

# **DESIGN DEVELOPMENT**

## **CHAPTER 300**

### **301 DESIGN DEVELOPMENT**

This Chapter describes the Consulting Engineer's involvement in the preparation of a set of contract documents from the beginning of the preliminary engineering studies to the completion of final design. The Consulting Engineer shall be concerned only with those design phases that are required to be prepared under the terms of the Agreement.

As the design progresses, the Consulting Engineer will be required to make periodic submissions, attend review meetings and respond to written comments, as described herein. In addition to the formal review meetings, additional meetings will be held as deemed necessary by the Department. All plans and computations prepared by the Consulting Engineer shall be checked before submittal to the Department for review.

All comments received from the Department shall be incorporated into the design prior to the next submission, or otherwise mutually resolved.

The material to be provided at each periodic submission, including the typical number of copies of each, is indicated in the following sections of this chapter. Actual number of copies will vary from project to project, and should be coordinated with the Project Engineer prior to each submission. Material prepared by the Department for inclusion in the contract documents will be supplied to the Consulting Engineer in singular quantity; however, the Consulting Engineer shall duplicate this material in the quantity indicated under each applicable submission.

Specific elements of design referred to in this Chapter, such as Geometry, Structures, Hydraulics and Drainage, Traffic, and Soils and Foundations are described in greater detail in Chapter 400 (Design Elements).

### **301.01      ESTABLISHMENT OF MILESTONE DATES**

The Department will establish a project schedule at the time of the initial Notice to Proceed outlining milestone dates as follows (all items may not apply):

1.            Start of Survey/Preliminary Engineering
2.            Preliminary Engineering Studies Submission
3.            Start of Preliminary Design
4.            Baseline Development Submission
5.            Preliminary Design Submission
6.            Structure Type Studies Submission
7.            Start of Final Design
8.            Drainage Submission
9.            Structure Layout for Design Submission
10.          Permit Application Submission
11.          Property Maps Submission
12.          Semi-Final Review Submission
13.          Final Plans for Review Submission
14.          Final Design Submission

The Department's Project Manager will review the progress to date at each milestone and will provide revised submission dates, if required, to the Consulting Engineer.

### **301.02      REPORTS OF MEETING**

All meetings attended by the Consulting Engineer with other State agencies, utilities or municipalities shall be documented by a written "Report of Meeting" which is to be forwarded to the Department for approval.

The written report shall document all problems, determinations and all conclusions with areas of responsibilities noted. The Consulting Engineer shall submit the report to the Department within four working days for approval.

### **301.03      INCORPORATION OF DEPARTMENT'S REVIEW COMMENTS**

The Department will review the Consulting Engineer's various submissions and will forward the review comments to the Consulting Engineer.

The Consulting Engineer shall submit to the Department the resolution of all review comments prior to the next design review submission. This will be done by indicating which comments have been incorporated into the design of the project and which ones have not on a copy of the review comment sheet.

Any comment that is not incorporated into the design must be justified. The Consulting Engineer shall notify the Department of any comments that will not be incorporated into the design in advance of the next review submission. If the justification is not acceptable to the Department, the Department will notify the Consulting Engineer accordingly.

The Consulting Engineer should review comments for conflicts with previous determinations or conflicts from different review units. The Consulting Engineer will contact the Project Engineer to resolve such conflicts as soon as they are identified.

The Project Engineer may arrange a post-review meeting with the Consulting Engineer and respective Department units to discuss resolution of comments.

Responses to previous comments and marked-up plans, specifications or other data should be submitted with subsequent review submissions to facilitate the review process.

### **302      PRELIMINARY ENGINEERING STUDIES PHASE**

The Consulting Engineer shall make a thorough review of all material furnished or referred to at the assignment meeting including the Environmental Statement, Corridor Public Hearing, and the scope of work established at the Assignment Meeting. Utilizing the conclusions contained therein, the Consulting Engineer shall develop preliminary plans and profiles. The horizontal alignment shall be refined from the given sketch plans,

generally within the designated corridor. The vertical alignment shall be studied with a view toward minimizing the impact on the affected area. Over-under relationships at structure crossings shall also be investigated. The location of interchanges will be determined by the Department; however, the Consulting Engineer shall study the configuration for each interchange.

