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## CHAPTER 2D - PLAN DESIGN

### SECTION 2D-1 PROJECT REVIEW

#### GENERAL

When the time arrives for presenting a project to the public through the public hearing process, it is the Lead Design Engineer\* responsibility to review the plans and supporting data to assure that it is current and representative of the section of roadway concerned. Such items include any change in topography, traffic counts or traffic data.

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\* Rev. 1/08

## **SECTION 2D-2 PREPARATION OF INFORMATIONAL BROCHURES**

### **RESPONSIBILITY**

Design and Combined Location and Design Public Hearings require informational brochures only, since the environmental document will satisfy the requirements of a study report, or in case of categorical exclusion, the requirement of a study report is waived. Study reports and informational brochures for Urban projects are to be prepared by the Project Manager or the Urban Program Manager in conjunction with other team members.

### **PURPOSE OF BROCHURE**

Informational brochures are to be prepared in accordance with the VDOT [Policy Manual for Public Participation in Transportation Project](#).<sup>\*</sup> Such brochures are to assist interested citizens in familiarizing themselves with various aspects of the project. They should be prepared in a professional manner, but remain easily understood by the layperson.

### **REVIEW OF DRAFT ENVIRONMENTAL DOCUMENT**

The draft environmental document must be completed prior to this stage, as certain data from this document must be included in the study report or informational brochure. It is essential that data in all publications be consistent with that shown on plans. Close coordination with other divisions and agencies is most important at this time.

### **CONTENTS**

Generally, the informational brochure should contain, as a minimum, the following information:

- (1) A general description of the highway system in the area
- (2) Project description and length
- (3) Design criteria, typical section, traffic data and costs
- (4) Summary of environmental considerations

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\* Rev. 1/13

(5) On state funded projects, it may be required to consult the Environmental Division to determine if an air and noise study will be required

(6) Project Schedule

(7) Any other related information

A breakdown of project cost responsibility is to be included on all projects. Each project must be considered on an individual basis and the amount of detail and documentation will depend on whether the project has been classified as a major or minor action regarding Federal requirements.

Deleted Information\*

## **SECTION 2D-3 PREPARATION AND PROCESSING OF PUBLIC HEARING DATA**

### **RESPONSIBILITIES OF THE PROJECT MANAGER AND THE DISTRICT PUBLIC AFFAIRS SECTION**

Please refer to the VDOT [Policy Manual for Public Participation in Transportation Project](#).

### **INTERSTATE, PRIMARY, URBAN AND SECONDARY PROJECTS**

The Project Manager and the District Public Affairs Manager is responsible for processing of the necessary data. For Locally Administered Projects, see the Locally Administered Project Manual, which can be accessed at

[http://www.virginiadot.org/business/locally\\_administered\\_projects\\_manual.asp](http://www.virginiadot.org/business/locally_administered_projects_manual.asp)

### **PROJECT MANAGER RESPONSIBILITIES**

The project manager should consult with the project designer to determine what materials will be required to properly present the project to the public. Depending on the complexity of the project, this data may vary from a simple plan layout to a presentation including slides, photographs, perspective drawings, models and other items to serve as aids for public understanding. The more complex displays may require up to 120 days to prepare.

After the needs have been determined, prints of plans and other necessary data are to be used in preparing display materials. The project manager should also contact the District Engineer/Administrator or his designee and other appropriate persons to determine if there are any special interest groups that require notification of the upcoming public hearing. This information is to be relayed to the District Public Affairs Manager.

The original informational brochure is to be provided to the District Public Affairs Manager. The District Public Affairs Manager is responsible for the distribution of all necessary materials to the District Engineer/Administrators' and Residency Engineer/Administrators' offices and other locations specified in the public hearing notice at the time the notices are posted.

The following notes are to be added to all plan and profile sheets including the title and detail sheets; "PUBLIC HEARING PLANS", "ADDITIONAL EASEMENTS FOR UTILITY RELOCATIONS MAY BE REQUIRED BEYOND THE PROPOSED RIGHT OF WAY SHOWN ON THESE PLANS", "PRELIMINARY EASEMENT FOR UTILITY RELOCATIONS ARE APPROXIMATE ONLY AND SUBJECT TO CHANGE AS PROJECT DESIGN IS FINALIZED" and "THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY."

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\* Rev. 7/15

## **SECTION 2D- 4 PRE- PUBLIC HEARING MEETINGS**

Refer to Section 3.0 of the VDOT [\*Policy Manual for Public Participation in Transportation Project.\*](#)\*



**SECTION 2D- 5 NOTICE OF WILLINGNESS TO HOLD A PUBLIC HEARING**

Refer to Section 3.0 of the VDOT [Policy Manual for Public Participation in Transportation Project](#).\*

## **SECTION 2D- 6 SCHEDULING THE PUBLIC HEARING**

### **ESTABLISHING TIME AND LOCATION**

Refer to Appendix C of the VDOT [\*Policy Manual for Public Participation in Transportation Project\*](#).<sup>\*</sup>

### **PUBLISHING NOTICE OF THE PUBLIC HEARING**

The Project Manager, upon notification that the hearing has been scheduled, will advise the District Public Affairs Manager to publish a notice that a public hearing is to be held.

If a pre-hearing meeting is to be held, the public hearing notice is also to include the time and place of this meeting.

The public hearing notice will also indicate that all pertinent data (including the environmental document) will be available for public review and copying at specified locations. This requires that the appropriate environmental document be prepared and cleared for public availability prior to the preparation of the hearing notice.

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\* Rev. 1/13

## **SECTION 2D- 7 PREPARATION OF ENGINEERING COMMENTARY**

### **CONTENTS OF COMMENTARY**

The engineering commentary, which is of vital importance in the public hearing process, should be written and presented in a manner which can be easily understood by the layperson. The commentaries and all written statements shall be coordinated with the District Public Affairs Manager. In most instances, the commentary should contain the following information relative to the project being presented:

- (1) The need for the project and the sequence of events leading up to the public hearing
- (2) A brief history of other corridors considered and rejected (if a combined Location and Design Hearing)
- (3) The project description and length, approximate lump sum cost (with a participation breakdown from other agencies or municipalities where applicable), and traffic data
- (4) A brief summary of environmental effects
- (5) Remaining steps required following the public hearing

### **THE PROJECT MANAGER \***

The Project Manager who prepares the commentary should also make the presentation. He/she should be thoroughly familiar with all facets of the project and should make an on-site inspection prior to writing the commentary. He/she should be proficient in the delivery and be familiar with all visual aids used.

