is necessary. Driveway entrances should provide for both traffic safety and the preservation of scenic and historic roadway character. Entrances that are cut into banks should preserve the original frontage of the roadway to the maximum extent possible, while maintaining AASHTO sight distance requirements.

Where left turn lanes are deemed to be necessary for safety reasons on the mainline road approaching a driveway, consideration should be given to adding a “bypass lane” in lieu of a full width left turn lane.

6. Lighting

Exterior illumination within the rural area of the county should be minimized to avoid aesthetic and environmental impacts. While intended to improve safety by improving visibility, lighting fixtures can also contribute to accidents as they are stationary objects near the travel way.

Where necessary, lighting should be shielded and directed away from homes to preclude excessive lighting or glare that is inappropriate for the rural environment. Lighting fixtures should incorporate partial cut-off shielding to direct light downward so that the light emitted is projected below the horizontal plane through the luminaire's lowest light-emitting part.

7. Traffic Barriers/Guardrails

Traffic barriers (i.e., guardrails) should only be installed in specific circumstances whereby a thorough roadside geometric safety review has been conducted and barrier warrants are met.

Where warranted, the amount of guardrail used should be determined on a case-by-case basis and the length should be minimized in low-accident and/or low-hazard situations.

Barriers should be constructed with appropriate systems (approved by NCHRP Report 350) and compatible with the scenic nature of the roadway. Possible barriers include:

STANDARD

- Galvanized
- Polyester Coated
- Weathering Steel

SPECIALIZED

- Ironwood Aesthetic Guardrail (TL-3)
- SHA Approved Cable Barrier System
- Steel-Backed Timber Guardrail (TL-3)
- Stone Masonry Guardwall (TL-3)
- Precast Concrete Guardwall (TL-3)

8. Utilities

Because rural roads are narrower, every effort should be made to limit the introduction of new, fixed structures in the roadway vicinity. Utilities should be placed or relocated so as to preserve or enhance the character of the scenic or historic roadway. The use of underground utilities is encouraged for both safety and aesthetics. Particularly in new road construction or where a trench is being dug for other purposes (e.g., fiber optics), efforts should be made to underground all utilities. Preservation and restoration of the scenic qualities of the roadway should be considered for all utility installation within the right-of-way.

Whenever possible, utilities should be consolidated and unnecessary poles removed. Overhead utility lines or replacements should be

designed to place any required guy wires or similar supports as far from the roadway as possible with minimal impact to the surrounding area. Where overhead utility wires are near the roadway, only low growing vegetation should be planted underneath wires to reduce the need for periodic pruning. New utility wires should be carefully sited where they will not require excessive pruning of existing or proposed landscape features. Vertical clearances of overhead supply and communications wires, conductors or cables shall meet the requirements of COMAR 20.50.02.02A.

The public utility easement (PUE) should be located where it will result in minimal disturbance to identified scenic and historic qualities. The alignment of the PUE should be determined on a case-by-case basis at the time of development plan review.

9. Landscaping and Plant Materials

Natural landscape features, particularly native and traditional plant materials and tree cover, should be preserved and enhanced. Natural vegetation should be allowed to become established as close to the shoulder edge as possible, with consideration of clear zones and trees. Where appropriate, the use of native plant materials in natural planting patterns and historically traditional plant materials should be emphasized to enhance the character of the roadway.

Where applicable, plantings of roadside grasses or native ground covers should be used to address erosion problems on shallow slopes. Erosion problems on steeper slopes should be addressed, where applicable, by the planting of vines, ground cover, or other lower-growing herbaceous or woody plants. Ground cover decreases runoff and uptakes harmful substances, which might otherwise make their way into the water.

Where public safety or future maintenance concerns are not at issue, removal of existing healthy trees should be avoided. In particular, specimen trees and other interesting landscape features within the right-of-way should remain undisturbed to the extent possible.

10. Bicycle Accommodations

Baltimore County rural roads are an important recreational resource. Biking has become more popular than ever especially with speed cyclists who need a long-distance network.

Bicycle use in the rural areas should be encouraged and protected as it provides an excellent way to enjoy the fruits of the county's land preservation efforts. All motorists need to recognize that bicycles are a legitimate roadway vehicle and understand how to properly share the road with cyclists.