Hydraulic crossings are to be assessed for potential floodplain management impacts as further described in Section 303.02 (Preliminary Design). This information should be documented and evaluated in the Preliminary Engineering Statement.

The Consulting Engineer shall submit 1:2500 scale preliminary plans, profiles, typical sections and supporting data in such detail that the geometric, operational and intersection features are clearly defined.

The Preliminary Engineering submission shall consist of the following material:

1. Prints of all plans, profiles and typical sections - 15 copies.
2. Preliminary Engineering Statement, sketches, a summary of the studies undertaken and the advantages and disadvantages of the various alternates considered - 10 copies.
3. Annotated print of all plans, profiles and typical sections to be displayed at the Preliminary Engineering review meeting, prepared in accordance with the guidelines contained in Section 309 (Presentation of Material at Meetings) - 1 copy.

After this material has been reviewed by the Department, a Preliminary Engineering review meeting will be held to convey the Department's comments to the Consulting Engineer. The comments will also be forwarded to the Consulting Engineer in writing.

The Consulting Engineer shall not proceed into the Preliminary Design Phase until written authorization is received from the Department.

### **303 PRELIMINARY DESIGN PHASE**

#### **303.01 BASELINE DEVELOPMENT**

The Consulting Engineer shall develop a 1:500 scale graphical baseline and profile for each road to be constructed or reconstructed within the project. The baselines shall reflect the project description and applicable design standards.

Some items to be considered when establishing baselines are:

1. Historic areas
2. Existing and proposed utilities
3. Other proposed state/town projects
4. Locally sensitive areas
5. Zoning - future development
6. Open space
7. Detours, maintenance and protection of traffic, and constructability.
8. Wetlands, floodways, floodplains and stream channel encroachment lines
9. Navigable waters
10. Property impacts (including commercial usage such as parking and access)

The Department will arrange a meeting with the town, if necessary. This meeting may also be combined with the Town Roads meeting.

A baseline submission will generally be required only for those projects on new location. Pavement edges and/or rights-of-way limits at critical points will be indicated.

The Baseline Submission shall consist of the following material:

1. Prints of all plans and profiles - 5 copies
2. Brief narrative explaining the controls used to establish the baseline, alternatives considered and reasons for the selected alternate - 5 copies.

#### **303.02 PRELIMINARY DESIGN SUBMISSION**

The Consulting Engineer shall develop preliminary plans, profiles, typical sections and supporting data for the proposed roadway, bridges and appurtenances within the limits of the assigned project. The consultant will make a Preliminary Design Submission when the project is approximately 35% complete. The plans and profiles should be drawn

1:500 scale unless directed otherwise by the Department. A detailed description of the information to be shown on the plans and profiles is given at the end of this section.

A Town Roads meeting will be scheduled by the Department to: a) identify community concerns; b) present conceptual project plans to the town; and c) describe Department Policy on items requiring Town financial participation, if applicable. The Consulting Engineer may be required to attend this meeting.

The Consulting Engineer shall develop appropriate structure studies, showing the type and location of the substructure elements and superstructure details as they affect highway geometry.

Sufficient pilot borings and other subsurface investigations necessary to develop a satisfactory Preliminary Design shall be obtained, and a Detailed Soils Program prepared, if these items are included in the assignment.

A preliminary concept for Maintenance and Protection of Traffic shall be indicated on 1:2500 scale plans and described in narrative form, and a preliminary signing plan shall be indicated on 1:2500 scale plans, if these items are included in the assignment.

An assessment of all hydraulic crossings (tributary area greater than one square mile or the subject of a detailed study in the applicable Flood Insurance Study (FIS)) will be made by the designer to determine if a regulatory floodway is in effect at the site of the proposed activity. This will be accomplished through inspection of the Flood Boundary and Floodway Map (FBFM) or Flood Insurance Rate Map (FIRM), as appropriate, for the area in question. Current FBRM or FIRM map panels for communities participating in the National Flood Insurance Program are available at the DEP Inland Water Resources Unit, the DOT Hydraulics and Drainage Unit and the DOT Office of Environmental Planning. The maps are also available at the appropriate town/municipal office. If the initial map inspection reveals possible floodway involvement, every effort will be made by the designer to eliminate any such conflicts.

