



# **CONSULTING ENGINEERS CONTRACT ADMINISTRATION AND DESIGN DEVELOPMENT MANUAL**

*Prepared By:*

**BUREAU OF ENGINEERING AND HIGHWAY OPERATIONS  
OFFICE OF ENGINEERING  
DIVISION OF CONSULTANT DESIGN  
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# **REVISIONS**

**LIST OF SECTIONS SHOWING LATEST DATE OF REVISIONS**

**ORIGINAL ISSUE DATE IS SEPTEMBER 1, 2008**



# CHAPTER 100

## OVERVIEW OF THE ASSIGNMENT

## **101 ASSIGNMENT MEETING**

After a Consulting Engineer has been selected to design a project for the Department, the Manager of Consultant Design will request the Consulting Engineer to attend an Assignment Meeting.

The purpose of the Assignment Meeting is to familiarize the Consulting Engineer with the project to be designed, discuss the scope of services in detail, discuss affirmative action requirements, request a proposal for design services, review the rights of way process and provide sample property acquisition maps.

The Consulting Engineer is encouraged to be familiar with the contents of this manual especially Chapters 300 and 400 in advance of the Assignment meeting and scope meeting(s) to minimize future misunderstanding about required submissions and procedures.

### **101.01 DESCRIPTION OF THE PROJECT**

The location, limits, classification and other pertinent data relative to the project will be discussed and defined at the meeting. The Consulting Engineer will be given available information already developed for the project, such as planning reports, public hearing transcripts and planning maps. The Department will identify any known unusual design problems which may be encountered.

The Department will designate the Project Number to be assigned to each Construction Contract; these project numbers shall be used on all pertinent documents and correspondence.

### **101.02 BASIC PROJECT ASSIGNMENT**

The Consulting Engineer will develop a complete set of plans, specifications and estimates, in accordance with the procedures contained in this manual, and the other documents referenced at the assignment meeting and stipulated by Agreement. The Consulting Engineer will furnish the qualified personnel, equipment, office space and supplies, except as described hereinafter, to accomplish this assignment.

The Consulting Engineer will make such investigations and additional field surveys, when survey is included in the assignment, or request such survey when not included in the assignment, as may be necessary to obtain supplementary data for estimating and design purposes. The Consulting Engineer shall make such studies as may be required to prepare a complete design in accordance with the standards hereinafter described or referenced.

The Department may elect to have certain tasks performed by personnel other than the Consulting Engineer. These items may include surveying, soils engineering, hydraulic analysis, design of traffic appurtenances, preparation of permits.

### **101.03 AFFIRMATIVE ACTION**

The Consulting Engineer must comply with the Department's Affirmative Action policies, as more fully described in Section 205 (Affirmative Action).

An Affirmative Action Plan or Policy Statement, as required, must be submitted by the Consulting Engineer and approved by the Department before an authorization to proceed with the assignment can be given. All other forms must be submitted as necessary.

The Department's Screening Committee will assign a goal for Disadvantaged Business Enterprise (DBE) participation on each project being designed by a Consulting Engineer. The assigned percentage is to be applied to the total amount paid to the Consultant, including, but not limited to survey, preliminary engineering, preliminary design, final design, review of shop plans, consultation during construction, soil borings, environmental studies, extra work and direct costs. Failure to comply will result in a financial penalty equal in dollars to the short-fall of the required goal. The penalty may be waived at the conclusion of the contract, but only if the Consultant can demonstrate, to the Department's satisfaction, that extreme and unavoidable circumstances were the cause of the non-compliance.

**Note:** Extra Work assignments during the construction phase often times results in an expanded contract fee and a DBE participation below the goal. This is an avoidable situation and the Consulting Engineer should plan accordingly.

The Department maintains a list of currently certified DBE's. This information is available through our Office of Contract Compliance. On some projects, the Screening Committee may assign a goal for Small Business Enterprises (SBE) instead of DBE's. The SBE listing is maintained by the Department of Economic Development.

The Department shall enforce this program and monitor compliance as more fully described in Section 202.07 (Subconsultant Invoice Summary Sheet).

### **101.04 SCOPE OF WORK**

After the Assignment Meeting, the Consulting Engineer shall prepare and submit a written scope of work to the Department. After solicitation and receipt of comments, it may be appropriate to schedule a follow-up discussion with specific Department review units to resolve scope issues in a timely and efficient manner. A field review meeting may benefit the scope of work discussion as well.

### **101.05 FEE PROPOSAL**

After approval of the scope, the Consulting Engineer shall prepare and submit a fee proposal to the Department's Negotiations Committee for the cost of engineering services to perform the work for a given project in accordance with the guidelines set forth at the Assignment Meeting.

The Consulting Engineer shall submit the fee proposal on a form supplied by the Department, a sample of which can be obtained from your Project Engineer. The proposal form

may be revised for special assignments but must be approved by the Department before submittal of a man-hour proposal.

Immediately following the completion of fee negotiations, the Consulting Engineer shall submit to the Department a letter detailing the revisions to the scope of services made during the negotiations process or a letter stating that the scope did not change.

### **101.06 AGREEMENT**

The Consulting Engineer will be provided with a draft copy of a Standard Agreement at the Assignment Meeting.

Once a design fee has been negotiated, the Department will prepare and process the Agreement. One of the following forms of Agreement will normally be used:

1. **Lump Sum** - The total fee is not subject to any adjustment on the basis of the Consultant's cost experience in performing the scope of services
2. **Cost Plus Fixed Fee** - The total fee is based on cost-reimbursement plus a negotiated fee for profit that is fixed at the inception of the Agreement

The Agreement will include the following pertinent information:

1. Generic scope of work
2. Calendar days to complete the work
3. Fee payment provisions
4. Audit requirements
5. Insurance requirements and forms
6. Subcontracting and DBE/SBE requirements
7. Extra work definitions
8. Statutory requirements
9. Termination
10. Indemnification/governmental immunity clauses

A current Affirmative Action Plan must be on file with the Office of Contract Compliance prior to consummating an agreement. Corporations, Limited Liability Partnerships and Limited Liability Companies must be registered with the Secretary of State. Corporations must be registered with the Professional Engineer's Board and Architectural Board. Joint registration is required if practicing engineering and architecture. If the firm is a Partnership or Sole Proprietorship, individual(s) must be appropriately licensed. The individual signing the Agreement must have written authorization to do so on behalf of the Corporation or Partnership.

Any comments or questions the Consulting Engineer has concerning the format of the Agreement should be addressed immediately to the Project Manager.

If a conflict arises between the Agreement and any of the referenced documents, the Agreement shall take precedence.

### **101.07 GIFT AND CAMPAIGN AFFIDAVITS**

Pursuant to Connecticut General Statutes and Executive Orders of Governor M. Jodi Rell, various Gift and Campaign Affidavits are required during the selection process, at the signing of the contract, and annually. Firms will be responsible to complete the affidavits at the appropriate times; however, the Department will strive to prompt firms to update these documents when necessary.

## **102 MATERIAL TO BE FURNISHED BY THE DEPARTMENT**

Below is a sample list of material to be furnished by the Department to the Consulting Engineer. The Consulting Engineer's activities should conform to the latest version of this material. Updates of the material are routinely distributed by mail to firms doing business with the Department. The requirements of a particular assignment and the availability of specific material will be defined at the assignment meeting for each specific project.

### **102.01 GENERAL MATERIAL MADE AVAILABLE AT ASSIGNMENT MEETING**

1. "Consulting Engineers Manual"
2. "Standard Specification for Roads, Bridges and Incidental Construction (Form 814A/815) and Supplemental Specifications"
3. "Highway Design Manual"
4. "Location Survey Manual"
5. Specifications for Aerial Photography and Photogrammetric Mapping
6. Specifications for Checking Photogrammetric Mapping
7. "Policies and Procedures for Property Maps"
  - a. Current approved samples of property acquisition maps
  - b. Sample schedule of owners spreadsheet
8. Guide for Preparation of 13a-57 Plans
9. "Bridge Design Manual"
10. Bridge Design Standard Practices
11. "Drainage Manual"
12. Bridge Scour Analysis - Technical Approach
13. "Water Resources Coordination and Permit Processing Manual"
14. "On-Site Mitigation for Construction Activities"

15. "Soils and Foundations Guide for Design by Consultant Engineers and Sample Contract Forms"
16. "Manual of Traffic Control Signal Design"
17. Utility Mailing List
18. "A Policy on the Accommodation of Utilities on Highway Rights of Way"
19. Standard Roadway Drawings and List of Road Standards
20. Design Aids (Factors for Estimating Quantities)
21. Bid Description Master File
22. Weighted Unit Prices
23. Product Use Status Lists
24. Index of Recurring Special Provisions and Index of Guide Special Provisions
25. "Digital Design Environment Guide"

**102.02 PROJECT-SPECIFIC MATERIAL FURNISHED AT ASSIGNMENT  
MEETING OR AS AVAILABLE**

1. Environmental Documents
2. Planimetric Maps
3. Topographic Maps
4. Cross Sections of existing ground, if survey is prepared by ground methods
5. Planning Sketches
6. Traffic Volume Diagrams
7. Soils Data
8. Any available reports, studies, investigations, etc. pertinent to the assignment
9. Consulting Engineer's Proposal Form
10. Rights of Way Boundary Maps
11. Soils Report, if not included in the Consulting Engineer's assignment
12. Hydraulics' Report, if not included in the Consulting Engineer's assignment
13. Traffic Appurtenance Plans, if not included in the Consulting Engineer's assignment

