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CHAPTER 2C - PRELIMINARY DESIGN

SECTION 2C - 1 - PROJECT REVIEW

GENERAL

When the time arrives for presenting a project to the public through the public hearing process, it is the designer's 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, project funding and a reassessment as to the actual need and scope of the project.

SECTION 2C - 2 - COORDINATING TIME SCHEDULES

REVIEW OF WORK LOAD

Upon receipt of a project, the appropriate Assistant State Location and Design Engineer or District Location and Design Engineer, will review the work load of the design units and assign work accordingly.

The designer shall review the parameters of the project's functional classification, size and geographic location as shown in Project Pool.* The correct alignment length and elements of work should be reviewed for correctness.

ESTABLISHING PRIORITIES

The District Preliminary Engineer Manager, along with the District Location and Design Engineer will review the tentative schedules available and establish a priority for the work.

* Rev. 7/20

SECTION 2C – 3 - REVIEW OF DATA / SETTING UP FILES

REVIEW OF CORRESPONDENCE

All correspondence received with the project is to be carefully reviewed and checked for completeness.

SETTING UP AN ELECTRONIC CORRESPONDENCE FILE

All correspondence shall be kept in ProjectWise.* Copies of the correspondence can also be kept in a general file which is conveniently segregated.

SETTING UP AN ELECTRONIC ROUTE FILE

All project plan files shall be archived at each major milestone. See electronic plan submission process for major project milestones.
http://www.virginiadot.org/business/locdes/e-plan-submission-index.asp

* Rev. 7/20

SECTION 2C – 4 - PROJECT ASSIGNMENT AND FIELD RECONNAISSANCE

PROJECT ASSIGNMENT

Upon receipt of the survey data, the District Location and Design Engineer and the District Preliminary Engineering Manager will request that the design unit prepare the preliminary design. Assignment will be determined based upon the projected availability of manpower either in the district or the Central Office design unit.

PROJECT MANAGEMENT

The design unit responsible for design shall review the parameters of the project's functional classification, size and geographic location as shown on the report from Project Pool.* The correct project length, project numbers and elements of work shall be reviewed for corrections.

In order to identify early, any potential problem that may develop in meeting advertisement dates, the State Location and Design Engineer has delegated to the District L&D Engineer or the District Preliminary Engineering Manager to ensure that the advertisement schedule is carried out as planned. The State Location and Design Engineer, in conjunction with the District Engineer/Administrator, will conduct quarterly manpower assessments of the design functions utilizing the Location and Design Division's manpower planning system. In the event any problem in the procedures outlined above cannot be resolved, the problem will be resolved by the State Location and Design Engineer and the District Engineer/Administrator. If the problem cannot be resolved at this level, it will be referred to the Chief Engineer.

FIELD RECONNAISSANCE

Field reconnaissance procedures are to be followed on projects received for initial development. Projects, which have been through the Location Public Hearing process, should generally follow these same procedures depending upon the elapsed time between the hearing and receipt of the survey.

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* Rev. 7/20

SECTION 2C – 5 - PREPARATION OF PLAN AND PROFILE SHEETS

DRAFTING

All drafting will be accomplished in accordance with the VDOT *CADD Manual*. Care must be taken to clearly distinguish items. Items of great importance should stand out over those of lesser importance. A proposed drainage structure should readily be obvious as to its location by plotting the structure to scale, clearly showing construction baseline stationing and clearly showing the skew, if any, the flow arrow and the description. It is important that the complete description of the existing structure not be obliterated by the proposed information. Where items of this nature conflict with proposed items, it is most important that the information be moved to a suitable location where it can be readily distinguished. Therefore, the need for legibility, clarity and neatness cannot be over emphasized.