The Consulting Engineer, through the Project Engineer, shall meet with a Fish Biologist from the Department of Environmental Protection to review all streams and determine which crossings and channels will be designed for fish passage. This meeting will be held prior to the Preliminary Design submission and prior to preparing the hydraulic

design.

Prior to the Preliminary Design review meeting, the Consulting Engineer will field review all watercourses and wetlands to determine their water quality and to review the drainage areas for size and runoff characteristics.

The Consulting Engineer shall determine drainage areas. The Consulting Engineer shall notify the Project Engineer of all drainage areas over one square mile and coordinate any anticipated retention studies. The determination and submission of the drainage areas over one square mile and anticipated retention studies are to be accomplished as soon as possible after the start of Preliminary Design to allow ample time for the hydraulic design. This information should be documented in the Preliminary Design Report.

The Hydraulics and Drainage Section will provide input concerning the type of structure, location and elevations to be used for all hydraulic crossings. The Consulting Engineer will incorporate this data in the final plans and will be responsible for the layout and structural design of these structures and estimating of the necessary quantities.

The Consulting Engineer shall develop an erosion and sedimentation control plan for the Preliminary Design meeting. This plan will depict all locations to be protected and the type of protection being proposed. Drainage computations and an estimate of quantities are not required; however, the proposed drainage pattern of pipes, ditches and swales should be shown. Following the Preliminary Design Review, another field review will be held with the Project Engineer and/or his designees for the purpose of reviewing the proposed sedimentation controls. Sedimentation and erosion control plans will be required for the final plans.

A Preliminary Design Report shall be prepared which describes the proposed design in detail. A list of items to be included in the Preliminary Design Report is offered later in this section.

A preliminary construction cost estimate, based on the Department's most recent weighted unit prices, shall be prepared. Preliminary estimating guidelines developed by the Department shall also be utilized. A copy of these guidelines may be obtained from the Project Engineer. The estimate shall include the cost of constructing detours and providing for maintenance and protection of traffic. The estimate shall be prepared utilizing a uniform

format, a sample copy of which will be provided by the Project Engineer upon request.

The Preliminary Design Submission shall consist of the following material:

1. Prints of all plans, profiles and typical sections - 18 copies
2. Annotated print of all plans, profiles and typical sections for display at the Preliminary Design Review Meeting prepared in accordance with the guidelines contained in Section 309 (Presentation of Material at Meetings)
3. Proposed Subsurface Exploration Program - 5 copies
4. Hydraulics Report - 2 copies
5. Preliminary Proposal Estimate - 5 copies
6. Preliminary Design Report - 18 copies

After the material has been reviewed by the Department, a Preliminary Design Review Meeting will be held to convey the Department's comments to the Consulting Engineer. The Consulting Engineer shall formally present the Preliminary Design plans at this meeting. The Department's written comments will also be forwarded to the Consulting Engineer.

The Consulting Engineer shall not proceed into the Final Design Stage until written authorization is received from the Department.

**303.03            INFORMATION TO BE SHOWN ON PRELIMINARY  
DESIGN PLANS, PROFILES AND TYPICAL SECTIONS**

1. Beginning and end of project
2. Horizontal curvature - radii, PC's, PT's
3. Direction of travel
4. Traffic volumes
5. Design classification of roadways
6. Design standards used for project
7. Design speed - maximum speed taking into account all elements including intersection sight distance, sightline obstructions such as rail, fence, etc. The Designer shall state that the stipulated design speed meets all applicable criteria. If the stipulated design speed is not met, the Designer must clearly show and explain the element that does not meet the applicable criteria.
8. Names of all roadways, rivers and streams
9. Beginning and end of vertical curves
10. Typical cross section of proposed structure near location on plan

11. Climbing Lanes
12. Special drainage provisions, sedimentation basins and major culverts
13. Approximate slope limits
14. Lane arrangement on all roadways
15. Lane arrangement at all legs of all intersections
16. Non-access lines (complete and dimensional to baseline)
17. Taking lines and property lines
18. Traffic control at intersections (existing and proposed)
19. Intersection sight distance
20. Need for guide rail
21. Sidewalk ramps
22. Proposed locations for all utilities which are to remain above ground
23. Stationing
24. Restrictive horizontal sight distances
25. Noise barriers
26. Inland Wetland Limits