## **103 REFERENCE MATERIAL**

The Consulting Engineer's activities shall conform to the latest versions of the following reference material and/or those materials identified in the Agreement:

1. Connecticut Department of Transportation directives in the form of "Consulting Engineers General Memoranda"

2. Connecticut Department of Transportation, "Construction Manual" and Construction Advisories
3. U.S. Department of Transportation, Federal Highway Administration, "Federal-Aid Policy Guide", December 9, 1991 and all subsequent revisions thereto.
4. Hydraulic Engineering Circulars
5. "Connecticut Guidelines for Soil Erosion and Sediment Control"
6. Connecticut Public Utility Control Authority, Rules and Regulations concerning clearances on Railroads
7. "Public Service Facility Policy and Procedures for Highways in Connecticut"
8. All publications of the American Association of State Highway and Transportation Officials (AASHTO) including, "A Policy on Geometric Design of Highways and Streets"
9. All publications of the National Transportation Research Board (NTRB) including, "Highway Capacity Manual."
10. "Manual on Uniform Traffic Control Devices"
11. "American Standard Practice for Roadway Lighting"
12. The Institute of Electrical and Electronic Engineers and the National Electrical Manufacturer's Association Requirements
13. "The National Electrical Code"
14. Rules and Regulations of the National Fire Protection Association and applicable State Fire Code
15. Connecticut Department of Transportation, "Merritt Parkway Bridge Restoration Guide"

## **104 MATERIAL TO BE FURNISHED BY THE CONSULTING ENGINEER**

The consulting engineer shall furnish the qualified personnel, equipment, office space and supplies to perform the field and office work necessary for the complete design of the project, including the necessary drafting and estimating operations, within the time period indicated in the Agreement. The Consulting Engineer shall submit material to the Department in accordance with the requirements of Chapter 300 (Design Development).

## **105 CONTROL OF THE WORK**

The Department will advise the Consulting Engineer in writing of the procedures to be followed when communicating with the Department. Normally, all written correspondence will be addressed to the Manager of Consultant Design. A Highway Project Engineer and a Bridge Project Engineer, if necessary, will be assigned to the project; they will monitor operations of the Consulting Engineer. All routine matters should be discussed with the appropriate Project Engineer.

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The Project Engineer will make visits to the Consulting Engineer's office to review the plans as the design progresses. Department representatives will be allowed immediate access to the Consulting Engineer's design quarters in order to review the design and observe the manpower and personnel being utilized.

The Consulting Engineer's design will be subject to the review and approval of the Department. Periodic submissions and review meetings will be held, as described in Chapter 300 (Design Development).

The Project Engineer may arrange a pre-review meeting with the Consulting Engineer and Department representatives to discuss design guidelines and material required for submissions.

During the performance of the work, the Consulting Engineer may receive supplemental or revised information from the Department which should be incorporated into the design. If the Consulting Engineer concludes that any of these supplemental requests constitute extra work, as defined in Section 203 (Extra Work), the Consulting Engineer should follow the procedures outlined therein.

## **106 RELATIONSHIP WITH OTHER AGENCIES**

The Department will furnish the Consulting Engineer with all available basic requirements for the design of structures, relocated streets, interchanges and incidental construction. The Consulting Engineer will supplement the furnished data by such field surveys, or request such survey if not included in the assignment, as may be necessary for the design of the project. The Consulting Engineer shall confer where necessary with Railroad and Utility Companies during the design of facilities that are to be maintained by agencies other than the Department.

The Department is responsible for coordination with municipalities, except for utility matters. Any meetings, information or policy determinations required by the Consulting Engineer from a municipality shall be requested through the Department.

The Consulting Engineer may begin coordination with the Railroad and Utility Companies upon the companies' receiving, from the Department, authorization to proceed with preliminary engineering for the project under design. The Consulting Engineer will receive a copy of this notification to the Railroad and Utility Companies.

The Department should be kept informed of all coordination between the Consulting Engineer and the agencies noted above; the Project Engineer should be invited to all meetings, a copy of all written correspondence should be directed to the Manager of Consultant Design and the Project Engineer should be kept informed of other general coordination.

The Consulting Engineer shall also coordinate activities with Consulting Engineers assigned to adjacent projects to ensure a compatible and continuous design.

## **107 ATTENDANCE AT MEETINGS AND PUBLIC HEARINGS**

The Consulting Engineer shall attend periodic meetings and public hearings related to the design of the project at the request of the Department. The Consulting Engineer shall be

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represented by the minimum number of personnel of the appropriate level to adequately address the subjects that may be discussed. If questionable, representation shall be discussed with the Project Engineer prior to the meeting.

### **107.01 DESIGN STAGE**

Review meetings will be arranged by the Department following certain submissions, as described in Chapter 300 (Design Development). The Consulting Engineer shall attend these meetings. The Consulting Engineer is also required to attend additional meetings at which design details will be a topic of discussion.

### **107.02 PUBLIC HEARINGS**

The Consulting Engineer will, when requested, attend Design Public Hearings and Environmental Public Hearings related to the design of the project and may be required to make the design presentation if so directed.

### **107.03 CONSTRUCTION STAGE**

If requested, the Consulting Engineer will attend the Pre-Construction Conference. The Consulting Engineer may also be requested to attend construction meetings.

## **108 RESPONSIBILITY FOR ACCURACY OF WORK**

The Consulting Engineer shall assume full responsibility for the accuracy of all products of engineering work produced under the Agreement with the State, including any supplements thereto. The Consulting Engineer shall indicate acceptance of this responsibility by affixing the Consulting Engineer's signature and Connecticut Professional Engineer's Seal on the Title Sheet of the construction drawings so produced.

Any reviews performed by and approvals given by the Department at various stages of design will not relieve the Consulting Engineer of responsibility for the accuracy of work. If the Consultant disagrees with a comment resulting from a review, the Consultant shall incorporate the comment into the design, but may disclaim responsibility for this comment in writing to the Department as soon as the comment is received.

In the event of errors, omissions, oversights or apparent neglect on the part of the Consulting Engineer, it will be the firm's responsibility to provide necessary corrective action, whether it be during design or construction, at no cost to the State. In addition to the above corrective action, the consulting firm shall reimburse the State for all expenses incurred by the State in corrective work and all expenses associated with corrective measures undertaken by the Contractor.

## **109 ENTRY UPON PRIVATE PROPERTY**

It is the responsibility of the Consulting Engineer to obtain written permission to enter private property, as an agent of the Department, from all owners or occupants of property involved in the survey, geological investigations or otherwise required to complete the assignment, prior to entering the property.

The Consulting Engineer shall advise the property owner of their intention to enter upon the property, describe the operations to be performed and the reason for the operations. The Consulting Engineer will then request the property owner to sign a right-of-entry-letter. The Department will provide right-of-entry form letters upon request. Non-resident property owners, who cannot be reached in person, shall be contacted by letter. To preclude the possibility of the property owner returning the letter directly to the Department, it should be attached to a letter prepared on the Consulting Engineer's letterhead. The letter should explain that the Consulting Engineer is responsible to the Department for the project concerned. Tenants should be informed prior to entering the property, although their permission need not be requested unless they are the agent of the owner.

If the property owner gives oral permission but will not sign the right-of-entry letter, the Consulting Engineer shall complete the right-of-entry letter, with the notation that oral permission only was granted. This notation shall also contain the name of the representative who actually interviewed the owner and the date of the interview. A confirming letter shall be mailed to the property owner by certified mail, within 24 hours. The Consulting Engineer shall maintain a file of signed right-of-entry letters until the work is complete. The file shall be forwarded to the Department with the final submission unless directed otherwise.

If the property owner refuses to grant entry, the file for the owner shall be forwarded to the Department, requesting that the appropriate action be taken. The file should contain all correspondence, dates of personal interviews and the name of the person interviewing the property owner. Complete information will simplify the action to be taken by the Department and expedite the entry onto the property. The Department will advise the Consulting Engineer when it is legally permissible to enter the property.

The Consulting Engineer shall use care so that no unnecessary damage results from entry onto the private property. Damage claims shall be referred to the Department for investigation.

The Consulting Engineer shall assume responsibility for obtaining all necessary permits and clearance for entry onto any properties subject to security regulations.

# CHAPTER 200

## ADMINISTRATIVE PROCEDURES

## **201 PROGRESS REPORTS**

### **201.01 ORIGINAL ASSIGNMENT**

Immediately after starting the assignment, the Consulting Engineer shall prepare and submit to the Department a proposed progress report for the project. The report should allow for the assignment of a "Percentage complete" for identifiable tasks and for the overall assignment.

The Consulting Engineer shall submit the progress reports on a monthly basis, indicating the percentage of the original assignment completed to date. Ideally, the progress reports should be submitted for approval prior to preparation of monthly billings. Line items which the Consulting Engineer considers 100% complete should be discussed with the Project Engineer prior to submitting the report. A copy of the monthly progress report form can be obtained from your Project Engineer.

### **201.02 SUPPLEMENTAL ASSIGNMENTS**

For each supplemental assignment, the Consulting Engineer will prepare a progress report form compatible with the required operations. The line items and percentage breakdown for each supplemental progress report shall be submitted to the Department for review and approval.

## **202 INVOICES**

The Consulting Engineer shall receive compensation for work performed by submitting invoices to the Department on forms furnished by the Department.