IDENTIFICATION

The first items to be shown on plan sheets are the applicable project numbers in blocks in the upper and lower right corners of the plan and profile sheets. 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: (L&D Survey Manager, Consultant Firm/VDOT Staff,* Firm and Date) (Date shall be the date the fieldwork was completed), Subsurface Utility Provided By: (Consultant Firm and Date) (Date shall be the date the fieldwork was completed), and Design By: (Responsible Person)

NUMBERING

Plan sheets are to be consecutively numbered beginning with "3". Match sheets for connection extensions, etc., are to be numbered "3B", etc., with the number corresponding to the applicable mainline plan sheet and the letter "A" reserved for the mainline profile sheets.

LAYOUT

Interstate, Arterial, Primary and Secondary plans are normally plotted on a scale of 1”=50’. Urban projects or other complex projects are to be plotted on a scale of 1”=25’. Plan sheets must be laid out with mainline stations increasing from left to right on the plan sheet. Anticipated proposed construction should be as near vertically centered as practicable, considering interchanges, connections, drainage, etc., with 28 inch lengths along the construction baseline for the proposed highway. Plan sheets are to be spaced longitudinally in order to show intersections entirely on one sheet where feasible and as much as possible of interchanges. A reasonable space, approximately 16 inches if feasible, is to be allowed at the beginning of the first plan sheet and at the end for the last plan sheet for possible extensions.

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* Rev. 7/20

BASELINE STATIONING

Station marks are to be shown on all baselines at 100 feet - Rural and 50 foot - Urban intervals, perpendicular to the baseline. Enter all alignments for new projects using the Departments current automated engineering design software OpenRoads Designer*. Circles are to be shown at each intersection point of two or more baselines, having these points as the center.

MATCH LINES

Match lines are to be shown perpendicular to the construction baseline at even construction stations. Stations and adjacent sheet number are to be shown at the beginning and end of each applicable plan sheet and at necessary points on connection and traverse baselines.

BEARINGS

Bearings are to be shown on each tangent or sub tangent segment on each plan sheet. If a tangent line extends for over half the length of the plan sheet, the bearing should be shown twice at equal intervals. Bearings should be shown so as not to conflict with station marks.

CURVE DATA

T.S.'s, S.C.'s C.S.'s, and S.T.'s on curves with spirals and P.C.'s and P.T.'s on curves without spirals are to be labeled along lines projecting from these points toward the center of the curve at a distance from the baseline adequate to clear anticipated proposed items and topography. P.R.C. lines may be projected toward either curve center point. Labeling is to be at an adequate distance from the baseline to clear anticipated proposed items and topography. Remaining curve data (degree; tangent; length; radius; curve stations superelevation rate (E), superelevation runoff (Lr), design velocity (V) and widening (W)) are to be shown on the inside of the curve, centered longitudinally and lettered along imaginary lines parallel to a line that would be tangent to the midpoint of the curve. Superelevation runoff (Lr) information is to be placed manually in the curve data. Curve data is to be shown as closely to the baseline as practicable, but beyond anticipated proposed items and topography. Complete curve data is to be shown on each sheet on which any portion of the curve appears. Curve data, including stations may, if necessary due to congestion, be located in other appropriate areas of the plan sheet. In these cases, the curve itself and the data are to be identified with a number ("1","2","3", etc.) inside a ¼ inch circle for existing and $^{5}/_{16}$ inch circle for proposed curve data.

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* Rev. 7/22

CONTROL* POINTS

Control points are contained on a survey data sheet, which is furnished by the survey processing unit.

REFERENCE BLOCK

A Reference Block is to be shown in the lower right corner of the plan sheet to designate the location of detail sheets associated with the plans (i.e.- plan profiles, entrance profiles, drainage descriptions sheets, etc.).

NORTH ARROW

A North Arrow is to be shown on each plan sheet in a conspicuous location.

SCALE

A bar scale is to be shown in the lower right corner of each plan sheet.