### **PROFILES**

1. Beginning and end of project
2. Vertical curvature - design speed, PVC, PVT, LVC, K value
3. Percent grade
4. Direction of travel (on one direction roadways)
5. Sight distance to all bifurcation points
6. Existing ground line and existing structures
7. Horizontal curvature
8. Climbing lanes
9. Structure locations and minimum vertical clearances
10. Stationing

## TYPICAL SECTIONS

1. Number of lanes
2. Lane width
3. Shoulder width
4. Median width
5. Climbing lanes
6. Superelevation
7. Traffic barriers and guide railing
8. Cross slope
9. Pavement depth
10. Pavement composition
11. Curbing
12. Sideslopes
13. Sidewalks (location and width)

### **303.04      INFORMATION TO BE CONTAINED IN THE PRELIMINARY DESIGN REPORT**

1. General description of project and project limits
  - a. Length
  - b. Structures
  - c. Detailed description of each facility
2. Geometric Detail - Provide the value of each of the following elements proposed for the project and the maximum or minimum provided in the Highway Design Manual, AASHTO, or other standards.
  - a. Design traffic volumes (ADT and DDHV)
  - b. Design classification - Design standards (ConnDOT and/or AASHTO)
  - c. Design speed
  - d. Posted Speed
  - e. Operating Speed
  - f. Maximum allowable curvature for classification
  - g. Maximum grade
  - h. Maximum superelevation

- i. Minimum stopping sight distance
  - j. Lane width
  - k. Shoulder width
  - l. Pavement type and composition
  - m. Horizontal alignment
  - n. Vertical alignment
3. Configuration of each interchange or intersecting street
  4. Location and minimum vertical clearance for each structure
  5. Climbing lanes (including lengths, transitions)
  6. Railroad involvement
  7. Right of way
  8. Noise walls
  9. Utilities
  10. Preliminary concepts
  
  11. Justification for any proposed drainage design which does not conform to standards or drainage policies, such as special structures, water diversion, use of dry wells, storage or pumping facilities
  12. Sedimentation and erosion control
  13. Intersection analysis (including level of service determination)
  14. Maintenance and protection of traffic
  15. Sequence and limitation of operations
  16. Modifications to Department's sketch plans or preliminary engineering plans
  17. Substandard features and their need for exception to design standards
  18. Commitments contained in Environmental Documentation
  19. Construction cost estimate and comparison to initiated amount
  20. Location plan (8 ½ X 11)
  21. Typical sections (reduced to 11 X 17 maximum)
  22. A recommendation of the need for illumination. If a need is identified, the limits of proposed illumination and a determination of ownership of proposed illumination (i.e. D.O.T., Town/City, Utility Co.) should be included.
  23. Water resource impacts
  24. Historic impacts

25. Accident experience
26. Permit involvement

### **303.05      STRUCTURE TYPE STUDIES**

If a new structure has been determined to be necessary by the Department, the Consultant shall prepare a Structure Type Study during Preliminary Design in accordance with the "Bridge Design Manual." Nine copies of the study report shall be submitted for Departmental Review.

After the Preliminary Design Review Meeting is held, a joint meeting between the Department and the Consulting Engineer will be held to review the structure type studies and determine which structure type will be advanced to Final Design. The Consulting Engineer will provide any additional studies, sketches and cost estimates as required by this review.

Upon approval of the selected structure type and when given authorization to proceed with Final Design, the consulting Engineer will be authorized to proceed with the preparation of Structure Layout for Design (SL/D) plans.

### **303.06      REHABILITATION STUDY REPORTS**

When an existing highway, pedestrian or railway bridge is to be retained, a condition survey and rehabilitation study report shall be prepared (in lieu of a structure type study) during Preliminary Design in accordance with the "Bridge Design Manual." Nine copies of the study report shall be submitted for Departmental review.

After the Preliminary Design Review Meeting is held, a joint meeting between the Department and the Consulting Engineer will be held to review the rehabilitation study and determine the appropriate course of action with respect to the structure that will be advanced to Final Design. The Consulting Engineer will provide any additional studies, sketches and cost estimates as required by this review.