### **202.01 PARTIAL PAYMENTS**

#### ***Lump Sum Agreements***

The Consulting Engineer may request partial payments, at minimum intervals of one month, as the work is performed. Partial payments for Survey, Preliminary Engineering, Preliminary Design, and Final Design will be 97 1/2% of the fee earned during the pay period, based on the progress of the work, as indicated by the progress report. The remaining 2 1/2% will be retained by the Department until the final payment is made.

#### ***Cost Plus Fixed Fee Agreements***

The Consulting Engineer may request partial payments, at minimum intervals of one month, as the work is performed. Partial payments for Survey, Preliminary Engineering, Preliminary Design, and Final Design will be 97 1/2% of the amount shown on the State approved certified payroll for the pay period, including burden, fringe, and overhead costs, and 97 1/2% of the fixed fee earned during the pay period, based on the progress of the work, as indicated by the

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progress report. The remaining 2 1/2% will be retained by the Department until the final payment is made.

### **202.02 FINAL PAYMENT**

The Consulting Engineer may request full payment for all work performed two years after submission of final plans, if a construction contract for the work covered by the Agreement has not been awarded.

If a construction contract is awarded within two years of submission of final plans, the Department will hold the retainage until construction is complete.

Partial release of retainage will be considered upon request on a case-by-case basis.

### **202.03 REVIEW OF SHOP PLANS**

The Consulting Engineer may request partial payments for review of shop plans as the work is performed.

### **202.04 SERVICES DURING CONSTRUCTION**

The Consulting Engineer may request payment for services performed during construction that are authorized in writing by the Department, in accordance with the amount specified in the Agreement.

### **202.05 SUBCONTRACTED WORK**

The Consulting Engineer may request partial payments for subcontracted work as it is being performed. A copy of the subcontractor's invoices must accompany the Consulting Engineer's invoice to the Department. The amount requested by the Consulting Engineer cannot exceed the amount paid to the Subcontractor.

### **202.06 DIRECT COSTS**

Procurement of Direct Cost services or products is to be in accordance with the following:

1. Services and Products valued up to \$2,500 may be purchased without quotations or bids.
2. Purchases valued at \$2,500 to \$10,000 are to be based upon the low bid of, when possible, three documented oral competitive bids from responsible and qualified sources.
3. Purchases valued at over \$10,000 are to be based upon the low bid of at least three written quotations or bids from responsible and qualified sources.

The Consulting Engineer may request partial payments for direct costs that are incurred as the work is performed.

### **202.07 SUBCONSULTANT TRACKING REPORTS**

In order to track the Consultant's use of subconsultants and monitor compliance with the Department's Affirmative Action DBE goals, a "Subconsultant Usage and Payment Report" must be attached to every invoice.

On a quarterly basis, the Consultant will submit a "Subconsultant Payment Log" which indicates the status of specific subconsultant invoices to ensure timely payment to subconsultants.

Lastly, in order for the Department to verify payment from the prime consultant to the respective DBE's and/or SBEs, a "Verification of Payment" form must be included with the final invoice for each project. Final payment will not be made without these completed forms, or an adequate explanation as to why full payment was not made to each subconsultant. Copies of the "Subconsultant Usage and Payment Report," and "Subconsultant Payment Log," and "Verification of Payment" forms can be obtained from your Project Engineer.

## **203 EXTRA WORK**

Extra work is defined as follows:

1. Such additional work ordered by the Department beyond the scope or limits of the agreement to the extent that such work is not reflected in the fee payments specified in the Agreement.
2. Such work as shall supersede or revise completed work that has been accepted by the Department in writing and subsequently deleted or changed.

Changes such as those to effect refinements in the design and such as those made necessary by errors, omissions, oversight or neglect on the part of the Consulting Engineer will not be considered extra work.

If, in the opinion of the Consulting Engineer, a given assignment by the Department constitutes extra work, they shall immediately advise the Department in writing. Upon receiving written concurrence from the Department, the Consulting Engineer shall prepare a scope and fee proposal for the extra work. This proposal will be negotiated in the same manner as the original proposal. The basis of payment (lump sum or cost plus) will be the same as the original agreement, unless directed otherwise by the Department.

The Consulting Engineer shall not proceed with any extra work until written authorization is received from the Department. Normally, this authorization will be given after the claim is negotiated and funding is in place. However, if the extra work is on the critical path, the Department may authorize the work to begin at any time.

It may be necessary for the Department and the Consulting Engineer to enter into a supplemental agreement to cover the terms of the extra work. This determination will be made by the Department.

Extra work costs must be segregated in the Consulting Engineer's records from those incurred in connection with the original assignment.

The Consulting Engineer may request partial payments for extra work in the same manner as partial payments for the original assignment. No percentage will be retained.

All extra work proposals must be submitted to the Department's Negotiations Committee, with a copy of the cover letter only forwarded directly to the Manager of Consultant Design.

## **204 SUPPLEMENTAL AGREEMENTS**

During the life of a Consulting Engineer's assignment, it may be necessary to enter into one or more supplemental agreements. Some of the circumstances requiring a supplemental agreement are:

1. An assignment that is not covered in the original agreement
2. An amendment to the original agreement
3. When accumulated extra work claims exceed the limiting amount specified in the agreement

The Department will prepare supplemental agreements as they are needed.

## **205 AFFIRMATIVE ACTION**

The following procedures constitute the Department's policy for EEO documentation by Consulting Engineers.

Firms desiring to do business, or to continue to do business with the Connecticut Department of Transportation either directly, through municipalities or as subconsultants, must have an approved Affirmative Action Plan on file. To maintain eligibility once it is achieved, submittal of an Affirmative Action Plan Update is required annually. If this information is not submitted, the firm will be removed from the prospective consultants list, or in the case of an active consultant, the design activities may be stopped and the contract terminated by the Department.

## **206 CONDITIONS FOR SUBCONTRACT OF WORK**

If the Consulting Engineer wishes to retain the services of a Subconsultant for a portion of this assignment, a written request and a copy of the proposed Agreement must be forwarded to the Department for review.

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Every attempt should be made to utilize Disadvantage Business Enterprises (DBE) Subconsultants. The Consulting Engineer must comply with Section 101.03 (Affirmative Action DBE Goals). If the subcontracted work qualifies as engineering, the request shall indicate whether or not the proposed Subconsultant is registered as a Professional Engineer in Connecticut. When the proposed Subconsultant is not so registered, approval of the subcontract, if granted, will be made subject to the Subconsultant obtaining such registration in accordance with the Statutes of the State of Connecticut and the regulations of the State Board of Registration for Professional Engineers and Land Surveyors.

The Consulting Engineer shall furnish to the Department certification of Public Liability and Property Damage Insurance Coverage, including the use of motor vehicles, for the operations to be performed by the Subconsultant.

Any work subcontracted by the Consulting Engineer will be paid for by the Department at the actual cost to the Consulting Engineer with no additions.

The Consulting Engineer shall not allow any of the subcontracted work to proceed without the written approval of the Department.

## **207 BURDEN FRINGE AND OVERHEAD**

Consultants shall comply with the latest requirements of the Office of Policy and Management concerning burden, fringe, overhead and profit maximums. A copy of these requirements will be furnished to the consultant at the Assignment Meeting.



# CHAPTER 300

## DESIGN DEVELOPMENT

## **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, computations and reports prepared by the Consulting Engineer shall be checked before submittal to the Department for review. These documents shall indicate the engineer responsible for their preparation and the engineer who has checked the work.

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
2. Preliminary Engineering 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"=200' 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"=40' 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:

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1. Know protected resources, Historic, Archeological water supply resources, protected species
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"=40' 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.

The Consulting Engineer will need to start addressing anticipated Work Zone Safety and Mobility (WZS&M) concerns as part of the Preliminary Design effort. If the project is determined to be “significant” for WZS&M concerns, the Consulting Engineer, in consultation with the Project Engineers, will develop a preliminary Transportation Management Plan (TMP) which is to include Temporary Traffic Control Plans (Staging, and Maintenance and Protection of Traffic Plans), a Transportation Operations Plan and a Public Outreach/Involvement Plan. The narrative of the TMP is to be documented in the Design Report.

A preliminary concept for Staging and Maintenance and Protection of Traffic Plans shall be indicated on 1”=200’ scale plans. A preliminary signing plan shall also be provided on 1”=200’ scale if these items are included in the assignment.

The Consulting Engineer shall investigate and confirm the major drainage areas for the project. Ideally, hydraulic crossings with tributary areas greater than one square mile will be identified in the project scoping phase to accurately assess the level of effort these situations demand. Confirmation and submission of the drainage areas over one square mile and unusual drainage designs (storage facilities, pump stations, tidal impacts, etc.) 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.

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, the DOT Office of Environmental Planning and on the internet ([www.msc.fema.gov](http://www.msc.fema.gov)). 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 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

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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.

The Consulting Engineer will evaluate pedestrian and bicycling needs and accommodations in the vicinity of the project, and make appropriate recommendations for inclusion in the work. The consultant should discuss this aspect of the assignment with Department staff for specific guidance early in the design.

A 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. The Design Report is to be updated and/or amended with each subsequent submission until the design is complete.