D. BRIDGES AND CULVERTS ON RURAL ROADS

1. General

Any improvements of bridges on rural roadways should be done in such a way as to preserve/enhance the character-defining features of the existing roadway. The goal is for the bridge to appear as a consistent and continuous extension of the approach roadways. For this reason county policy encourages the rehabilitation of an existing bridge rather than the building of a new structure.

For the purposes of this document, a bridge is any structure with a length from face of abutment to face of abutment of 20 feet or greater. This is also the threshold for qualifying a structure for federal bridge funds. Structures with a length of less than 20 feet are defined as culverts.

2. Bridge and Culvert Rehabilitation

Bridge and culvert rehabilitation should attempt to maintain/replicate the appearance of those features of the existing bridge/culvert that are visible from the roadway to the extent feasible. The County will repair when a structure can reasonably be repaired and replace to a minimum width when replacement cannot be reasonably avoided.

Railings and other visible features that have deteriorated should be rebuilt or replaced with elements of the same appearance. Where elements need to be strengthened to meet modern requirements the strengthened members should be designed to resemble the original elements as closely as possible. If concern about a hazard adjacent to the bridge indicates a possible need for transition guardrail, the first choice should be to extend the rebuilt existing railing/parapet and flare it away from the bridge to serve in lieu of guardrail. If transition guardrail cannot be avoided, the connection with the rehabilitated railing/parapet should be as simple and unobtrusive as possible. Road widening will be no longer than necessary to provide smooth and safe transition back to existing road width.

Aging pipe culverts that need rehabilitation should be replaced with similar structures rather than more significant and larger/wider bridges if practical and allowed by permitting agencies. A waiver should be sought from the State if they require a bridge to replace a culvert.

3. Bridge and Culvert Replacement

a. Alignment and Profile

The design speed and character of the horizontal alignment and profile of the replacement structure should be consistent with the design speed and character of the existing roadway on either side of the bridge. The bridge/culvert alignment should be set to appear continuous with the approach roadways.

b. Bridge/Culvert Width and Driving Surface Width

Bridge/culvert width from face to face of railings/parapets should be based on the width of the existing approach pavement plus a three foot refuge area on either side subject to the minimums available under state and federal guidelines and as shown in the chart below.

ADT	Minimum Width*
Less than 400	22 (2-9-9-2)**
400-1500	26 (3-10-10-3)
1500-2000	28 (3-11-11-3)
Greater than 2000	30 (3-12-12-3)

*Additional width may be required depending on environmental or geometric constraints.

**If existing roadway is 1000' each direction and less than 15' wide AND existing bridge is less than 15' wide- replace with single lane bridge approximately 2' wider than the approach roadway width but not less than 13' wide.

Waivers from SHA will be requested as appropriate to achieve widths of 26 feet or less unless existing road width is 26 feet or greater.

The driving surface should appear to continue across the bridge at the same width as the approaching roadways. The driving surface should be delineated separately from the refuge areas by making the pavement of the refuge areas a different color and/or texture or, where conditions permit, by continuing reinforced turf shoulders across the bridge.

There are several techniques that should be investigated for achieving a differential color and texture for the refuge areas. They include stamped and colored concrete, formed grooved concrete, rumble strips, rolled aggregate and saw cut grooved asphalt or concrete. Reinforced turf shoulders can be continued across the bridge on precast concrete arches and similar structures where the depth of earth fill above the top of the structural slab is sufficient to support turf growth, usually about 24 inches, and where the top of the structural slab can be adequately waterproofed and drained to prevent salt buildup on the slab surface.

c. Spans

Bridge spans are established by the needs of the under-crossing stream or other feature and are not addressed by these guidelines. The use of open bottom culverts to allow for continuation of natural streambeds through the culvert is an environmental matter and is also not addressed by these standards.

d. Railings, Parapets and Approach Guardrail

Railings and parapets should be consistent in appearance with other bridges along the same road and/or with the previous bridge on the site. In general, the goal is to keep the railings simple and with a minimum number of different elements, so that the bridge does not call attention to itself and so that the railing is easily maintained.