Upon approval of the selected course of action, and when given authorization to proceed with Final Design, the Consulting Engineer will be authorized to proceed with the preparation of Structure Layout for Design (SL/D) plans.

### **303.07      DESIGN EXCEPTION DOCUMENTATION**

Subsequent to the Preliminary Design Review Meeting, the Consulting Engineer shall prepare justification to be submitted to the Design Exceptions Committee for each substandard design element identified in the Preliminary Design Report. The Consulting Engineer may be asked to present its case to the committee for approval. The Consulting Engineer should request the current list of design exception elements from the Project Engineer.

## **304      FINAL DESIGN PHASE**

### **304.01      SEMI-FINAL DESIGN SUBMISSION**

This submission occurs when the project is approximately 60% to 70% complete and pertains predominantly to non-structural drawings. See Section 304.02 for Structural Submission.

A primary focus of the submittal is to illustrate incorporation and/or resolution of all Preliminary Design comments. Additionally, all horizontal and vertical control should be mathematized, and all Rights of Way needs, including temporary as well as permanent encumbrances, should be accurately defined with this submission. Property Maps shall be submitted for review within 30 days after this submission.

The submission shall include the drainage design for review by the Department in accordance with the criteria established in the Department's "Drainage Manual." **A separate, earlier drainage submission (at approximately 50% completion) may be required if the drainage design is particularly complicated, requires significant right of way and/or otherwise might jeopardize the schedule of the project.**

All hydraulics and/or drainage computer programs which are to be used shall be submitted to the Department for approval. Documentation required for approval is outlined in Section 404 of this manual. It is essential that an early approval be obtained, prior to the use of these programs, in order to preclude delays in the design of the project. The plan sheets shall indicate the size of culverts, design discharge (Q) for each culvert, invert

elevations, drainage structure and its design discharge, outlet elevations, channel or ditch treatments and proposed drainage easements and watershed areas. "On-board" reviews may be conducted to review the drainage design and to advise the engineer.

Existing drainage systems shall be analyzed for adequacy to meet the proposed conditions and, if found inadequate, will be designed in conformance with the criteria established in the "Drainage Manual."

The Semi-Final submission shall include Maintenance and Protection of Traffic plans and Sequence and Limitation of Operations plans.

1. Site Access assumptions
2. Traffic Management assumptions
3. Water Handling assumptions
4. Specialized equipment and/or construction method assumptions
5. Subsurface condition assumptions

The Semi-Final Design submission shall consist of the following material (confirm number of copies with Project Engineer):

1. Prints of all (non-structural) plans, profiles, cross sections and drainage details - 18 copies
2. Drainage computations - 2 copies
3. Contour map(s) showing contributory areas to each drainage inlet - if such areas extend off the construction plans - 1 copy
4. Roadway Soils Report - 4 copies
5. Special provision(s) for Maintenance and Protection of Traffic and Sequence and Limitations of Operations - 6 copies
6. Traffic control signal calculations and supporting materials (see Sec. 406)
7. Semi-Final Design Report - 18 copies
8. Cost Estimate - 6 copies

After the Department completes its review, a meeting may be arranged to discuss the comments. The Department will forward a copy of the written comments to the Consulting Engineer.

### **304.02      STRUCTURE LAYOUT FOR DESIGN (SL/D) SUBMISSION**

Upon approval of the Structure Type studies and/or the Rehabilitation studies, and following notification by the Department authorizing the start of Final Design, the Consulting Engineer shall prepare Structure Layout for Design (SL/D) Plans for all bridges, box culverts, and retaining walls in accordance with the "Bridge Design Manual."

The Consulting Engineer shall submit the following information for all structures:

1. Prints of SL/D drawings - 11 copies
2. Soils and Foundation Report with boring logs - 3 copies
3. Structure cost estimates - 3 copies

For bridges over or under a railroad, add the following:

1. Two additional sets of the SL/D plans
2. Two additional copies of the cost estimates

If the project has full Federal oversight (confirm with project Engineer), add the following:

1. Two additional sets of the SL/D plans
2. Two additional copies of the Soils and Foundation report with boring logs
3. Two additional copies of the cost estimate

### **304.03      FINAL PLANS FOR REVIEW SUBMISSION**

This submittal occurs when the project is approximately 85% to 90% complete. This submittal should include all items associated with a complete bid package, including all contract plans, specifications and estimates. To facilitate the Department's review process, Consultant is to make coincident but separate highway and structure submissions.