TOPOGRAPHY

All existing topography provided by VDOT Survey Section or Consultant in the planimetric file (sUPC#) is to be shown on the plans. Station pluses and distances are to be shown on the plans for items of great importance (such as property corners, iron pins, etc.) Survey staff is responsible for providing all stations and offsets to all monumentation found once final construction centerline is completed. In critical areas, distances only are shown to other items of topography (such as the closest corner of buildings in critical areas are to be shown similarly. All existing drainage structures are to be shown as they are provided in the survey planimetric file. An effort must be made to keep annotation close enough to the item to readily identify it, but beyond anticipated proposed items.

UTILITIES

All available existing utility information provided in the SUE file (suUPC#) is to be shown on the plan. The designation for all underground utilities should be shown frequently on the plans to easily identify the type of underground utility. Overhead utility lines, except for high voltage transmission lines, are not to be shown. It is extremely important that all invert and rim elevations for sanitary sewer manholes (SMH) be shown. At connecting roadways or other points where gravity sanitary sewer facilities leave the project corridor, it is essential to show the next manhole with its elevations. A note is to be shown in the upper left corner of the plan sheet listing owners of each utility shown on that sheet.

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* Rev. 7/20

RIGHT OF WAY

All existing right of way acquired in fee will be shown on plans as established by the survey information or other data. The plans should not designate prescriptive or statutory right of way as existing right of way. It is not necessary to show entire property boundaries on plans. Property lines and lot lines are to be shown as provided in the survey file (sbdUPC#).* All available information is to be shown on the plans in this respect (bearings, distances, lot numbers, all data used for plotting, etc.). This information is to be individually labeled, whether "survey" or "plat" information. Property line symbols are to be shown on all property lines. (Note: This information shown already be provided in the survey file, coordinate with survey if not shown.) Property owners' names are to be shown in conspicuous locations within each applicable property, along with deed book numbers, page numbers, and total acreages. This information can be obtained from the spoUPC# file provided by survey. Distances, bearings and curve information (metes and bounds) are to be shown for the entire periphery of take on all properties owned by U.S. and state agencies; National Forests; Railroads and Power Companies. For more information see Chapter 6 in the *Survey Manual*.

ROAD AND STREET NAMES

Road and street names are to be shown on plans and in correspondence in addition to route numbers. The name is to be shown below the route number block in the upper right hand corner of all plan sheets and, if feasible, the name is to appear within the roadway limits.

Otherwise, the name is to be shown on the plan sheet in close proximity to the road or street. This procedure is of particular value to field personnel and area residents who can more easily identify existing thoroughfares by road or street names rather than by route numbers. Individual lot numbers, where assigned, are to be shown in cities, towns and built-up areas. If lot numbers have not been assigned, the block numbers should be prominently shown. Lot numbers should be shown within the limits of the building, if possible. If not, they should be shown as close to the buildings as practicable.

SITE PLANS

Site plans for developments to be constructed during the plan development process will not be shown on roadway plans until the development construction is complete and the site has been surveyed in the field.

PLOTTING OF PROFILE SHEETS

Profile sheets are to be plotted at this stage using the base sheet available from the Automated Engineering Section and in accordance with the following:

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* Rev. 7/20

IDENTIFICATION OF ITEMS ON THE PROFILE SHEETS

The first items to be shown on the profile sheets are the applicable project numbers in the preprinted blocks. 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: (L&D Survey Manager, Consultant Firm/VDOT Staff*, Firm and Date) (Date shall be the date the fieldwork was completed), Subsurface Utility Provided By: (Consultant Firm and Date) (Date shall be the date the fieldwork was completed) and Design By: (Responsible Person)

NUMBERING OF PROFILE SHEETS

Profile sheets are to be consecutively numbered beginning with "3A", with the numerical digit corresponding to the applicable plan sheet. Profile sheets for connections, ramps, etc., are to be appropriately numbered and lettered with numerical digit corresponding to the mainline plan sheet.