A preliminary construction cost estimate shall be prepared utilizing actual quantity estimates of major contract pay items and the most current version of the Department's Preliminary Cost Estimating Guidelines. The Department's Weighted Unit Prices may also be utilized in support of the Preliminary Cost Estimating Guidelines. A copy of these documents may be obtained from the Project Engineer. This Preliminary Design Estimate is very important to all parties in that it may be this first detailed attempt to identify the full range of project costs. It will become the benchmark budget by which final project costs will be measured. It must be accurate and inclusive of all known expenses with appropriate inflation and contingency components. The estimate must include the cost of constructing detours, providing for maintenance and protection of traffic, and any ancillary items including, but not limited to, Railroad Force Accounts, utility relocation costs, disposal of contaminated materials, etc. 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 (confirm the number of copies of all materials with the Project Engineer):

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. Drainage Design Checklist and Hydraulic Report - 2 copies
5. Preliminary Construction Cost Estimate (including computations) - 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 & TYPICAL SECTIONS**

1. Beginning and end of project
2. Horizontal curvature - radii, PCs, PTs
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. Bicycle accommodations
17. Non-access lines (complete and dimensional to baseline)
19. Taking lines and property lines
19. Traffic control at intersections (existing and proposed)
20. Intersection sight distance
21. Need for guide rail, anchorages, and attenuators
22. Sidewalks and ramps
23. Proposed locations for all utilities which are to remain above ground
24. Stationing
25. Restrictive horizontal sight distances
26. Noise barriers
27. Inland and Tidal Wetland Limits and watercourses, Floodway, Floodplain (100 & 500 year) SCEL
28. Preliminary Temporary Traffic Control Plans (Staging and/or Maintenance and Protection of Traffic)



**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. Side slopes
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
    - d. Location plan (8.5 X 11)
    - e. Typical Sections (reduced to 11 X 17 max)
    - f. Accident experience and analysis as it relates to the purpose and need of the
-

- project
  - g. Describe any proposed modifications to Department's sketch plans or preliminary engineering concepts provided at inception.
  - 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
    - o. Climbing lanes (including lengths, transitions)
    - p. Substandard features and their need for exception to design standards
  - 3. Traffic Control
    - a. Configuration of each interchange or intersecting street
    - b. Existing and projected turning volumes
    - c. Intersection capacity analysis (including level of service determination and projected queues)
    - d. The Traffic Management Plan, including draft Temporary Traffic Control Plans, Maintenance and Protection of Traffic Plans, staging plans, Traffic Operations Plans, Public Outreach Plan.
    - e. 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.
  - 4. Structural Components
    - a. Identify and summarize bridges and retaining wall requirements
    - b. Location and minimum vertical clearance for each structure
    - c. Railroad involvement
  - 5. Alternate Transportation Modes
    - a. Pedestrian path(s)
    - b. Bicycle path/accommodations
  - 6. Rights of way discussion and a "Preliminary Schedule of Property Owners"
  - 7. Historic Archeological Impacts
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8. Noise/Air Impacts and design features
9. Drainage and Permitting
  - a. Preliminary drainage issues including anticipated water diversions, special structures, detention design, fish passage, major culvert crossings and overview contour maps showing watershed areas.
  - b. Water resource impacts
  - c. Sedimentation and erosion control and possibilities for stormwater treatment as applicable
  - d. Permit involvement
10. Utilities
11. Comprehensive discussion of construction cost estimate and comparison to initiated amount

### **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. Note: SL for D may dramatically affect Federal permitting, ACOE Category I, Category 2 or Individual Permit.

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**

The Consulting Engineer will be given specific authorization to enter the Final Design phase of the project and the first order of business is to resolve and incorporate all Preliminary Design comments.

The Consulting Engineer should undertake the following actions (not all inclusive) to progress the project to the Semi Final Design Submission:

Mathematize all horizontal and vertical control for the project

Initiate rights of way activities with a rights of way coordination meeting

Initiate utility company involvement with utility coordination meeting

Initiate environmental permitting with a permit coordination meeting

Progress the hydraulic and drainage design elements, including a coordination meeting with appropriate Department staff if warranted

Progress soil boring program

Progress structural design elements toward a structural layout for Design submission

### **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 of all Preliminary Design comments. NOTE: The disposition of all Preliminary Design comments should be resolved at or shortly after the start of Final Design. It is not intended that previous comments remain unresolved until this next milestone submission. All Rights of Way needs, including temporary as well as permanent encumbrances, should be resolved and accurately defined with this submission. The plans should be consistent with all previously submitted property maps.

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." A condition survey shall be conducted for existing facilities (pipes, structures, swales, ditches, etc.) that are to remain in use within the project limits. New drainage/culvert materials are to be selected based on an evaluation of durability, hydraulic capacity, structural capacity, compatibility of pipe materials to site conditions and life cycle costs.

A construction cost estimate shall be developed based on actual quantity computations. A draft proposal estimate shall be prepared summarizing contract items, quantities and cost estimates. All contract items, including any unresolved contract costs, such as contaminated materials, railroad, and utility costs, shall be estimated as accurately as possible so that the construction estimate is complete and a true representation of all anticipated project costs, including inflation.

The Semi-Final submission shall include Maintenance and Protection of Traffic plans and specifications as well as Sequence and Limitation of Operations plans and/or specifications. The Design Report should be updated to address the following items and any other significant issues that warrant documentation.

1. Site Access assumptions
2. Transportation Management Plan-including the Temporary Traffic Control Plan assumptions, Traffic Operations Plan and Public Outreach Plan.
3. Water Handling assumptions
4. Specialized equipment and/or construction method assumptions
5. Subsurface condition assumptions
6. Summary of Construction Cost Estimates changes, including discussion of specific differences from previous estimates
7. Draft list of "Major Elements" associated with the critical path of the Construction schedule.

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. Semi-Final Design Report - 18 copies
3. Draft Proposal Estimate and Cost Estimate - 6 copies
4. Hydraulic Report – 2 copies
5. Draft Drainage Report with checklist, computations and condition survey results - 2 copies
6. Contour map(s) showing contributory areas to each drainage inlet - if such areas extend off the construction plans - 1 copy
7. Roadway Soils Report - 4 copies
8. Special provision(s) for Maintenance and Protection of Traffic and Sequence and Limitations of Operations - 6 copies or included in the Design Report under Transportation Management Plan
9. Traffic control signal calculations and supporting materials (see Sec. 406)
10. Two unbound copies of all previous comments and the Consultant's responses

After the Department completes its review, a meeting may be arranged to discuss new Semi Final Review 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 (confirm the number of copies of all materials with the Project Engineer):

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 (FPFR) 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.

Resolution of earlier review comments will have taken place in advance of this milestone submission. The FPFR submission must have incorporated the comments from the "Non-Structural" Semi-Final Design submission and the SL/D submission.

Furthermore, in transmitting these FPFR documents, the Designer shall confirm in writing that the plans have been checked and are consistent with previously submitted property maps and permit applications.

#### **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. Final Design Report – 18 copies
6. Design Statement - 18 copies
7. Roadway Soils Report and Foundations Report for Structures - 3 copies
8. Final Hydraulics Report - 3 copies
9. Final Scour Evaluation Report - 3 copies
10. Final Drainage Report with checklist and drainage computations - 3 copies
11. Complete computations and quantity estimates supporting the submission - 3 copies
12. 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
13. Utility Estimate - 3 copies
14. Calendar Day Bar Chart based on the Major Elements of the construction schedule developed previously - 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)
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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 should occur a minimum of two weeks prior to the Final Design Plan date (FDP) established by the Department for internal scheduling. This 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 (confirm number of copies with the Project Engineer):

1. Complete set of project mylars
  2. Complete set of project prints - 3 copies
  3. Special Provisions - 3 copies in print, one electronic copy
  4. Proposal Estimate - 3 copies
  5. Federal Estimate - 3 copies
  6. Final Calendar Day bar chart, with and without durations
  7. Stand alone Transportation Management Plan document culled from the Final Design Report
  8. Updated Final Design report – as necessary
  9. Design Statement - 3 copies
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10. All supporting documents that required revision as a result of the Final Plans for Review phase - 3 copies
11. 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. Three 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 files for the entire project in conformance with the Department's policies. 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 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.

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### **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 CONSTRUCTION COST ESTIMATES**

Construction cost estimates directly impact the financial plans of the Department. A major increase in cost that is not discerned until the project is ready for advertising will disrupt the financial plan and can unnecessarily delay any number of unrelated projects. An accurate estimate based upon the best information available at the time is critical.

Construction cost estimates will be prepared in the following manner:

- The Consulting Engineer will be requested to confirm or correct the Department's project Initiation estimates during the scoping and negotiations phases.
- All construction cost estimates prepared during the design process will be written and conform to the "CONNDOT Preliminary Cost Estimating Guidelines" and (preferably) actual quantity takeoffs. The guidelines include inflation factors to be applied such that the estimate reflects the current advertising schedule.
- Cost Estimates prepared for the Semi-Final Submission and beyond must be based on actual quantity takeoffs.
- The Construction Cost estimate is to be updated at each major milestone (e.g. Preliminary Design submission, Semi-Final Design submission, Final Plans for Review submission and Final Plan submission) or when a significant change in the project scope occurs. Furthermore, the estimate is to be updated as necessary so it is never more than a year old. The Design Report submitted with major milestones is to contain a discussion/documentation of the changes in the cost estimate.

The "Preliminary Cost Estimating Guidelines" will be updated regularly by the Department. The Department's "Weighted Unit Prices" are also available for this task.

Consulting Engineers will be responsible for the accuracy of the cost estimates. Failure to maintain reliable estimates will be reflected in the Consultant's Performance Evaluations.