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\* Rev. 7/12

## **SECTION 2D-8 OPERATIONAL / CAPACITY ANALYSIS - PLAN IDENTIFICATION - ALIGNMENT AND GRADES**

### **OPERATIONAL / CAPACITY ANALYSIS**

The capacity checks previously documented should be reviewed and updated if necessary. The capacity analyses as indicated in [Chapter 2B, Section 2B-3-DETERMINATION OF ROADWAY DESIGN](#) should be performed.

### **UPDATING PLAN IDENTIFICATION**

The Project Manager: (VDOT), Surveyed By and Date (completed): (L&D Survey Office Manager or Firm and Consultant Survey Project Manager), Design By: (Responsible Person) and Subsurface Utility Provided By and Date (completed) names are to be shown in the top left corner of the border of each plan and profile sheet. Project numbers not previously assigned are to be obtained through the "Project Pool" in IPM. State project numbers must be shown on the plan and profile sheets to which they apply. (Federal project numbers are to be shown on the Title Sheet only.) Bridge project numbers and major drainage structures (D#s)\* are to appear only on the sheets that actually apply to the structure such as the plan sheet showing the bridge, its profile and typical section, the crossroad profile, if applicable, and the title sheet.

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\* Rev. 1/19

## REFINING HORIZONTAL ALIGNMENT

Although horizontal alignment is in the proper location at this stage, it must be reviewed for exact tie-ins with adjoining projects, connection tie-ins, interchange ramp tie-ins, traverse tie-ins, etc. Horizontal alignment is to be computed, where possible, to locate special design bridges either completely on tangent or on a curve, with superelevation transitions encroaching neither on the bridge itself nor the approach slabs. Horizontal alignment is to be shown on all connections, drainage traverses and new entrance locations. See [Chapter 2A, Section 2A-6](#)\*

## DEPICTING HORIZONTAL ALIGNMENT ON PLANS

P.I.'s, P.C.'s, P.T.'s, etc., curve data, bearings, delta's, direction of angle and tie stations are to be shown where applicable as outlined in Section 2C-5 (Curve Data).

Construction baselines are to be shown by a heavy solid line (see standard symbols in [CADD Manual](#) and sample plan sheet in Chapter 2H, Figure 2H-31) with all alignment data clearly noted "Const.", "Survey", etc., where applicable.

Superelevation is to be applied to horizontal curves in accordance with the latest [Road and Bridge Standards](#). The rate of superelevation, length of transition, and design speed are to be shown directly below the applicable curve data.

Where right of way is to be acquired for future design features, the outline of these features is to be shown on the plans with a dashed line. This applies to ultimate interchanges, dual lane highways, etc. The entire configuration of interchanges is to be shown with a dashed line. This will show the reason for acquiring additional right of way and will serve as a means of recording the original design intent. Designs for ultimate interchanges and dual lane highways are to be shown graphically and, if available, computed alignment is to be shown. Ultimate dual lanes are to be labeled on each plan sheet as "Approximate Location Future (NBL, EBL, etc.) baseline." It will also be necessary to show the grades graphically or computed as is the case for horizontal alignment. The proposed future grade is to be labeled on each profile sheet as "Approximate Future (NBL, EBL, etc.) Grade." The ultimate construction limits are to be plotted on the plans showing cuts and fills.

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\* Rev. 1/17

## REFINING VERTICAL ALIGNMENT

Vertical alignments or grades are to be reviewed and computed for smooth, exact tie-ins with adjoining projects and existing road elevations. Also, connections, interchange ramps, etc., are to be computed considering pavement crowns, variable widths, etc.

Grades on divided highways are to provide for allowable median crossover grades (See [Appendix F, Section 2-MEDIAN CROSSOVER GRADES](#)). Grades are to be checked for proper mainline sight distances at median crossovers, connections, and entrances.

## STOPPING SIGHT DISTANCE

Stopping sight distances exceeding those shown in the table below should be used as basis for design wherever practical.

In computing and measuring stopping sight distances, the height of the driver's eye is estimated to be 3.5 feet and the height of the object to be seen by the driver is 2 feet, equivalent to the taillight height of a passenger car. The "K Values" shown are a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve that will provide minimum sight distance. Crest vertical curves shall meet or exceed AASHTO design criteria for Stopping Sight Distance, not the "k" Values. The "K" values for sag vertical curves take into account the headlight sight distance.

Height of Eye 3.5'	Height of Object 2'										
Design Speed (mph) **	25	30	35	40	45	50	55	60	65	70	75
Min. Sight Distance (ft.)	155	200	250	305	360	425	495	570	645	730	820
Minimum K Value For:											
Crest Vertical Curves	12	19	29	44	61	84	114	151	193	247	312
Sag Vertical Curves	26	37	49	64	79	96	115	136	157	181	206

Source: 2011 AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-4

**TABLE 2D-1 STOPPING SIGHT DISTANCE**

\*\*For all tables, use design speed if available, if not use legal speed.

When a highway is on a grade, the sight distances in the table below shall be used. \*

Design Speed (mph) **	Stopping Sight Distance on Grades					
	Downgrades			Upgrades		
	3%	6%	9%	3%	6%	9%
15	80	82	85	75	74	73
20	116	120	126	109	107	104
25	158	165	173	147	143	140
30	205	215	227	200	184	179
35	257	271	287	237	229	222
40	315	333	354	289	278	269
45	378	400	427	344	331	320
50	446	474	507	405	388	375
55	520	553	593	469	450	433
60	598	638	686	538	515	495
65	682	728	785	612	584	561
70	771	825	891	690	658	631
75	866	927	1003	772	736	704

**TABLE 2D-2 STOPPING SIGHT DISTANCE ON GRADES**

(See 2011 AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-5)

\*\*For all tables, use design speed if available, if not use legal speed.

Connection grades are to provide for a smooth tie-in with the mainline edge of pavement in accordance with [Appendix F, Section 2-INTERSECTING CROSS ROAD GRADES](#) and are to provide for adequate sight distance.

Current practice is to eliminate scuppers on most bridge designs. For this reason a minimum gradient of 0.5 percent is desirable to facilitate surface run-off. There will be instances where flatter gradients are required, through vertical curves, long water crossings, etc.; therefore, the water should be removed by means of inlets in lieu of open scuppers. Gradients are to be computed to as few decimal places as possible and should be in numbers evenly divisible by four, where feasible.

All grades are to be checked, as accurately as possible at this stage. See [GS standards](#) or proper minimum vertical clearances at underpasses and overpasses.

Minimum vertical clearances for structures or limits of work at grade crossing of railroads are to be obtained from the Department of Rail and Public Transportation.