PROFILES

Stationing of profiles is to match the station of the applicable plan sheet. Station numbers are to be shown in the space provided immediately below the ruled portion of the sheet. 500 feet stations and the first and the last stations on all sheets are to be shown in their entirety. Only the last digits of other stations are to be shown. Applicable elevation data information is to be shown in the upper left corner of the first profile sheet. Normally, the vertical scale of the profile sheet is 1"=10' Rural, 1"=5' Urban. Elevations are to be shown in the spaces provided both left and right at 10-foot intervals on the heavy ruled lines. Elevations are to be shown to encompass the high and low extremities of the profile line. The profile line is to be centered vertically as nearly as practicable; allowing space at the bottom of the sheet for proposed finished grade elevations. A profile line of the existing terrain is required for each construction baseline shown on the plans. Existing terrain profiles for survey baselines are to be shown where deemed appropriate by the designer and shown as long dashed lines. Profile lines are to be plotted at appropriate intervals, whether or not a cross section is taken at the particular plus or not, except for drainage sections reflecting flow line elevations, which are not to be shown on the plans. Profile lines are to be plotted as a solid line with straight segments connecting the plotted points. Connection route numbers, street names, railroads, etc. are to be labeled at appropriate stations along the mainline profile. Where individual profile sheets are required for connections, etc., the connection route number and street name is to be clearly shown in the upper right corner of the sheet.

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* Rev. 7/20

In order to provide water level information on the highway plans that is complementary to other project documentation, only the following data are to be shown on the profile sheets when the project crosses or parallels a waterway:

1) Ordinary High Water is to be shown in lieu of normal water on non-tidal stream crossings. Normal water elevations provided by field survey will not be shown. The ordinary highwater elevation will be supplied by the appropriate drainage engineer.

(2) Mean high tide and mean low tide will be shown on all tidal stream crossings. These elevations will be supplied by the appropriate drainage engineer. The tidal data provided by field survey or other source will not be shown.

(3) The maximum historical highwater elevation will be shown for all stream crossings where such data is available. The plan designation shall read high water elevation, date of occurrence, flood frequency if known, e.g., High Water Elevation 465.3' August 1940, 50 year ± flood. The flood frequency will be determined by the appropriate drainage engineer.

BENCH MARKS AND PERMANENT TURNING POINTS

All benchmarks and permanent turning points, are to be shown on the survey data sheet. All survey processing units have the facilities to develop the survey data sheet. All survey plan assemblies will include the sheet(s).

HORIZONTAL TRAVERSE* AND VERTICAL CONTROL DATA

- A Survey Data Sheet containing the projects horizontal survey traverse, control points and vertical controls, along with corresponding control data is furnished along with the project survey plan sheets by the Survey Section. The Survey Data Sheet eliminates the need to show horizontal traverse, points and bench marks on the plan and profile sheets. Note: The horizontal and vertical control points shall be shown on the RW series sheets for clarity. (See Chapter 2H, Figure 2H-8 for sample sheet)

- A Horizontal Construction Alignment Data Sheet plotted from the alignment data files, will be utilized on all projects. (See Chapter 2H, Figure 2H-9 for sample sheet)

- The sheet(s) will be made a part of the plan assembly in accordance with the guidelines contained in the Road Design Manual (Section 2E – 6 – Preparation of Supplemental Sheets – Index of Sheets).

- Projects not requiring Alignment Data include Landscape, Signal, Maintenance and projects without surveys.

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* Rev. 7/20

SECTION 2C – 6 - DEPICTING TENTATIVE DESIGN ON PLANS

PREDETERMINED DESIGN

On projects on which a location public hearing has been held, preliminary design is to be shown on the plans along with any necessary adjustments needed to conform to the current Road and Bridge Standards or necessary development. Items in Sections 2B-1-GROUND SURVEYS and 2B-2-COORDINATION WITH OTHER DIVISIONS AND AGENCIES should be reviewed and updated if necessary.

INITIAL DESIGN

Projects without prior horizontal and vertical design are to be studied in accordance with instructions in Sections 2A-6-STUDY OF ALL ALTERNATES, 2B-1-GROUND SURVEYS and 2B-2-COORDINATION WITH OTHER DIVISIONS AND AGENCIES. The substitution of "plan of development" for the word "corridor" will render these sections applicable for this phase of the project.