### **308 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.

### **309 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.

### **310 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 20 feet. 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 500 ft 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.

# CHAPTER 400

## DESIGN ELEMENTS

## **401 GEOMETRY**

### **401.01 BASIC STANDARDS**

Basic geometric design standards are contained in the Department's "Highway Design Manual" (HDM) and AASHTO'S "A Policy on Geometric Design of Highways and Streets." A copy of the HDM will be given to the Consulting Engineer at the Assignment Meeting. The Department will specify the applicable design document and the classification to be used for each highway section. If non-classified state roads or local roads are included in the design, the Department will advise the Consulting Engineer of the standards to be applied.

The design criteria outlined in the HDM should be considered minimum desirable values. Design conditions should be as high as are commensurate with field conditions. Should condition warrant the application of a sub-standard design feature, a description of the proposed design feature, a description of the proposed design, the standard design and the reasons for recommending the proposed design should be included in the Preliminary Design Report.

### **401.02 HORIZONTAL GEOMETRY**

Maximum curvature should be commensurate with design speed. Continuous use of maximum curvatures should be avoided. Curvature less than  $0^\circ - 30'$  should be avoided. Broken back curves and compound curves should be avoided. If compound curves are necessary, the ratio of the curves should not exceed the allowable minimum. The tangent distance between reversals of curvature should be long enough to allow for proper super-elevation transition. Lengths of climbing lanes and tapers should be clearly indicated on the plans.

### **401.03 VERTICAL GEOMETRY**

Maximum grades should be commensurate with design speed. In order to obtain satisfactory drainage, the minimum gradient recommended is 0.5%. Proposed grades flatter than 0.5% should be discussed with the Project Engineer. Angle points in the profile grade line should be avoided. Available sight distance and corresponding safe speed should be indicated for vertical curves. Climbing lane warrants should be derived from the applicable design standards. Sag vertical curves in cut sections should be avoided. Flat grades and sag vertical curves should be avoided on bridge decks because water pockets may result, causing sand accumulation, deterioration and scaling of the bridge deck.

### **401.04 COMBINATION OF HORIZONTAL AND VERTICAL GEOMETRY**

The horizontal and vertical geometry should be balanced and blend into the existing terrain. A change in horizontal geometry should not be hidden by a crest vertical curve. Adequate passing distance should be included in the design, where applicable. The geometry should consider earthwork quantities and earthwork balance. Headlight glare from opposing roadways

should be considered. When determining minimum vertical clearances, the ultimate condition should be considered on an expandable roadway.

When lane drops are necessary, adequate continuous sight distance throughout the lane drop should be provided. The vicinity of the lane drop should be free of horizontal and crest vertical curves. It is preferable to drop the right lane. Dropping a lane in an interchange area should be avoided. Adequate distance for advance signing should be available. The full shoulder width should be provided throughout the transition.

#### **401.05 INTERCHANGES**

Configurations which would result in unfamiliar traffic operations should be avoided, such as left-hand exits and entrances, lane drops in the interchange area, partial interchanges and split interchanges. The distance between interchanges should consider signing and weaving. Interchange configurations should be compatible with the design traffic volumes and favor the heavier movements. Lane continuity should be provided through interchanges, and weaving sections and operational lanes should be avoided.

The gore area should be designed with a flat cross slope to allow for recovery of errant vehicles, designed for impact attenuators where necessary and graded to reduce runoff of water through the gore area. Infield areas should be clear of fixed objects, graded to allow errant vehicles adequate distance to stop or recover and graded to minimize guide railing requirements on both diverging roadways. Exits from mainline curves to the left should be avoided because the ramp could be misconstrued to be the mainline. Storage length of acceleration and deceleration lanes should be in accordance with the appropriate standards. The angle of intersection between a ramp and local road should not be less than 60°. "Second" curves to provide a 90° angle of intersection on diamond ramps should be avoided.

#### **401.06 AT-GRADE INTERSECTIONS**

Turning movement volumes at intersecting roads should be evaluated to determine requirements for signalization, turning lanes, approach width and lane arrangement. Turning radii should accommodate the design vehicle. Intersection sight distance should be commensurate with design speed. Profiles should be designed to give preference to the through street. Right angle intersections are desirable. Steep grades at intersections, angle points at the curblines, angles of intersection less than 60° and tapering roadway widths through intersections should be avoided whenever possible.

#### **401.07 MEDIAN**

In keeping with the concept that each roadway of an expressway is to be designed independently, thus achieving a separated roadway design, the typical sections for expressways will usually not indicate a median width. In instances where an expressway design is of the "Divided Highway" type, the median width and treatment shall be indicated. Where a change in width of median is required, the transitions shall be made smoothly. The change shall generally be made on a horizontal curve and without the use of reversed curvature in alignment of pavement or curbs. Where the transition must be made on a tangent, it is preferable to have it occur on the crest of grade to make the change in alignment less conspicuous.

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### **401.08 CUT AND FILL SLOPES**

The height of fill is the vertical distance measured from the toe of slope to the junction of the line of the slope and the grade of the edge of the shoulder. Fill slopes shall be as flat as feasible to reduce the need for guide rail. Excess earth material should be used for this purpose.

When it becomes apparent that the proposed improvement will require the use of borrow material, the Designer will review the topography of the project and determine if widening of the earth cut sections or decreasing the angle of slopes or a combination of both can be accomplished economically to produce the additional fill material.

If this can be accomplished without detriment to proposed or future planning, roadside development, or adversely affect wetlands, the original template for cross sections shall be revised where advisable to make available additional excavation to decrease the borrow item. In instances where flattening the slopes would project the slope limits beyond the standard or available right-of-way width, the Department will determine if the additional impact is warranted.

### **401.09 SIDE SLOPE TRANSITIONS**

For safety and aesthetic reasons, it shall be the practice to provide adequate lengths for transitioning from one rate of slope to another in fills and also at the approaches to earth cuts. The actual rate of transition will vary according to the site conditions controlling at each individual location, i.e., the contour of the natural ground, drainage, appearance, ease of maintenance, right-of-way and other considerations. As a basic guideline, it is recommended that the rate of one point of slope be used every 50 ft. For example, in transitioning from 1:2 to 1:6 in fill, successive 50 ft sections shall have side slopes as follows: 1:2, 1:3, 1:4, 1:5 and 1:6. These rates of slope must be clearly indicated on the cross sections throughout the length of the transition.

### **401.10 SUPERELEVATION**

The superelevation rates contained in the HDM are based on design speed and degree of curvature. Engineering judgment shall be used in determining the speed from which to calculate superelevation rates for ramps, turning roadways, climbing lanes, frontage roads, local roads and any other road sections which are not part of the main line. On climbing lanes, the rate of superelevation should be that required for the vehicle speed, decreasing in rate as the higher part of the grade is approached. Superelevation of local roads will be determined at the Town Roads Meeting.

### **401.11 DRIVER EXPECTANCY**

The most fundamental elements of the driver communications system begin with, and to a large extent are determined by, the natural features which exist around the roadway. Variations in weather conditions, the existence of construction and maintenance operations, and a lack of continuity or consistency in basic design alter the environmental situation. The information reaching the driver from these many varied sources must blend into a comprehensive picture of



the conditions which exist ahead; otherwise, the possibility for driver confusion and indecision exists.

The driver assimilates the many cues necessary for driving and establishes a course of action which must be taken in the near future. This decision-making process is repeated on a continuous basis as the driver is provided new information. The following items should be reviewed by the designer as they relate to establishing driver behavior patterns:

1. The aesthetic treatment of the median and roadside has been designed to be harmonious with general topography and vegetation in the area consistent with current safety and operating policies.
2. When the driver's view ahead is limited, the upcoming roadway alignment does not conflict with the alignment suggested by natural terrain features.
3. Has consideration been given animal movements, falling rocks, unusual drainage patterns, and other natural environmental elements which could constitute a hazard to the driver.
4. Signing delineation, vegetation and other means have been used to clarify design inconsistencies.
5. Pavement striping and reflectors in combination with either fixed illumination or post-mounted delineators have been included to provide reasonably adequate delineation of major roadways under a variety of adverse weather conditions.
6. Pavement surface contours have been prepared and appropriate consideration has been given to vertical alignment, cross slope and pavement surface to provide proper drainage. Special attention has been given to especially flat grades, curve transitions, and similar situations where drainage of the standard pavement cross section may be inadequate under heavy rainfall conditions.
7. The alignment on bridges and roadways approaching bridges does not increase the hazard of ice on the structure.
8. All intersections have been located to provide greater than the minimum sight distance for approaching traffic.
9. Consideration has been given to adding lanes for turning traffic at intersections to reduce delay and accident potential.
10. Intersection channelization has been designed to ensure a high degree of operational safety.
11. Design standards greater than minimum, particularly with regard to sight distance to the roadway features, have been utilized to improve the communication of the roadway with the driver.
12. Interchange design has been simplified to provide better driver understanding and to permit effective directional signing.
13. The relatively high potential for wrong-way movements at interchanges has been recognized and considered in the design process.
14. Access and egress have been designed to afford the driver maximum visibility at merging and diverging areas.

15. A variable median width has been designed to afford the driver maximum visibility at merging and diverging areas.
16. Adequate transition and clarifying information has been provided the driver well in advance of the point where a new and different roadway design is encountered.
17. Additional sight distance is provided at points where adequate transitions cannot be provided between two sections of different cross section design. (Warning signs are not always effective in alerting the driver to this situation.)