Drainage of the existing terrain and adequate cover for drainage structures are also important factors to be considered in designing grades.

Proposed grades for roadside ditches and/or special design ditches are to be shown on corresponding profile sheet. See [Chapter 7 of VDOT Drainage Manual](#).

\* Rev. 1/16

Conflicts with utilities are to be avoided wherever practicable. See VDOT [Survey Manual](#), Chapter 8 for additional analysis information.

The Department's permit policy allows vehicles with excess heights to operate on our highways under an over-height permit. In view of this, 14'-0" has been accepted as the maximum allowable height to be provided for during construction, reconstruction, or maintenance operations. Every effort must be made to insure that a minimum vertical clearance of 14'-2" is provided on existing grade separation structures during construction, reconstruction, or maintenance. If temporary reduction in the vertical clearance below 14'-2" is unavoidable and is apparent in the design stage, the Permit Office is to be advised when the project is turned in to the Construction Division.

The following information is to be furnished so that permit holders can be notified:

- Route, County, and Mile Post
- Name of railroad or Route overpass
- Minimum overhead clearance prior to change
- Minimum overhead clearance after change

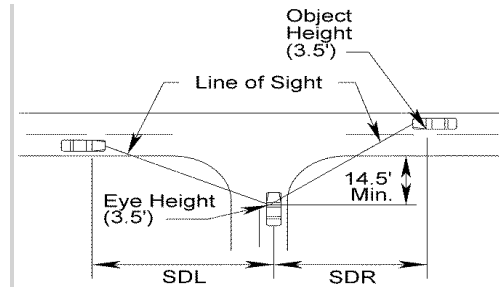
Date of change

Temporary or permanent



### INTERSECTION SIGHT DISTANCE

The following table shows intersection sight distance requirements for various speeds along major roads: \*



SDR = Sight Distance Right (For a vehicle making a left turn)  
 SDL = Sight Distance Left (For a vehicle making a right or left turn)

Height of Eye 3.5'		Height of Object 3.5'										
Design Speed (mph)**		20	25	30	35	40	45	50	55	60	65	70
SDL=SDR: 2 Lane Major Road	In Feet	225	280	335	390	445	500	555	610	665	720	775
SDR: 4 Lane Major Road (Undivided) or 3 Lane		250	315	375	440	500	565	625	690	750	815	875
SDL: 4 Lane Major Road (Undivided) or 3 Lane		240	295	355	415	475	530	590	650	710	765	825
SDR: 4 Lane Major Road (Divided – 18' Median)		275	340	410	480	545	615	680	750	820	885	955
SDL: 4 Lane Major Road (Divided – 18' Median)		240	295	355	415	475	530	590	650	710	765	825
SDR: 5 Lane Major Road (continuous two-way turn-lane)		265	335	400	465	530	600	665	730	800	860	930
SDL: 5 Lane Major Road (continuous two-way turn-lane)		250	315	375	440	500	565	625	690	750	815	875
SDR: 6 Lane Major Road (Divided – 18' Median)		290	360	430	505	575	645	720	790	860	935	1005
SDL: 6 Lane Major Road (Divided – 18' Median)		250	315	375	440	500	565	625	690	750	815	875
SDL: (Where left turns are physically restricted)		210	260	310	365	415	465	515	566	620	670	725

**TABLE 2D-3 INTERSECTION SIGHT DISTANCE**

Source: AASHTO Green Book, Chapter 9, Section 9.5.3, page 9-37 thru 9-52, Table 9-5 thru 9-14

\*\*For all tables, use design speed if available, if not use legal speed.

\* Added 7/17

Note: Both SDR and SDL must be met at the entrance or intersection, unless left turns are physically restricted by a median or channelization island; then only SDL is needed. Intersection sight distance determinations apply both horizontally and vertically, measured in each direction, and are to be based on a height of driver's eye of 3.5' and a height of object 3.5'.\*

The term "Major Road" refers to the road with the higher functional classification, or if both have the same classification, the road with the higher volume.

Intersection sight distance does not control the access spacing for entrances and intersections shown in [Appendix F, Table 2-2](#).

For major roadways of more than four lanes, large truck volumes on a minor road or median crossover, or median widths over 60', see AASHTO's A Policy on Geometric Design of Highways and Streets.

The Engineer must check each entrance and intersection to insure that adequate sight distance is provided. On a typical two-lane road horizontal curve there are numerous objects that restrict sight distance such as cut slopes, buildings, vegetation, vehicles, etc.

These obstructions should be considered when reviewing commercial entrances. A divided highway can have similar problems. It is very important to obtain adequate intersection sight distance for all "New" and "Reconstructed" commercial entrances from the entrance as well as the left turn position into the entrance. If the minimum intersection sight distance values in the table mentioned above cannot be met, including applying the adjustment factors for sight distances based on approach grades, a Design Waiver shall be requested in accordance with [IIM-LD-227](#), see 2011 AASHTO Green Book, Chapter 9, Section 9.5.3, page 9-32 for further guidance. Design Waiver and Design Exception requirements are based on the following;

- 1) Design Waiver – Meets Stopping Sight Distance but not Intersection Stopping Sight Distance.
- 2) Design Exception – Does not meet the minimum Stopping Sight Distance.

The Intersection Sight Distance values in the table above permit a vehicle stopped on a minor road or median crossover to cross the major road safely or merge safely in the case of turns. The Intersection Sight Distance table above is based on the following criteria:

The AASHTO Green Book shows that it requires 7.5 seconds for a passenger car to turn left onto a two-lane road. For a passenger vehicle to turn right into the first lane, the Green Book shows that only 6.5 seconds is required because drivers making right turns generally accept gaps that slightly shorter than those accepted in making left turns.

The reference to 18' median in Table 2D-3 applies to medians up to 18' in width (18' or less). For medians up to this width there is not sufficient room to stop so more sight distance is needed. For wider medians, there would be room to stop in the middle of the highway so sight distance can be less.

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\* Added 7/17

## DEPICTING VERTICAL ALIGNMENT ON PLANS

Proposed grade lines are to be shown in a heavy solid line, except for dual lane highways, in which case one lane should be shown as a heavy dashed line. Both are to be clearly labeled.

Percent of gradient is to be shown on each tangent line.