Railings and parapets must be of a crash tested design approved by FHWA for use.

e. Details and Finishes

Details and finishes should preserve/enhance the character defining features of the existing roadways on either side and of the surrounding locale. In many cases the existing bridge parapets are of concrete, which has weathered to a dark tan color with a rough texture. New concrete should be made to approximate this color and texture through application of stains and sandblasting. Colors on railings and other features should be kept to neutral earth tones with the goal of having the element blend into the natural background in all seasons.

4. Pipe Culverts

Smaller culverts are often constructed of round or elliptical pipe. Such structures can usually be constructed to avoid the use of guardrail altogether. Wherever environmental conditions and stream alignment permit, culverts should be extended so that their ends are outside of the clear zone. In most cases this will remove the need for guardrail. The driving surface should appear to continue across the bridge at the same width as the approaching roadways.

The culvert should be ended simply with a flared end section set even with the approach slopes. This will remove the need for headwalls. The area between the edge of pavement and the end of the culvert should be planted to match the side areas of the approach road.

E. Traffic Calming

The term *traffic calming* refers to measures intended to reduce the undesirable effects of traffic. Such effects are generally two-fold: inappropriate (generally too high) speeds for a route or street, and inappropriate traffic (e.g., through traffic on a residential street). It is important for designers and the community to fully understand the traffic problems that might be addressed by a traffic-calming solution. The context sensitive design standards presented in this document are in themselves a means of traffic calming. On local, rural roads, limited sight lines, narrow bridges, and narrow driving lanes are desired for their cautionary influence on drivers as well as their contributions to rural character.

Many traffic calming programs are developed around the three “E’s” – education, enforcement, and engineering. These same three components can be used to address the problems associated with the rural road system in Baltimore County, namely excessive vehicular speeds and traffic searching for “shortcuts” off of the more appropriate arterial roadways which have increasing congestion.

Education – This component alerts people to ways they can ease traffic problems. Examples include: speed radar display boards and community outreach.

Enforcement – Utilizing Baltimore County Police and Maryland State Police, along with appropriate technological options, to enforce the traffic laws especially in high speed areas and in areas where vehicles exceed weight or size restrictions.

Engineering – Traditional traffic calming efforts in neighborhood areas call for the engineering of active devices, such as speed humps, chicanes, etc. to slow and moderate vehicular traffic flow. On rural roadways outside of the neighborhood area traffic calming can be incorporated in a more passive methodology by allowing existing vertical and horizontal alignments to be maintained, and by utilizing the narrower roadway widths, which were outlined in Chapter III. Some active traffic calming methods may be appropriate on the rural

Traffic calming challenges the traditional design view of a roadway design, namely that higher speeds are desirable and indicative of a high-quality design. While this may be true for higher-classification facilities, it may not be viewed as true by those who live along the highway or on residential or local streets. Designers should learn to adapt to the request by the public to provide a safe, *lower-speed* street that meets functional requirements.

A Guide for Achieving Flexibility in Highway Design, AASHTO, May 2004, page 88

road network. These methods include: traffic circles, single-lane roundabouts, multi-way stop signs in lieu of new traffic signals, and rumble strips.

F. CONCLUSION

These standards were developed in response to input from property owners and communities in rural Baltimore County and are in keeping with the provisions in the Baltimore County Master Plan 2010.

Public opinion and the context-sensitive design movement have come together to suggest that Baltimore County should embrace new standards for rural roads. The key principles should be to minimize width changes, to minimize design speeds and to create consistent driver expectations which are compatible with rural preservation. Rural road standards that allow roads to maintain their rural characteristics support the county's commitment to managed growth and land preservation and provide for safe use of the public roadways by a variety of users.

G. Abbreviations

The abbreviations listed in the General Provisions, Section 1, item 1.04, of the Maryland Department of Transportation (MDOT) State Highway Administration (MSHA) *Standard Specifications for Construction and Materials* (latest edition) are adopted. In addition, the following abbreviations shall have the meanings indicated here:

AASHTO - American Association of State Highway and Transportation Officials

ADA - Americans with Disabilities Act

ADT - Average Daily Traffic

FHWA - Federal Highway Administration

MDOT - Maryland Department of Transportation

M-NCPCC - Maryland National Capital Park and Planning Commission

MSHA - Maryland State Highway Administration

MUTCD - *Manual on Uniform Traffic Control Devices*

NCHRP - National Cooperative Highway Research Program

CHECK LIST

ROADS & STREETS (TRAFFIC WAYS) CONTRACT DRAWINGS

PROJECT _____

J.O. _____ DATE _____

CHECKED BY _____

APPROVED _____ DATE _____

PROJECT ENGINEER SHALL COMPLETE,
SIGN AND SEAL THIS CHECKLIST AND
INCLUDE THE ORIGINAL WHEN SUBMIT-
TING PLANS FOR REVIEW.