FRONTAGE ROAD (SERVICE ROAD)

On surveys where limited access is proposed or anticipated, properties that will be landlocked due to the control of access are to be noted on the survey roll, on the data collector, or in the data file. A comprehensive study is required to determine if it is in the public interest to construct a frontage road, having determined the estimated construction cost, which is to include any additional right of way and anticipated maintenance cost. This cost is then to be compared with the estimated damages that would be paid if access were not provided to the landlocked property to determine justification.

On the Interstate system, where service roads are parallel to, or visible from the roadway, the Interstate slope design is to be used, except where the cost would be excessive or where it would not be practical, such as in mountainous terrain.

After preliminary scheme(s) and grades have been developed, the designer will make plans available in ProjectWise*. The Transportation and Mobility Planning Division will be requested to obtain the design year traffic volumes, the Materials Engineer will be requested to provide preliminary pavement design, and the Right of Way Engineer will be requested to provide the Frontage Road Study Form CE7 (if applicable).

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* Rev. 7/18

After receipt of information, the design is to be finalized to the extent necessary to determine justification to construct. The construction estimate, including additional right of way (see Form CE7) and maintenance (annual cost per mile x length x 2) is to be compared to the damage figure shown in column 5, Form CE7. Since the annual cost per mile for maintenance will vary from county to county and year to year, the Asset Management Division is to be consulted. To arrive at the maintenance cost, the annual cost per mile x length is doubled in consideration of two treatments within 10 years.

Projects with Federal Highway Administration participation require concurrence prior to construction. A set of prints transmitted by letter stating the estimated cost, accompanied by a copy of Form CE7 is to be submitted requesting approval. A copy of this request is to be retained in the project file.

Whenever a service road or other road, which is to be maintained by others, is to be constructed in a municipality or in the two counties, which maintain their own networks, the construction is to conform to the requirements, both structural and geometrical, of the particular city or county. Full Federal Highway Administration approval is also to be obtained for this work and the design should be an integral part of the plans from the earliest stage.

OPERATIONAL / CAPACITY ANALYSIS*

If the project has been through the location study stage, the capacity stage checks previously documented should be reviewed and updated if necessary.

For projects that have not been through this stage, the capacity analysis as indicated in Section 2B-3-DETERMINATION OF ROADWAY DESIGN should be performed.

In addition, the designer should now proceed with the following:

Major at-grade intersection capacity checks:
1. Overall intersection level of service.
2. Level of service for each approach.
3. Number and length of turning lanes.
4. Pedestrian and bicycle influence.

Interchange capacity checks:
1. Basic ramp level of service.
2. Ramp termini level of service.
3. Entrance - exit levels of service.
4. Weave - merge lengths and widths.
5. Acceleration - deceleration lane lengths.

* Rev. 1/12

SECTION 2C – 7 - SOLICITING COMMENTS WITHIN DIVISION AND COMPLETING DESIGN

SOLICITING COMMENTS WITHIN DIVISION

In order that all disciplines within the Location and Design Division are given an opportunity to provide input into the total design, plans are made available through ProjectWise*, for review prior to Preliminary Field Inspection. The Hydraulics Section must review the preliminary design plans at this stage and furnish recommendations, comments, and questions relative to drainage that are pertinent to the Preliminary Field Inspection and the resolution of a proper design. The appropriate design section must review the design for conformity to current VDOT *Road and Bridge Standards* and make recommendations concerning the design features shown.

INCORPORATING COMMENTS INTO DESIGN

Upon receipt of comments, questions and recommendations, they are to be reviewed and a common solution determined and shown as the Division's proposals on the preliminary design scheme of development. Should time not permit the resolution of these matters, they are to be discussed at the Preliminary Field Inspection. In any event, the Preliminary Field Inspection is to consider all input that could lead to the most feasible scheme of development.

* Rev. 7/18