Grades are to be designed in conformance with the Geometric Design Guidelines shown in [Appendix A](#) for the Functional Classification, traffic volumes and design speed of the road being designed. Also, see [Chapter 2A, Section 2A-6](#).\*

Finished grade elevations are to be shown in the bottom 1" of the profile sheet from beginning to end at prescribed intervals (50' for Rural, Primary and Interstates and 25' for Urban) and at transition points. (Transition points are to be computed and shown through the superelevation transitions of all horizontal curves for TS, SC, CS, ST, PC, PT and every 25' increment. Chord points are to be computed ( $Lr/10$ ) and shown on projects with pavement widening only. For clarification of transition and chord points, see Road and Bridge Standards.) When showing the superelevation diagram on the profile sheet, station pluses, centerline elevations, edge of pavement elevations (left and right) and offset distances (left and right) through the transition are to be furnished. If projected grades are computed manually, the St'd. TC-5 Tables are used in computing transition point elevations. Finished grade elevations are also to be shown at change of grade points without vertical curves, at the beginning and end of each profile sheet, at the beginning and end of the project, beginning and end of bridges, at equalities, and equivalent stations.

Begin and end project stations are to be flagged as shown in Chapter 2H, Figure [2H-35](#).

Flagging for both begin and end stations and elevations shall be shown for all connection grades, ramps grades, etc.

Splined (not mathematically computed) grades are to be used only where computed grades are not practical and are to be noted "Spline Grade" with elevations shown, to the nearest five hundredths of a foot (or more accurately, if available), from beginning to end at 25 feet intervals. Approximate percent of gradient is to be shown on each tangent line and approximate vertical sight distances are to be shown for each crest vertical curve. Approximate design speeds are to be shown in accordance with the information in [Appendix A](#), Section A-1. For spline grades, these values are to be clearly marked "approximate".

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\* Rev. 1/17

## **SAG VERTICAL CURVES**

Criteria for establishing lengths of sag vertical curves are (1) headlight sight distance, (2) rider comfort, (3) drainage control, and (4) a rule-of-thumb for general appearance. (See AASHTO's *A Policy on Geometric Design of Highways and Streets*, Chapter 3 for controls - applicable to both rural and urban projects).

## **CREST VERTICAL CURVES**

Crest vertical curves are to be in accordance with Geometric Design Guidelines for the Functional Classification, traffic volumes and design speed of the road being designed.

## DESIGN WAIVERS

**This Design Waiver Policy is applicable to VDOT owned and maintained roadways only.**

Design Waivers are required when deviations from VDOT's design criteria occur. When design criteria meet or exceed AASHTO minimal design but fall short of VDOT's minimal design, a Design Waiver shall be required. Design Waivers will be applicable to all projects regardless of functional classification and funding and shall be documented and approved in accordance with the Design Waiver Request Form [LD-448](#). Please refer to [IIM-LD-227](#) for specific guidelines on obtaining a design waiver.

## DESIGN EXCEPTIONS

When plans are being prepared where, for any reason, one or more locations do not meet the AASHTO minimum design criteria (for example **shoulder width, horizontal curve radius\***), the location(s) and reason for difference(s) are to be noted on the title sheet. In order to alert everyone concerned, it will be necessary to identify these locations from the earliest stages of plan development. If changes are made during plan development that would alter the situation, then the title sheet must be corrected to reflect the new design. Design exceptions shall have the approval of the State Location and Design Engineer ([Form LD-440](#)) on both State and Federally funded projects. Please refer to [IIM-LD-227](#) for specific guideline on obtaining design exceptions.

The following methods will be used to show these exceptions:

- a. Plans with Functional Classification block:

EXCEPTIONS TO MAINLINE DESIGN SPEED			
Sta. To Sta.	Design Speed (mph)	Reasons for Exception	Approval Date
102 + 75 to 104 + 75		<b>Shoulder Width</b>	
621 + 00 to 624 + 50	60	<b>Horizontal Curve Radius</b>	

The data as indicated in the previous example is to be shown directly below the Functional Classification block.

- b. Plans Without [Functional Classification block](#):

Exceptions should be noted inside the title sheet border lines immediately following the design speed classification as follows:

V = 70 mph Exceptions: 102 + 75 - 104 + 75 (50 mph) <b>Shoulder Width</b> 621 + 00 - 624 + 00 (60 mph) <b>Horizontal Alignment</b>
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\* Rev. 7/16

**SECTION 2D- 9 CROSS SECTIONS AND EARTHWORK QUANTITIES**

**PLOTTING CROSS SECTIONS**

The names and phone numbers, including area code, and District, if applicable, of the following persons are to be shown in the upper left corner: Project Manager: (VDOT), Surveyed By and Date (completed): (L&D Survey Office Manager or Firm and Consultant Survey Project Manager), Design By: (Responsible Person) and Subsurface Utility Provided By and Date (completed).

Cross sections are to be developed in the preliminary stage of the Project Development Process and are to be updated as the design progresses. The cross sections sheets are to be archived with the plans at each milestone.

Cross sections sheets are to be developed utilizing the criteria set by the AES section.

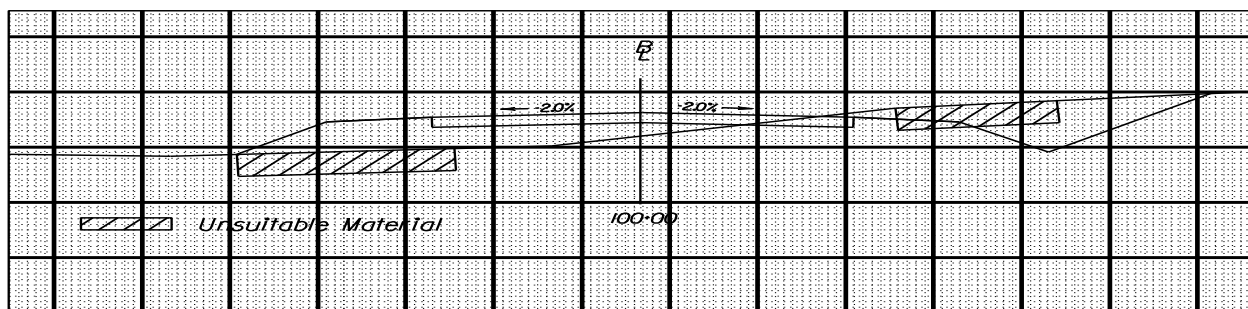
Cross sections are plotted on a scale of 1" = 10' and so noted at the top of each sheet. Curb and gutter projects, or other projects requiring greater detail, are plotted on a scale of 1" = 5'. Cross sections are to be cut at the following intervals, Rural - 50' and Urban - 25'.

Cross section templates are to be plotted in accordance with the appropriate typical section, to the finished grade elevation shown. Care must be taken to correctly plot all superelevated sections, pavement widening, pavement and shoulder transitions, gore areas, ramps, auxiliary lanes, etc. in accordance with the appropriate geometric, slope and superelevation standards (See [Appendix A-1](#)).