## **402 ROADWAY**

### **402.01 GRADE LISTS**

After the final grade has been established, it shall be accurately depicted on the profile sheets. The rate of tangent grades shall be shown to the nearest 0.001%. The station and elevation, to the nearest 0.01ft, shall be shown for each P.V.C. and P.V.T. The length of each vertical curve shall be shown. From the grades shown on the profile sheets, grade lists shall be prepared. These lists shall show the finished roadway grade at the point of grade application at each 50 ft station, the elevations and stations of all P.V.C.s and P.V.T.s, grade controls, rates of grade, etc. Where superelevation is required, the elevation differential from the control grade shall be shown for each edge of a travel lane. The grade list shall include the superelevation to the nearest 1/8 inch where applicable.

### **402.02 PLOTTING TEMPLATES ON CROSS SECTIONS**

The cross section of the proposed highway shall be drawn on the applicable section of the original ground line, showing clearly the upper limit of fill material and lower limit of excavation and related side slopes. The proposed grade elevation to the nearest 0.01 ft at each 50ft station shall be shown above the point of application, together with the superelevation, in meters, where applicable. Proposed drainage design shall be shown. Limits of unsuitable material should be defined on the cross sections.

### **402.03 PLOTTING SLOPE LINES**

Limits of earth excavation or fill activity shall be determined from the cross section sheets and plotted accurately on the plan sheets. These lines shall indicate either the top of the slopes in cut or the toe of the slopes in fill and shall be labeled "Approximate Slope Limits."

The limits of toe of slope (Fill) shall be indicated by the symbol (F) and the limits of top of slope (Cut) shall be indicated by the symbol (C) at the extremities of the slope limits on each sheet. Both letters shall be noted where there is a change from cut to fill or vice versa.

Example:

(F)\_\_\_\_\_ (F)

(C)\_\_\_\_\_ (C)

(F)\_\_\_\_\_(F) (C) \_\_\_\_\_ (C)

In cases where the toe of slope (Fill) is contiguous with the top of slope of a side ditch, the symbol (F) shall be used because it is the intent to show the relationship of the slope line to the roadway.

#### **402.04 PAVEMENTS AND SUBBASE**

The subbase design depth at any location will be determined in the Roadway Soils and Foundations Report and approved by the Department. The limits and depths of subbase shall be shown on the bottom of the profile sheets in straight line diagram format. Care shall be exercised that no ground water be trapped where transitioning from one subbase depth to another. Abrupt changes in subbase depth shall be avoided by using transitions. Foundation under-drains or other means should be provided for draining the subbase in cut sections.

#### **402.05 SIDEWALKS**

Sidewalks disturbed by construction shall be replaced in-kind unless otherwise directed by the Department. Existing curbing disturbed by construction shall also be replaced in-kind. New sidewalks and curbing and/or an upgrade of existing facilities shall be included only where called for by agreement between the Department and the Municipality concerned.

#### **402.06 MEDIAN OPENINGS**

Median openings shall not be provided unless specifically directed by the Department.

#### **402.07 DRIVEWAYS**

Whenever possible, driveway grades shall be no greater than the grade of the existing driveway that is being replaced. If the grade must be increased, the maximum desirable grade shall be 12% for residential properties and 8% for commercial and industrial properties. Grades in excess of the above must be brought to the attention of the Project Engineer.

In order to assure a clear understanding of the intended driveway construction, the plans and profiles shall be supplemented by a standard sheet, a typical section or a special detail. The typical section or detail shall be of a scale and sufficiently detailed so that there will be no misunderstanding by construction personnel or claim of misrepresentation by the Contractor.

#### **402.08 SIDEWALK RAMPS**

Sidewalk ramps shall be designed in accordance with the HDM and current Americans with Disabilities Act (ADA) guidelines.

Sidewalk ramps shall be constructed at all pedestrian crosswalks in all new designs and at pedestrian crosswalk locations where an existing curb or walk is to be disturbed by construction. Pedestrian crosswalks shall be defined as that portion of a highway (includes streets and roads) ordinarily included within the prolongation or connections of lateral lines of sidewalks at intersections, or any portion of a highway distinctly indicated as a crossing for pedestrians by lines or other markings on the surface, except such prolonged or connecting lines from an alley across a street.

Drainage design in the vicinity of sidewalk ramps shall be considered an integral part of the design of these ramps. No drainage structures shall be placed within the limits of a sidewalk ramp.

Regardless of the type of pavement of adjacent sidewalk, all sidewalk ramps shall be constructed of Portland cement concrete.

### **402.09 FENCING**

Fencing along a controlled access highway is a means of preventing unwanted and hazardous intrusion from outside of the right-of-way line into the vicinity of moving traffic. Where drivers move at high speeds with expectation of complete protection from all forms of roadside interference, fencing should be installed to ensure safety of traffic movement for one or more of the following:

1. To keep animals off the highway
2. To keep children or pedestrians off the highway
3. To prevent vehicles and people from entering or leaving the highway at unauthorized places
4. To prevent stones or other objects from being dropped or thrown from highway overpasses onto vehicles passing underneath

To accomplish the above, continuous chain link fencing shall generally be provided on either the right-of-way or access-control lines. Engineering judgment should dictate exceptions in areas of precipitous slopes or natural barriers where fencing may not be required to effectively preserve access control, or others such as noise barriers where the noise barrier itself provides a physical barrier. The fence shall be 6-foot high in areas having a high concentration of children such as schools, churches and playgrounds. A 5-foot fence shall be used in areas adjacent to housing developments, single family homes, parks, reservoirs, commercial and industrial properties, etc. During design, consideration shall be given to impending development to preclude replacement a short time later.

The Designer should also consider the need for temporary (during construction) and permanent replacement of privately-owned fencing affected by the construction activity. It is particularly important to coordinate the private fencing requirements with the property owner and document the planned work in the Rights of Way acquisition process.

Protective fencing shall be provided on all pedestrian bridges and should be in compliance with the "Bridge Design Manual" for all other structures.

#### **402.10 CONCRETE STEPS**

Concrete steps shall be designed in accordance with the HDM and ADA guidelines.

#### **402.11 OBJECT MARKERS**

Object Markers shall be installed near off-the-road drainage structures, at Type II guide rail end anchors and to otherwise identify minor roadside objects. Two object markers shall be required at all culvert endwalls where such endwalls are not covered by any type of guide railing.

#### **402.12 NOISE BARRIER WALLS**

The type of Noise Barrier Walls used on a project shall be at the Contractor's option, providing the weight of a masonry wall on a bridge does not preclude its use.

Currently, the Department has standard drawings for wood, metal, and masonry Noise Barrier Walls. All are considered applicable where structures are not involved.

The Consulting Engineer is responsible for all modifications to the design of the applicable standard walls as may be required to ensure their suitability for use as a structure mounted Noise Barrier Wall and for the design of the connection of the wall to the structure. All of the approved types of Noise Barrier Walls, except masonry, are to be included as alternatives when a structure mounted Noise Barrier Wall is required.

### **403 STRUCTURES**

The design of structures should be accomplished in a professional manner with due consideration for the aesthetics of the structure, the economy of design relative to the initial construction and long-term maintenance cost, but mostly with consideration for the safety of the public using the structure and those in the vicinity of the structure. It is the Department's opinion that good design produces good looking structures and that gingerbread and other non-natural aesthetic treatment is expensive, and at best only produces short-term aesthetics.

The design of all bridges, box culverts, and retaining walls shall be in accordance with the latest edition of the Connecticut Department of Transportation's "Bridge Design Manual" and in accordance with the criteria noted in the report of the Assignment Meeting. The design and details of all structures and structure components shall conform to the requirements set forth in the latest edition of the AASHTO LRFD Bridge Design Specification. In addition to the requirements of the AASHTO LRFD Design Code, all bridges shall also be analyzed for two Department operating vehicles. Approval for any deviation from these policies must be requested and obtained from the Department before proceeding with the design.

The Consultant shall perform an independent design check of all critical structure components. This should include but not be limited to all abutments, piers, walls, girders, splices, cross frames, connections, bearings, etc. This shall consist of a totally independent design, complete with a stand alone set of computations. The result of the independent design

shall be compared against the original design and modifications made to the final design as deemed appropriate. The final design computations submitted to the Department must include a statement that they reflect the required independent design check.

The following list outlines the design process and describes the various submissions that may be required. These submissions are presented in more detail in the “Bridge Design Manual” and in Chapter 300 of this manual. The list should not be considered all inclusive.

- Environmental Review of the site
- Hydrology Study\*
- Preliminary Hydraulic Study (including any temporary facility as required)\*
- Structure Type Study
- Rehabilitation Study Report
- Scour Analysis (draft/final) Report\*
- Railroad Clearance Diagram \*\*
- Structure Layout for Design (SL/D) plans and Soils and Foundation Report
- Final Hydraulic Study \*
- Final Plans for Review
- Final Submission

\* For structures crossing a waterway

\*\* For structures over a railroad

#### **403.01 LIGHTING ON STRUCTURES**

On State highways, the Department will designate those structures that are to be lighted during the review of SL/D plans, and will determine the basic lighting requirements, specifically the light intensities, and types and location of luminaires. The location and details of light standard anchorages and conduits will be provided to the Consulting Engineer for insertion into the structure plans. Special Provisions for the pertinent items will be furnished by the Department. The Consulting Engineer shall maintain close liaison with the Department concerning details of the required lighting.