The Consulting Engineer shall also include a completed copy of the latest Quality Control Checklist. A copy of the most current Quality Control Checklist can be obtained from your Project Engineer. The Consulting Engineer shall submit the contract drawings in the format described in the Department's CADD Manual. The submission must incorporate or address the comments from the Semi-Final Design submission.

## **HIGHWAYS**

The Final Plans for Review (FPFR) submission shall consist of the following material (confirm number of copies with Project Engineer):

1. Prints of contract drawings (less Structures drawings) - 18 copies
2. Special Provisions (non-structural) - 18 copies
3. Proposal Estimate (complete with structural items)- 18 copies
4. Federal Proposal Estimate (complete with structural items) - 18 copies
5. Design Statement - 18 copies
6. Roadway Soils Report and Foundations Report for Structures - 3 copies
7. Final Hydraulics Report - 3 copies (with 3 ½" diskette)
8. Final Scour Evaluation Report - 3 copies
9. Final Drainage Computations - 3 copies
10. Complete computations and quantity estimates supporting the submission - 3 copies
11. Construction cost estimate for the project including a separate estimate for each structure. Each structure cost estimate shall be divided into footings, substructure, superstructure and temporary construction- 3 copies
12. Utility Estimate - 3 copies
13. Calendar Day Chart (A draft shall be submitted to the Department along with progress prints, four weeks prior to FPFR Submission so initial comments can be incorporated) - 18 copies

## **STRUCTURES**

The Consulting Engineer shall submit the following structure related items separately:

1. 12 sets of Structural Plans (Signed, per the Bridge Design Manual)
2. 4 sets of Structural Special Provisions
3. 2 copies of the proposal estimates (Structural items only)
4. 5 copies of the Soils Reports - Structure
5. 3 sets of design computations
6. 2 copies of estimated structural steel weights
7. 2 copies of structure costs

If Federal funds are used on the project, the number of each of the preceding items

shall be increased by one.

After the Department completes its review, written comments will be given to the Consulting Engineer for resolution.

All projects which involve railroads are to have a railroad coordination meeting during this review stage. The purpose of this meeting is to identify possible problems before the construction contract is awarded. Plans and specifications, including limitation of Contractor's operations, must be available at this meeting. The meeting should be attended by the Department's Design and Railroad Liaison Engineers, and representatives of the Railroad including engineering operations and electrical section, and the Consulting Engineer.

The Consulting Engineer shall coordinate the railroad review meeting date with the Project Engineer.

#### **304.04      FINAL DESIGN SUBMISSION**

This submission occurs when the plans, specifications and estimates are complete. This submission allows the Department the opportunity to verify that all comments have been incorporated into the project.

The Final Design Submission shall consist of the following material:

1. Complete set of project mylars
2. Complete set of project prints - 3 copies
3. Special Provisions - 3 copies
4. Proposal Estimate - 3 copies
5. Federal Estimate - 3 copies
6. Design Statement - 3 copies
7. All supporting documents that required revision as a result of the Final Plans for Review phase - 3 copies
8. A record copy of the traffic control signal, intersection signing and pavement marking plans, plotted on mylar, having the seal of a Connecticut licensed professional engineer

### **304.05      POST-FINAL DESIGN SUBMISSION**

Inevitably, revisions to the Final Design Submission will be necessary as a result of the Department's review and processing of final contract documents. When the Department is satisfied with the condition of the contract documents, the Consulting Engineer shall make a Post-Final Design Submission consisting of the following materials:

1. 3 copies of all documents that required revision as a result of the Department's review and processing of final contract documents (except one copy each of original mylars).
2. Electronic CADD files for the entire project in conformance with the Department's "CADD Manual." The Consulting Engineer shall coordinate media type with the Project Engineer to ensure compatibility with Department hardware prior to making this submission.
3. A second copy of electronic CADD files for traffic control signal, intersection signing, pavement marking plans and the traffic item detailed estimate sheet

### **304.06      ADDENDUM PREPARATION**

In the event changes are required to the contract documents after the project has been advertised, the Consulting Engineer will be required to make expeditious changes for the Department's use in preparing an Addendum. The procedures for preparation of an addendum will be made available by the Department's Project Engineer.