(*CAP*) - CAPITAL PROJECTS ONLY

PLANS – GENERAL REQUIREMENTS

- ___ 1. In compliance with General Instructions Section (attach check list from that Section)
- ___ 2. Check for compliance with approved Development Plan, as applicable.
- ___ 3. All plan sheets are signed and sealed by a Professional Engineer licensed to practice in Maryland. Certification signed.
- ___ 4. Plan sheets use latest Title Block and comply with Section 2 – CADD Standards in all respects.
- ___ 5. Proposed Right-of-Way – fee simple and easements – shown in accordance with Section 4 – Land Acquisition requirements. Plans submitted at earliest possible time to Land Acquisition for plat preparation and acquisition. (*CAP*)
- ___ 6. Sediment Control plans preparation begun upon approval of 70% plans. (*CAP*)
- ___ 7. Traffic Engineering plan for construction requested and coordinated with design.
- ___ 8. Storm Drainage plans prepared in accordance with Section 7 – Storm Drainage requirements.
- ___ 9. Paving section developed in accordance with Section 9 – Paving Design.
- ___ 10. Utility locations mapped, relocations determined and coordinated with applicable Design Section/Utility company.
- ___ 11. Plans as printed are complete (there are no hidden layers in CADD that are hiding information).
- ___ 12. Match lines references checked for final configuration of drawing set; all references take reader to appropriate sheet. in accordance with General Instructions.
- ___ 13. Provide cross-reference table on each highway plan sheet to reference corresponding storm drain, sediment control, stormwater management and traffic plan sheets, by assigned drawing number.
- ___ 14. Provide a location plan:
 - ___ a. Scale 1" = 500' plus small scale when required.
 - ___ b. Show site of proposed work shaded.
 - ___ c. Show names of proposed & adjacent traffic ways.
 - ___ d. Show arterial streets leading to site.

TITLE AND DETAIL SHEETS FOR MULTIPLE SHEET SETS

- ___ 1. Title sheet in accordance with General Instructions section V-A-5, showing vicinity map, bench marks information, drawing index with drawing numbers, General Notes, and complete revision notes. (*CAP*)
- ___ 2. Formatting as instructed by Design Section.
- ___ 3. Local survey control points shown.
- ___ 4. Where necessary, required Title Sheet items may be carried over to a second sheet.
- ___ 5. Additional sheets shall follow the title sheet(s) as necessary to show project-specific geometry details and schematics, typical sections, superelevation data, soil boring data, etc.

PLAN SHEETS

- ___ 1. In multiple sheet sets, highway design plans follow the general information and geometry sheets.
- ___ 2. Provide a properly oriented North arrow and a minimum of 3 coordinate tics at multiples of 250'. Note coordinate system used (BCMD or NAD-83) per Section V-A-8 of General Instructions.
- ___ 3. Note Baltimore City, MdSHA and railroad permit areas clearly on plans. Provide permit numbers.
- ___ 4. Supplementary Information on Plans:
 - ___ a. All property/easement lines abutting traffic way right-of-way (R/W) are shown in proper symbols. See Design Plates C-A and C-B in CADD Section.
 - ___ b. Existing R/W shown and dimensioned.
 - ___ c. Show subdivision plat book and folio numbers for adjacent private property when available.
 - ___ d. Subdivision layout shown is checked against final subdivision plat.
 - ___ e. Show subdivision name, section and block letter when available.
 - ___ f. Check field run topography against plan for poles, fences, buildings, driveways, hydrants, shrubs, trees, pavement, walks, ped ramps, symbols, traffic boxes, etc. Field check final plans for topo.
 - ___ g. Carry topography 100 feet beyond R/W lines and 200 feet beyond ends of traffic ways or beyond approval limits.
 - ___ h. Show existing pavement and label type of surface. Provide boring information indicating

underlying layers and depths of paving material.