Superelevation rates shall be shown along proposed pavement slopes.

Pavement trenching for the proposed template will agree with the pavement design provided by the Material Division.

Unsuitable Material or Undercut Excavation limits are to be shown on the cross sections when provided by the Materials Division. GEOPAK has the capabilities to show the outline of the limits on the cross sections; however the designer will have to manually place hatching to depict the difference between regular excavation and the unsuitable material See Figure 2D-1.



**FIGURE 2D-1\***

\* Rev. 1/15

Construction baselines are to be labeled on the first and last sections on each sheet. Finish grade elevations are to be furnished on all cross sections at all hinge points (construction baseline, crown, edge of pavement, edge of shoulders, toe of ditches, etc) as appropriate and are to be labeled to one-hundredth of a foot on all cross sections. Existing and proposed Right of Way limits as well as cut and fill areas and volumes\* are to be furnished on all cross sections for projects being developed using the GEOPAK software.

Stationing shall be shown on the cross sections for the begin and end of projects, connections, ramps, frontage roads, bridges, etc., and are to be shown centered with the baseline, at the appropriate locations.

Cross section template separators are to be shown on all cross sections in areas that the roadway intersects with other connections or at the beginning or end of a bridge structure to be constructed on a skewed angle. Template separators are required to avoid the overlap of earthwork quantities.

Groundline elevations are to be shown in the last block on the right end of the sheet. Groundline elevations should be shown every 5 feet for Urban projects and 10 feet for Primary and Interstate projects.

An index is to be shown on the first cross section sheet showing sheet numbers assigned to the mainline, connections, ramps, frontage roads, etc.

Cross section sheets are to reflect all applicable project numbers in the appropriate blocks and are numbered in order beginning with "1".

## **DETERMINING WIDTH OF PAVEMENT**

Preliminary design typical sections are to be thoroughly checked for compliance with the applicable Geometric Design Standards (see [Appendix A](#)). Interchange Ramp typical section geometrics are to be checked for adequate pavement widths for the curvature used as explained in AASHTO's *A Policy on Geometric Design of Highways and Streets*. [Minimum ramp pavement widths](#) are to be as shown in the Geometric Design Standards (see [Appendix A](#)).

## **DETERMINING AREAS AND QUANTITIES**

Earthwork areas are computed to the bottom-most line of pavement trenching. End Areas are shown immediately below ground lines with the cut area in the third block to the left of the construction baseline preceded by the letter "C" and the fill area in the third block to the right preceded by the letter "F".

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\* Rev. 7/06

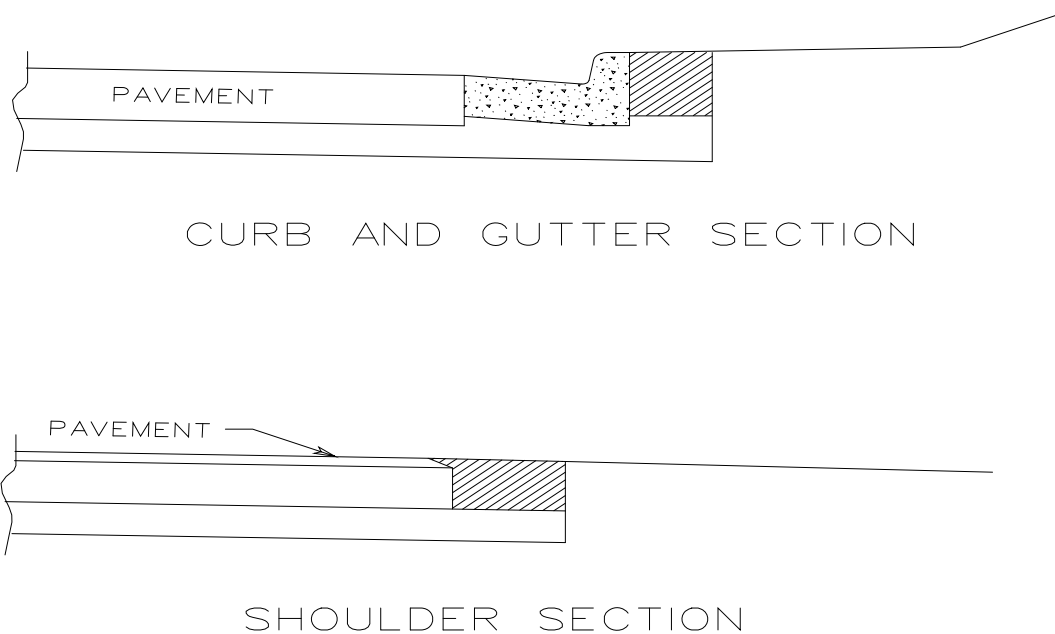
Earthwork quantities are computed as follows:

Add the areas of adjacent cut or fill, multiply by the distance between stations along the Construction baseline, and divide by 54.

(See [Appendix D, Section D – 1 – QUANTITY TABLES](#)):

The Volume Quantity is shown centered vertically between sections and in the second block to the left (for cut) and to the right (for fill) of the construction baseline.

On projects where the typical section and cross sections indicate a base or subbase material extended beyond the proposed pavement, curb, or curb and gutter in cut sections, the regular excavation will be computed to a vertical plane bounded by the farthest point.



**FIGURE 2D – 2 EARTHWORK QUANTITY EXAMPLE**

A quantity is to be included in the plans for backfill of the hatched areas as shown in Figure 2D – 2 above.

On projects with bridges, earthwork quantities need to be adjusted to account for any excavation or fill material associated with the bridge spill.



## SECTION 2D- 10 PAVEMENT, ENTRANCES, PROJECT LIMITS

### **PLOTTING EDGES OF PAVEMENT**

All edges of pavement are to be plotted on plans, using care to properly apply "TC" standards where applicable. For ramp terminal treatment, see [Appendix C, Section 8](#).

### **PLOTTING ENTRANCES AND MEDIAN CROSSOVERS**

All proposed entrances are to be designed in accordance with VDOT's Road Design Manual, [Appendix F](#).

Additional guidance may be obtained in the *Land Development Document*, Volume II – “Traffic Engineering Consideration” available from Local Assistance Division.

All entrances and median crossovers impacted by construction are to be shown on plans to proper tie-ins and labeled as to width, type, material, and grade. Grades for entrances are to be depicted as shown in Chapter 2H, Figure [2H-41](#)\*. Procedures shown in [APPENDIX F, Section 2](#) are to be followed.

The Standard CG-9D entrance gutter is to be used for most single family residential entrances with curb and gutter.