### **305      CONSTRUCTION STAGE**

The Consulting Engineer shall attend the preconstruction conference, if requested by the Department, to assist in answering questions relative to the design and resolving conflicts that may arise.

During construction, the Consulting Engineer shall attend meetings, if requested by the Department, to solve design problems resulting from unexpected field conditions. The Consulting Engineer may be requested to prepare plans and specifications for construction orders.

If errors, omissions or inconsistencies are discovered in the design, the Consulting Engineer shall make the necessary revisions.

In the event changes are required to the contract drawings after the project has been awarded to a contractor, a construction change order shall be prepared by the Consultant.

The procedures for preparation of a construction change order will be made available by the Department's Project Engineer.

### **306 INTERMEDIATE SUBMISSIONS**

The Department may vary the Consulting Engineer's normal sequence of operations to give priority in critical areas so that schedule, right of way clearance, or other Department commitments can be met. The Consulting Engineer may be requested to make intermediate submissions that will allow the Department to meet its commitments.

### **307 PROGRESS PRINTS**

The Department may request prints of the latest design plans and copies of the latest backup material at any time during the course of design. This progress information is usually needed to evaluate progress reports, extra work claims, and closeout if the Agreement is terminated.

### **308 MISCELLANEOUS MATERIAL**

The Consulting Engineer shall submit all miscellaneous material belonging to the Department at the time of the Post-Final Design Submission, unless directed otherwise by the Department. This information may include but is not limited to survey maps, field books, soils samples and design studies.

The Department may request the return of any part or all of this information, on a temporary or permanent basis, at any time.

### **309 PRESENTATION OF MATERIAL AT MEETINGS**

When the Consulting Engineer is to make a formal presentation of the design at a meeting, the following guidelines shall be used in preparing the display plans. This procedure shall apply to the Preliminary Design review meeting, and any other presentations deemed necessary by the Department.

The display must be readable from a distance of up to six meters. All pertinent

grades, number of lanes, climbing lanes, critical controls, stationing, curvature and design speed, on both plans and profiles, should be enlarged on the display to be readable. Furthermore, each 100 m station should be enlarged. Traffic data for each roadway and turning movements should be clearly labeled, and where necessary, enlarged traffic diagrams for intersections should be placed on the plans.

Color plotters, pencil, pen, or tape may be used in preparing the display. The colors should be translucent and should coincide with the various design features as follows:

### **PLANS**

Reconstructed Pavement	Yellow
Climbing Lanes	Orange
Bituminous Concrete Drive	Dark Gray
Undisturbed Existing Pavement	Light Gray
Fill Slopes	Green
Cut Slopes	Light Brown
Bridges	Orange
Wetland Limits	Blue
Watercourses With Flow Arrow	Blue
Critical Controls	Red
Proposed ROW Line	Red
Sidewalk	Orange

### **PROFILES AND SECTIONS**

Existing Ground Below Grade Line	Green
Existing Ground Above Grade Line	Brown
Finished Pavement and Slopes	Yellow
Critical Controls	Red

A Critical Control is defined as any existing or proposed physical feature affecting the horizontal or vertical geometric alignment. As such, critical controls may be existing features such as cemeteries, schools, industries, parks, walls or 4f features upon which the horizontal alignment is governed, or they may be proposed structures such as bridges or

cross culverts, which affect the vertical alignment. Proposed Critical Controls should be indicated on both plans and profiles, and existing controls should be shown on the applicable critical section as well as in plan view.

Inland Wetlands should be defined.

Soil conditions affecting vertical or horizontal geometry should also be indicated on applicable displays.

Proposed structures should indicate the minimum clearance attained and culverts should indicate cover.

The direction of travel and lane configurations for all roadways should be indicated by black arrows on all plans and profiles; the direction of flow for all watercourses should also be indicated.

Profiles of side roads, drives and watercourses should be shown in relation to the main roadways.

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