- ___i. Show existing and proposed storm drain manhole and inlet locations.
- ___j. Show and label existing and relocated utilities.
- ___k. Note scale of drawing in proper location.
- ___l. Show names and route numbers of traffic ways in proper positions so that this information is readily apparent.

PLAN VIEW - PROPOSED ROADS AND STREETS (TRAFFIC WAYS)

- ___1. Names of all traffic ways are shown in proper position.
- ___2. Limits of contract are clearly shown and/or stationed.
- ___3. Limits of new R/W are shown & dimensioned.
- ___4. Limits of necessary easements are shown and dimensioned.
- ___5. Widths of proposed pavement are properly shown and dimensioned.
- ___6. Centerlines/base lines are properly shown, stationed and labeled. Stationing shown at 50' intervals and as otherwise required. Coordinate tables are shown for end points, P.C.s, P.I.s, P.T.s, ties, etc.
- ___7. Bearings are indicated on base line tangents.
- ___8. Centerline / base line curve data is shown and verified mathematically.
- ___9. Show proper radii for curb returns.
- ___10. P.I.s of curb lines are located and labeled.
- ___11. Show direction of flow arrows at curb returns, and sumps and crests in curb lines.
- ___12. Note slopes of non-standard gutters on plan.
- ___13. Show and label locations of curb, gutter, side ditches, outlet ditches, swales or mountable curb and gutter where necessary.
- ___14. Guard fence and barricade post locations noted and labeled as required.
- ___15. Cul-de-sacs and tee turn-arounds correctly drawn and dimensioned in accordance with Design Plates and Standard Details.
- ___16. Existing utilities.

PROFILE - PROPOSED ROADS AND STREETS (TRAFFIC WAYS)

- ___1. Supplementary Information on Profile views:
 - ___a. Existing ground along property lines shown with proper symbol and labeled with survey date.
 - ___b. Existing ground along proposed center line shown with proper symbol and labeled with survey date.
 - ___c. Previously established grade lines labeled with date established and original drawing number when available.
 - ___d. Existing traffic ways shown and labeled.
 - ___e. Existing ground lines or top curb lines extended 200' at tie-ins or breaks. Height of existing curb faces noted.

___f. Existing utilities along/crossing the area of work.

- ___2. Names of all traffic ways are shown in proper position.
- ___3. Centerlines of intersecting traffic ways are shown and labeled.
- ___4. Top Curb Grade or centerline grade are properly shown and labeled.
- ___5. Profiles of warped curbs are shown with proper symbol (one solid line, one dashed line).
- ___6. P.V.C.s and P.V.T.s indicated, and P.I.s of intersecting curb lines indicated and labeled.
- ___7. Grades meet minimum and maximum gradient requirements.
- ___8. Tangent percents of grade are shown to two decimal places (e.g. 1.02%).
- ___9. Stationing and elevations shown at 50' intervals and as otherwise required.
- ___10. Show linear profile around cul-de-sacs.
- ___11. Profiles carried 200' beyond proposed limits of work and 200' beyond breaks.
- ___12. Finished centerline grade profiles shown for alleys and entrances to parking areas as required.

COMPUTATIONS

- ___1. Horizontal curves and intersections meet AASHTO Design Speed requirements.
- ___2. Vertical curves meet sight distance requirements.
- ___3. Widening is applied as applicable per Design Plate R-G.
- ___4. Intersection curb top elevations computed and verified per Design Plate R-H.
- ___5. Estimate of working days provided.
- ___6. Quantities and Construction Costs estimated per Section VIII of General Instructions using items described in Standard Specifications and Commodity Catalog or in Special Provisions for project.

SPECIAL PROVISIONS

- ___1. Special Provisions complete and submitted for review with 95% plans.
- ___2. Special Provisions meet requirements of General Instructions, Section VI.

PERMITTING & SUBMITTALS (*CAP*)

- ___1. Stormwater Management plans approved by DEPRM, signed by BCSCD.
- ___2. Sediment Control plans approved and signed by BCSCD.
- ___3. All issues with Railroad, Utility companies resolved.
- ___4. Check status of Joint Permit. Resolve any remaining issues, as required.
- ___5. All Rights-of-Way acquired.