The Standard CG-9A and 9B entrance gutters should be considered only as a last resort in situations where the access into the property is too narrow to accommodate a Standard CG-9D, or if it is known that the lane adjacent to the curb will be used as a parking lane **AT ALL TIMES**.

If “accessible routes” are being provided for pedestrians, see [IIM-LD-55](#). Additional right of way is **NOT** required for entrance construction except in cases where the limits of the “accessible route” extend beyond existing or proposed VDOT right of way.

For situations where the difference in elevation between pavement and adjacent property is such that a desirable entrance grade cannot be provided, it is recommended that a Standard CG-11 entrance design be used with the grade beginning at the flow line. Care shall be exercised to provide adequate drainage.

The Standard CG-11 entrance design is the required method of treatment for **ALL** entrances with curb and gutter except for single family residential entrances. If the use of Standard CG-11 will result in:

- 1 - Major drainage problems or excessive drainage costs,
- 2 - Driver confusion due to the close proximity of an adjacent intersection, or
- 3 - Closely adjacent entrances on a road with a design speed < 35 mph

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\* Rev. 7/16

Then: consideration may be given to using one of the other Standard entrances. However, this requires a Design Waiver which shall be approved by the District Location and Design Engineer. **This Design Waiver Policy is applicable to VDOT owned and maintained roadways only.**

In those rare instances when the District Location and Design Engineer has given approval to use the Standard CG-9D entrance gutter for a commercial entrance, the Standard CG-13 entrance design shall be used\*. **This Design Waiver Policy is applicable to VDOT owned and maintained roadways only.**

The minimum entrance radii outlined in [Appendix "F"](#) shall be adhered to in the design of **ALL** entrances. For Commercial Entrances where a high percentage of trucks are anticipated, consideration shall be given to increasing the entrance radii to accommodate the turning requirements of those vehicles.

If the Standard CG-11 entrance design is used and there is insufficient right of way to construct the full curb return using the minimum entrance radii outlined as stated above, a partial curb return should be constructed to the right of way line. Radial curb or combination curb and gutter shall not be constructed beyond the right of way line except for replacement purposes.

Any sidewalk constructed in conjunction with the Standard CG-11 or CG-13 entrance design is to be paid for as Hydraulic Cement Concrete Sidewalk 7" in S.Y.

The Standard CG-9A, CG-9B, CG-9D, CG-11, CG-12 and CG-13 are available at [http://www.virginiadot.org/business/locdes/2016\\_roadand\\_bridge\\_standards.asp](http://www.virginiadot.org/business/locdes/2016_roadand_bridge_standards.asp) For entrances at new locations, a centerline with bearing, delta and tie-in station is required.

[Site plans](#) for developments adjacent to a proposed project will be reviewed by the designer and proposed entrances will be shown on the site plan. A note reading as follows is to be placed on the roadway plans on the parcels of land affected by the site plan:

"ALERT: SITE PLAN PROPOSED FOR THIS AREA. CHECK FOR THE SITE PLAN CONSTRUCTION AT EACH STAGE OF PROJECT DEVELOPMENT AND ORDER ADDITIONAL SURVEY WHEN CONSTRUCTED. STATUS OF ANY PROFFERED R/W SHOULD BE CHECKED AT R/W STAGE."

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\* Rev. 7/18

## APPLICATION OF STIPLING

Stippling is to be applied in accordance with the VDOT [CADD Manual](#), Appendix D.3 “Stippling and Cross-Hatching.

## SHOWING PROJECT TERMINI ON PLANS

When determining the extents for placing project number flags on the title sheet and appropriate plan and profile sheets several circumstances must be considered.

The PE project number shall be placed at the outermost locations at which any preliminary engineering has to be performed to complete the design, whether that is drainage, roadway, utilities, incidental items, pavement, signals, markings etc. and should coincide with the “Begin and End Construction” designation.

The Right of Way Project Limits should encompass all proposed, and projected, right of way and easements on the project. The RW project number shall reflect the limit of required right of way or easement delineation on the project. Proposed right of way lines and permanent easements should be projected, whenever practical, to allow for any anticipated future construction. Right of way and permanent easements should also be projected to any property line within a reasonable distance. This should minimize the need for negotiations with the same property owner on a future project. On projects where all construction is within existing Right of Way, a RW project number may not be needed.

The beginning and ending points of projects (C or M) are generally determined by the first and last full width template of construction. **Other**\* construction beyond these points is to be flagged showing “Begin Construction,” “End Construction” and applicable stations.

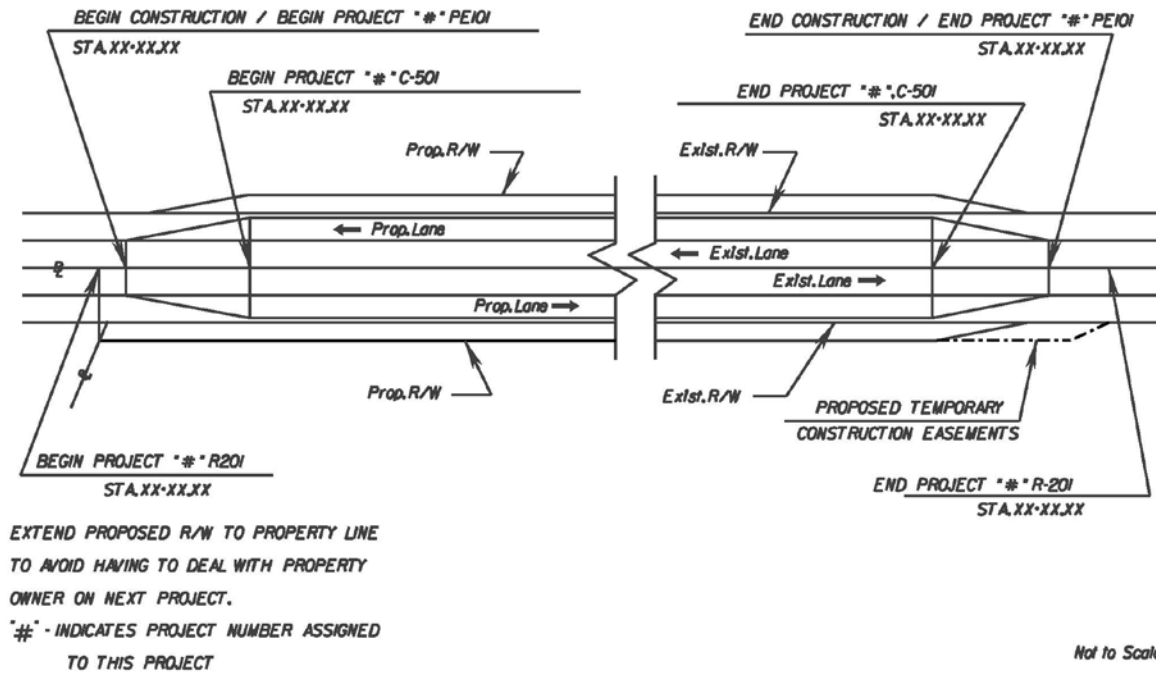
The transition area is the distance on the project from “Begin Construction” to the first full width and last full width template to “End Construction”, where required. There are no Design Exception or Waivers required in transition areas (see [IIM-LD-227](#)). Any deviation from the sketch in Figure 2D – 3 (there may be many) should be discussed at the Preliminary Field Inspection.