On local streets, the Consulting Engineer is responsible for contacting the City or the Utility Company representing the City to determine lighting needs and incorporating these requirements into the contract documents.

#### **403.02 SIGNING ON STRUCTURES**

The Department will designate those structures on which signing will be required during the review of the SL/D plans. The Department will determine the type and location of the sign structures. This data will be submitted to the Consulting Engineer to be used in the design of the anchorages. Details of the anchorages are to be shown on the structure plans.

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Sign supports located on parapets and wingwalls are subject to large loads being developed by the signs and appurtenances. It is, therefore, required that the designer investigate these loads and design the superstructure slab, parapet and/or wingwall accordingly.

If the design agreement requires the Consulting Engineer to design the lighting or signing, then the Consulting Engineer should include the required structure appurtenances in his SL/D plans.

### **403.03 PEDESTRIAN STRUCTURES**

Pedestrian structures shall be designed in accordance with current AASHTO guidelines for such structures and the "Bridge Design Manual." This material will be made available to the Consulting Engineer upon request.

Specific attention will be given to ensure accessibility to the structure.

### **403.04 HIGHWAY GRADE SEPARATIONS**

The minimum vertical and horizontal clearance shall be in conformance with the "Bridge Design Manual," the "Highway Design Manual," and/or AASHTO's "A Policy on Geometric Design of Highways and Streets" whichever governs, as determined by the Department for individual structures.

### **403.05 SCOUR ANALYSIS**

A preliminary screening for scour classification shall be performed on all structures over waterways or in the floodplain, which are being totally replaced, are undergoing major bridge work or whose decks are being repaired. Major bridge work includes substructure widening, deck replacement and superstructure replacement. A preliminary screening classification is already on record in the Department's bridge inspection files for some bridges.

The screening shall be performed in accordance with Hydraulic Engineering Circular No. 18 (HEC-18) or a successor document.

### **403.06 NAVIGABLE WATERS**

If requested by the Department, the Consulting Engineer shall determine the navigability of the stream being crossed. This will be accomplished by first contacting the Department to see if a previous determination of the stream has been made. If no such determination has been made, the Consulting Engineer, in writing, shall request the navigable determination.

If requested by the Department, the Consulting Engineer shall prepare hydraulic data as described in Section 404 (Hydraulics & Drainage) and shall also prepare plans in accordance with the requirements of Chapter 800 (Permits).

Warning lights required for navigation shall be designed in accordance with the requirements of the U.S. Coast Guard.

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### **403.07 RAILROAD STRUCTURES**

The minimum vertical clearance for a structure over a railroad track is limited by Section 13b-251 of the Connecticut General Statutes. See the "Bridge Design Manual" for detailed information.

The Consulting Engineer shall arrange a field meeting with representatives of the railroad involved, and Department of Transportation personnel to investigate the site, determine controls, and establish clearances. This meeting should be held early in the Preliminary Design phase.

Following the initial meeting with the railroad, the Consulting Engineer shall develop railroad clearance diagrams and an "Approval of Railroad Clearance" form for the railroad's approval.

To minimize any possible problems before the construction contract is awarded, the Consulting Engineer shall arrange a railroad field review meeting at the Final Design for Review Submission. At this time, plans and specifications including limitation of the Contractor's operations must be available. The meeting shall be attended by the Department's Design and Railroad Liaison Engineers, and representatives of the Railroad including engineering operations and electrical section.

The Consulting Engineer is to inform the Bridge Liaison Engineer prior to the scheduling of such a meeting.

### **403.08 SOILS**

The subsurface exploration program for structures must essentially be completed prior to the SL/D submission so that the boring logs can be included. Reference is made to Section 405 (Soils and Foundations) for more detailed instructions.

### **403.09 UTILITIES**

During the SL/D review, a structural utility meeting will be held to determine what utilities will be incorporated into the structure design. The Consulting Engineer shall be responsible for coordinating and incorporating such utilities into the structure.

### **403.10 POST DESIGN RESPONSIBILITIES**

The Consulting Engineer is responsible for various post design activities as detailed in the "Bridge Design Manual."

These include the following:

- Contractor inquiries both during the bidding process and during construction
- Changes to the contract documents both by Addendum and by Construction Order



- Review of Shop Plans
- Review of Working Drawings

## **404 HYDRAULICS AND DRAINAGE**

The requirements for hydraulics and drainage facilities are specified in the Department's "Drainage Manual" (DM). In addition, guidelines and procedures outlined in current FHWA hydraulic circulars shall be followed. Chapter 3, Design Development, in the DM should be referred to in developing the hydraulic/drainage design. The design checklists referred to in the DM need to be completed, signed by the engineer and included with the design submissions. This will expedite the review process.

If a project involves crossing a watercourse, then the Department will coordinate with the DEP Fisheries Division to determine if fish passage is a concern. If a project involves fish passage, then coordination with the Fish Biologist should be maintained as the project develops to ensure Fisheries requirements/concerns are addressed.

All hydraulic and/or drainage computer programs which are to be used shall be submitted to the Department for approval. Documentation should be provided to verify that the computer program proposed by the Consulting Engineer will generate the same data requested in the DM. It is essential that an early approval be obtained, prior to its use, in order to preclude delays in the design of projects.

### **404.01 HYDRAULICS**

A hydraulic analysis is involved when a waterway opening conveys a watercourse with a watershed area greater than one square mile (1.0mi<sup>2</sup>). Section 3.5 of the DM shall be followed if the project involves hydraulics.

In order to ensure Quality Control/Quality Assurance on hydraulic designs, the engineer performing the analysis must be approved by ConnDOT on a project by project basis. The Department requires that an individual responsible for the work be a licensed Connecticut Professional Engineer. Approval requests for previously qualified engineers to work on other State projects will not require the resubmission of a resume. However, an approval request for the current project together with a copy of the Department's prior approval letter and an updated list of hydraulic designs performed by the candidate is required.

One critically important element in the hydraulic design of waterway crossings is the analysis of bridges relative to scour. The Department is committed to assuring that all new and existing structures remain safe from scour related damage. Accordingly, specific guidelines have been established for the design and analysis of bridge foundations. This multidisciplinary effort, involving hydraulic, structural and geotechnical engineers, is detailed in Chapter 9 of the DM as well as Section 5.14 of the Bridge Design Manual. Prior to undertaking a scour analysis or scour countermeasure design, it is imperative that the design engineer become thoroughly familiar with the FHWA documents entitled HEC-18, "Scour at Bridges," HEC-20, "Stream Stability at Highway Structures" and HEC-23, "Bridge Scour and Stream Instability Countermeasures."

### **404.02 DRAINAGE**

Drainage design development shall be performed in accordance to the following sections of the DM:

Preliminary Design Submission	Section 3.4
Drainage/Semifinal Submission	Section 3.6
Final Design Submission	Section 3.7
Drainage Guidelines for Resurfacing Projects	Section 3.10

### **404.03 HYDRAULIC PERMIT REQUIREMENTS**

Section 3.11 of the DM outlines the hydraulic permit requirements.

## **405 SOILS AND FOUNDATIONS**

### **405.01 GENERAL**

The Consulting Engineer shall prepare soils and foundations engineering studies and analyses as may be required for the proper design of the project including pavement, structures and overhead sign support foundations. The Consulting Engineer shall be responsible for the procurement of the necessary data and information to aid in accomplishing such studies and analyses.

The Consulting Engineer shall have an engineer who will supervise the soils and foundations engineering work, said person may already be on the Consulting Engineer's staff in such a capacity, or in their employ, or be a consultant specifically retained to do this work. As stipulated in the Agreement, this person shall be qualified in soils and foundations engineering and must be acceptable to the Department.

Depending upon the nature and scope of the project, it may be necessary to prosecute the soils and foundations engineering work in two separate phases; a Pilot Program in the preliminary design and a more in-depth investigation in the final design. The complexity of the project will generally determine the degree of soils and foundations engineering work to be accomplished in a particular design phase. The degree, type and necessity of such work, and the manner in which it is to be performed, shall be subject to the prior approval of the Department.

Detailed information relative to procedures for accomplishing the various phases or aspects of soils and foundations engineering work is contained in "Soils and Foundations Guide for Design by Consulting Engineers."

The Consulting Engineer is reminded that field activities associated with obtaining soils data are subject to environmental regulations administered by federal and state agencies. Permits

may be required if exploratory work is to be performed in regulated areas. The Consulting Engineer should coordinate permitting requirements with the Project Engineer.

#### **405.02 SOILS AND FOUNDATIONS ENGINEERING LIAISON**

The Consulting Engineer's personnel or consultant, approved by the Department to be responsible for the soils and foundations work, shall maintain adequate liaison with the Department. Such liaison activities will involve matters relating to procedure, special design considerations and any other technical aspects which may require mutual resolution for the successful and scheduled completion of various phases of design.

Communication with the Department through normal channels, or other means, such as office and field conferences, will be necessary. The frequency and depth of these liaison contacts will be governed by the complexity of the project relative to soils and foundations features.

#### **405.03 DATA FOR SOILS AND FOUNDATIONS ENGINEERING STUDIES AND DESIGN**

The Department will make available to the Consulting Engineer any subsurface information, soil testing results, engineering studies and evaluations, etc., which are in its possession, and which may be applicable to the project.