The project description (From: and To:) on the Title sheet located under the County/City name shall be as set forth by the Project Sponsor in Project Pool and should, in most cases, reflect the outermost Preliminary Engineering (PE) limits of the proposed work. Should project limits change during the development of a project, documentation should be sent to the Project Manager to inform them of the change and the revised limits should be updated in Project Pool.

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\* Rev. 7/15

*EXAMPLE OF PROJECT TERMINI  
(MAY VARY DEPENDING ON SITUATION)*



**FIGURE 2D – 3 SETTING PROJECT TERMINI**

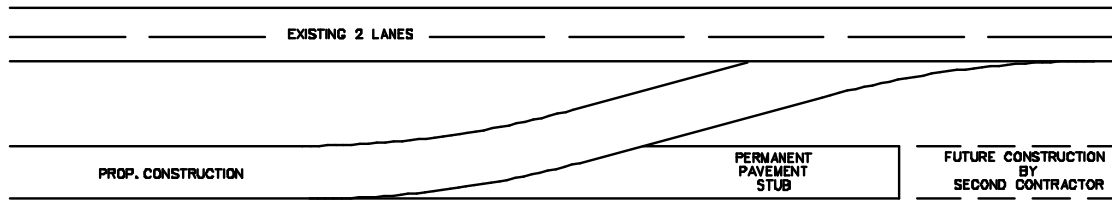
## PAVEMENT TERMINATION

On projects where dual laning is expected to be extended in the near future, provide for the stubbing of the pavement of the parallel lane. This practice allows the next project to tie in with a minimum of interference with traffic.

Do not provide the pavement stub if a period of over five years is anticipated, due to the deterioration of pavement which is not exposed to traffic.

Figure 2D - 4\* is a sketch outlining the method of pavement stubbing. This cannot be accomplished on every project due to super elevation required to tie into the existing pavement, or other circumstances. Pavement stubbing should be discussed in detail at Preliminary Field Inspection and comments noted in the Preliminary Field Inspection Report.

\* Rev. 1/15



**FIGURE 2D – 4 SUGGESTED PAVEMENT STUBBING TREATMENT**

### **PLOTTING CONSTRUCTION LIMITS**

Proposed and ultimate (where applicable) construction limits are to be plotted from cross section limits using short dashed lines for cuts and longer dashed lines for fills with "C" and "F" notations separating cuts and fills. A note should be placed on the plan sheets showing cut and fill symbols (See Sample Plan Sheets in Chapter 2H, Figures [2H-31](#) thru [34](#)).

Construction limits are to be plotted through entrances to the point of normal roadway construction. This distance is to be used for establishing right of way and easements. For entrances on which grades and cross sections are available, show any construction limits

Where rock slopes are used, construction limits for both rock slopes and normal slopes are to be plotted with proposed R/W encompassing normal slopes.

## **SECTION 2D-11 REQUEST FOR SUPPLEMENTAL DATA**

### **SOIL INVESTIGATION, PAVEMENT RECOMMENDATIONS AND STAKING**

The location (in [ProjectWise](#)<sup>\*</sup>) of plans, profiles, and typical sections, along with Form [LD-252](#) are sent to the State Materials Engineer requesting soil investigations, pavement recommendations, and staking data (if required). Request is to be made after Final Scoping.

If staking is required (after discussions with Materials Division), it should be so noted in the space provided for remarks on Form [LD-252](#), with a copy to the Assistant State Location and Design Engineer in charge of location.

### **BRIDGE DESIGN**

Form [LD-23](#), and the location of the plans pertaining to each bridge (title sheet, typical sections, plan and profile sheets) are to be sent to the Structure and Bridge Engineer after Final Scoping. Future requests because of changes can be noted via email with the UPC number and the Falcon location of the plans.

Bridge situation plans are to be requested from Central Office Survey Section at the time the survey is authorized ([PM-100](#)) for conditions where the roadway project ties to an existing bridge and/or major box culvert or passes under an existing bridge.

Bridge Situation plans are to show all revised alignment data, making certain that the alignment is clearly delineated to insure that the correct line is used in the design of the structure.

Structure and Bridge Division should be requested to provide this information a minimum of 30 days prior to the scheduled Public Hearing date.

### **PUBLIC HEARING DATA**

Form [LD-252](#) and the location of plans on Falcon are to be distributed (as noted on [PM-104](#)) to the applicable divisions whenever a combined Location and Design or a Design Public Hearing is required. Requests for data on Urban projects are the responsibility of the Local Assistance Division.

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\* Rev. 7/18

**SECTION 2D-12 CONSTRUCTABILITY QUALITY REVIEW**

For Constructability Quality Review Information See [Appendix E](#)\*

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\* Rev. 1/08

## **SECTION 2D-13 CONDUCTING THE PUBLIC HEARING**

### **THE PRE-HEARING MEETING**

Prior to the scheduled hearing, it may be desirable to hold an open forum meeting. This meeting will permit the public to review and discuss with Department and Municipal (or other) engineers and officials, particular points of concern to them and to become generally familiar with the project to be presented. Mosaics, typical sections and other displays to be presented at the public hearing should be available at this meeting, along with unapproved detailed plans. A properly conducted pre-hearing meeting may eliminate a great number of questions which would otherwise be asked at the formal hearing and will convey a sense of mutual concern between the Department and the public.

As many public hearings are held at night, a period of approximately two hours prior to the formal hearing should normally be provided for this discussion prior to the formal hearing.

If sufficient interest is anticipated, consideration should be given to holding the pre-hearing meeting on the night preceding the hearing; or, if the projects are controversial or of great magnitude, consideration should be given to holding one or more meetings approximately a week in advance of the formal hearing.

### **PROCEDURES FOR A FORMAL PUBLIC HEARING**

See Section 3.06 Public Involvement Manual\*

The District Engineer/Administrator, or a designated representative, moderates all formal public hearings except in rare circumstances when the Chief Engineer determines otherwise.

At the appropriate time, the engineering commentary (as described in Section 2D-7-PREPARATION OF ENGINEERING COMMENTARY) is presented. This presentation is made by a representative of the Location and Design Division, District Engineer/Administrator's office or the Local Assistance Division (on applicable projects). It is desirable to have the project designer, project manager, or a representative, assist in this presentation.

At the conclusion of the presentation, those present are afforded an opportunity to provide comments. Department representatives with expertise in the fields of right of way, environmental quality, etc. should be present and may be called upon by the moderator to answer general questions which may arise. Department representatives should remain as long as necessary at the conclusion of the hearing to discuss individual problems and questions relative to the project.

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\* Rev. 7/15



The moderator is to advise those attending the hearing that ten calendar days will be allowed from the date of the hearing for the submission of written statements to the Department for inclusion in the public hearing record. See Approval Process Flow Chart in the VDOT [Policy Manual for Public Participation in Transportation Project](#) for guidance on both Tier 1 and Tier 2 projects.

### **PROCEDURES FOR AN INFORMAL (OPEN FORUM) PUBLIC HEARING**

See Section 3.07 Public Involvement Manual\*

See Pre-Hearing Meeting Procedures on the previous page.

When the public hearing package is ready for submission to the Chief Engineer for approval of the public hearing (PM-130) must be completed and distributed to the Right of Way Division and/or the Environmental Division as appropriate. This should occur approximately 45 to 60 days ahead of the Right of Way submission date. This form will initiate the Right of Way Quality Control and/or the Environmental Re-evaluation process (except for Programmatic Categorical Exclusions). The Project Manager will be notified by email upon completion of the review. Upon receipt of the email, the Location and Design Project Manager will finalize the plans for Right of Way submittal.

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\* Rev. 7/15

## **SECTION 2D-14 RESOLUTION OF PUBLIC HEARING QUESTIONS**

### **REVIEW OF PUBLIC HEARING TRANSCRIPT AND POST- HEARING CORRESPONDENCE**

See Approval Process Flow Charts in the VDOT [Policy Manual for Public Participation in Transportation Project](#)\* for guidance on both Tier 1 and Tier 2 projects.

### **STUDY OF ALTERNATE SOLUTIONS**

Any item of concern requiring further investigation is to be studied by the designer or project manager and discussed with the localities (if appropriate) for possible solutions. All feasible solutions are to be explored, taking into consideration engineering judgment, economics, standard policies, etc.

### **RECOMMENDING A SOLUTION**

Upon reaching a conclusion as to the most feasible solution to an area of concern, the designer or project manager will furnish his/her recommendation to the District Location and Design Engineer.

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\* Rev. 1/13

## **SECTION 2D-15 PROJECT APPROVAL**

### **DESIGN APPROVAL**

On projects where Federal Funds are used to purchase ROW, when the Public Hearing package (Design or Combined Location and Design) is ready for submission to the Chief Engineer for approval, the **PM -130** must be completed and distributed by the Project Manager to the District Right of Way Manager. This should occur approximately 45 to 60 days prior to the Right of Way submission date. This Form initiates the Right of Way Quality Control Review process for Right of Way Authorization. The Project Manager will be notified by the District Right of Way Manager with an email that includes the RW-300 and 301 upon completion of the review. Upon receipt of this email, the Project Designer will make any necessary modifications, and finalize the plans for Right of Way authorization and the Project Manager will notify the District Environmental Manager with the **PM -130** that the plans are available for the Environmental Re-evaluation. Once the Environmental Re-evaluation (EQ-201 not applicable for Blanket Categorical Exclusions (BCE) or Programmatic Categorical Exclusion (PCE) projects) has been completed the Right of Way Quality Control Review for Right of Way authorization is complete. See Right of Way Re-evaluation Flow Chart:

<http://www.virginiadot.org/business/environmental.asp>

### **DISTRIBUTION OF PRINTS**

See Electronic Plan Submission @ [http://www.extranet.vdot.state.va.us/locdes/reference-guides/ElectronicPlan\\_Submission.pdf](http://www.extranet.vdot.state.va.us/locdes/reference-guides/ElectronicPlan_Submission.pdf)\*

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\* Rev. 1/15

## **FINAL ENVIRONMENTAL DOCUMENT**

On Federal-Aid projects, the final environmental document must be completed before location and/or design approval is granted by the FHWA. If the document was approved at the [Location Public Hearing stage](#), environmental requirements will have been satisfied (except as noted below in FHWA Approval) and no further action need be taken on the environmental document. If a Combined Location and Design Public Hearing was held, the [Project Manager\\*](#) will advise the [District Environmental Manager](#) of the Board Action and request that the final environmental document be completed. The designer is to furnish the Environmental Division with updated plans that reflect all modifications resulting from the public hearing process for their use in completing the environmental document.

## **FHWA APPROVAL**

Approval of the Final Environmental Document is the FHWA's concurrence with the project. If this was done at the [Location Public Hearing stage](#) for a Certification Acceptance Project, and following adoption of the major design features, the project may now be advanced to the Right of Way Acquisition Stage.

An update of the environmental document is required if significant changes in the project have taken place.

If a Combined Location and Design Hearing was held, the [Assistant State Location and Design Engineer](#) will notify the [appropriate FHWA representative](#) for their review prior to approving the Final Environmental Document. Following approval of the Final Environmental Document by the FHWA, the public is notified and the project may be advanced to the Right of Way Acquisition Stage.

## **REQUEST FOR APPROVAL OF MAJOR DESIGN FEATURES (FOR NON-CERTIFICATION ACCEPTANCE PROJECTS WHERE ENVIRONMENTAL DOCUMENT WAS APPROVED AT LOCATION PUBLIC HEARING STAGE)**

Following approval, the updated Final Environmental Document (if updating is necessary) is forwarded by the Environmental Division to the FHWA.

The [Public Hearing Certification](#) shall be forwarded to the FHWA along with the request for approval of major design features. The public is notified through the office of Public Affairs of the Department's request for approval and is also notified of the FHWA's response to the request.

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\* Rev. 7/11

Following approval of the major design features by FHWA, the project may be advanced to the Right of Way Acquisition Stage.

### **FINAL SCOPING CERTIFICATION**

Prior to the plans being signed for right of way (or construction when no right of way is needed), the Project Manager fills out a **Scoping\*** Certification **PM -131** form stating the project is within original scope or documentation as to deviations.

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\* Rev. 7/11