In the absence of such data, or in the event the available data is insufficient to generate proper studies for completion of project designs, the Consulting Engineer will be required to procure the necessary data and/or augment available data.

Subject to the approval of the Department, the Consulting Engineer shall plan, arrange for and inspect whatever field, laboratory and office work of a soils and foundations nature is necessary to complete the required roadway and structure designs appropriate to the particular phase of the project design. The Department may limit, reduce, or expand any field or laboratory programs proposed by the Consulting Engineer for procurement of the necessary data for soils and foundations engineering studies and analyses. All data and information shall be procured by currently accepted methods and practices in the field of soils and foundations engineering, unless otherwise indicated or stipulated by the Department.

#### **405.04 ENGINEERING STUDIES AND DESIGN**

The Consulting Engineer shall submit to the Department copies of all types of field subsurface information procured, laboratory test results, computations, etc., made in formulating and achieving specific soils and foundations recommendations for the design of the roadways and structures. Such supportive material or documents shall be submitted, prior to, or concurrently with, the various project design submissions, unless otherwise indicated by the Department.

### **405.05 SOILS AND FOUNDATIONS ENGINEERING REPORTS**

The Consulting Engineer shall prepare and submit to the Department, engineering reports covering the soils and foundations features of the work necessary to support the presented designs for the various submissions required for the roadways and structures on the project.

Such reports shall be prepared by or supervised by the Consulting Engineer's approved designated soils engineer. In any case, these reports shall be signed by the approved individual.

These reports will be reviewed by the Department in arriving at its acceptance, modification or rejection of various soils and foundations aspects of the project designs as submitted.

## **406 TRAFFIC**

The Traffic component of the project design effort involves designing permanent features such as signals, signing, striping and illumination. It also includes planning and designing an appropriate Work Zone Traffic Management Plan (TMP) in compliance with the Department's Work Zone Safety and Mobility Policy. All projects will necessitate the development of a TMP; however, those projects that rise to the level of "significant" (generally work on interstate expressway, see Department staff for project-specific determination) can be expected to require a broader/regional assessment of traffic impacts and subsequently more detailed planning of the Contractor's and the Department's actions to provide a high level of safety for both workers and the public during construction.

The Traffic Management Plan (TMP) involves three specific elements, including Temporary Traffic Control (TTC) plans (staging plans; maintenance and protection of traffic plans and specifications; prosecution and progress specifications, etc.); a Transportation Operations (TO) Plan; and a Public Information/Outreach (PI or PO) Plan.

The TMP is to be presented as a separate and distinct section in the Design Report; incorporating revisions and more detail over the course of the design process. Some of the TMP is to be physically presented in the contract documents (in particular the TTC plans), so the written TMP in the Design Report should reference and summarize the contract controls in the TTC Plans.

The US DOT-Federal Highway Administration has published the following guidance documents concerning implementation of Work Zone Safety and Mobility Policies.

- 1) Implementing the Rule on Work Zone Safety and Mobility
- 2) *Developing and Implementing Transportation Management Plans for Work Zones*
- 3) Work Zone Impacts Assessment
- 4) Work Zone Public Information and Outreach Strategies

### **406.01 SIGNALS**

Signals should be designed in accordance with all current Federal and State Standards and/or guidelines including but not limited to the MUTCD, the Department's "Manual of Traffic Control Signal Design," "Standard Specifications for Roads, Bridges and Incidental Construction," "Guidelines for Highway Design," State Traffic Commission Regulations, the requirements of the Americans with Disabilities Act, and the requirements of the Department of Transportation's Office of Rights of Way.

#### **PRELIMINARY DESIGN PHASE**

The **preliminary design** plans for traffic signals should reflect the drafting guidelines contained in the Department's "Manual of Traffic Control Signal Design." Accompanying the PD design submission should be the following:

1. Peak-hour turning traffic volumes for each intersection in a flow diagram format
2. Intersection capacity analysis results using the methodology described in the Transportation Research Board's "Highway Capacity Manual" (HCM) for each intersection and peak-hour analyzed
3. For each peak hour analyzed, queue analysis for each lane group approaching the signalized intersections in the project
4. The Traffic section of the Design Report should address all pedestrian crossings and indicate the consultant's intended signal design for each location. At a minimum, it should address design considerations which will be affected by capacity, accident history, and field conditions. It shall also address the type of signal system planned and why, if applicable, as well as the duration and number of timing plans needed. It should also contain a section specific to the Traffic Management Plan addressing Temporary Traffic Control Plans and methods (staging and maintenance and protection of traffic plans), a Transportation Operations Plan, and a Public Outreach Plan.

#### **FINAL DESIGN PHASE**

The **semi-final design** plans should reflect the comments of the PD phase and continue to follow the Department's "Manual of Traffic Control Signal Design" and include a complete electrical design. Accompanying the semi-final design submission should be the following:

1. Traffic Control Signal Plans
  2. Project specifications and special provisions needed to construct the traffic signal work
  3. Span pole calculations
  4. Intersectional signing and pavement marking plans if applicable
  5. Time space diagrams and complete coordination and programming information for each proposed timing plan for each signal to be interconnected
  6. Appropriate standard detail sheets and special details necessary to construct project
  7. Appropriately updated Transportation Management Plan in the Design Report
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8. Completed unmetered service request forms for each location
9. Traffic signal item detailed estimate sheet
10. Communications/interconnect plan for those signals to be interconnected

The **Final Plans for Review** Submission should reflect the comments of the semi-final design phase and incorporate ongoing coordination with utility companies and town entities when appropriate. Those items originally accompanying the semi-final submission which require revision as a result of the semi-final review should be resubmitted at this time.

The **Final Design Plans** submission should reflect the comments of the Final Plans for Review phase and include the following:

1. All traffic related plans, specifications and estimates included in the complete contract document submission.
2. A record copy of the traffic control signal plans plotted on Mylar having the seal of a Connecticut licensed professional engineer affixed
3. Intersection signing and pavement marking plan (if required) plotted on Mylar having the seal of a Connecticut licensed professional engineer affixed
4. Appropriately updated Transportation Management Plan in the Design Report
5. For signal systems, a record copy of the communications/interconnect plan plotted on Mylar

The **Post Final Submission** should include a separate digital storage disk containing the CADD file(s) for the signal plans, the intersection signing and marking plans, and the detailed estimate sheet of traffic items. This is in addition to the submission of complete contract plans in electronic format (See Section 304.05).

#### **406.02 SIGNING**

A preliminary signing pattern (1"=200' scale plans) shall be included with the Preliminary Design submission. The Consulting Engineer must be aware that large sign foundations may require subsurface investigations and must prepare soil program accordingly.

Signing required for the maintenance and protection of traffic will be submitted with the Semi-Final Design submission.

Final signing plans, specifications and estimates should be included with the Final Plans for Review submission. Any required "Manual on Uniform Traffic Control Devices" (MUTCD) project signing occurring outside the project limits shall be included with the design of the project.

#### **406.03 PAVEMENT MARKINGS**

Pavement Marking plans, specifications and estimates shall be included with the Semi-Final Design Submission and prepared in accordance with the drafting guidelines in the "Manual of Traffic Control Signal Design."

#### **406.04 ILLUMINATION**

If illumination is part of the Consulting Engineer's assignment, it shall be designed in accordance with current federal and state standards, including "FHWA Roadway Lighting Handbook," "AASHTO Guide for Roadway Lighting," the Department's standard specifications, and the "National Electrical Code."

The Preliminary Design submission should address whether to install illumination, limits of illumination, preliminary illumination concept (conventional roadside, median, utility pole, high mast arm, etc.), and a determination of who will own, maintain and pay energy costs.

The Semi-Final submission should include plans showing illumination layout, design criteria, legend, notes and the electrical layout. The submission should also include miscellaneous detail sheets, lighting and electrical calculations, and proposed special provisions.

The Final Plans for Review submission should reflect all corrections and completion of the semi-final submission, plus pay items, quantities, cost estimate, and Utility Company correspondence. Illumination/Electrical information must be properly coordinated with all highway, bridge, drainage, signing, and signal designs. Highway and bridge plans shall reflect illumination/electrical appurtenances as required.

The Final Design submission shall incorporate all previous Department comments and be in a format described elsewhere in this manual.

#### **406.05 MAINTENANCE AND PROTECTION OF TRAFFIC (Transportation Management Plan-TEMPORARY TRAFFIC CONTROL)**

This item includes all necessary plans, specifications, temporary signals, construction signing, temporary pavement markings and temporary illumination as required to maintain and protect traffic operations. The geometry for all detours should be compatible with the approaching highway and shall equal or exceed the requirements of Part VI of the MUTCD. The Department will provide the Consultant with a "Limitation of Operations" chart which will dictate the number of lanes required on all expressways. Liquidated damages will also be provided for construction violations relative to the "Limitations of Operations" chart.

The Consultant and the Department shall discuss the optimum method for maintaining traffic during construction. On complex projects, a 1"=200' scale concept plan and descriptive narrative for the Maintenance and Protection of Traffic should be included with the Preliminary Design submission. A fully developed 1"=200' scale Maintenance and Protection of Traffic plan, 1"=40" scale detour plans, and special provisions for Maintenance and Protection of Traffic and Prosecution and Progress should be included with the Semi-Final Design Submission.

If any traffic appurtenances are designed by the Department, final plans, specifications and estimates will be forwarded to the Consulting Engineer for incorporation into the project.

**406.06 MAINTENANCE AND PROTECTION OF TRAFFIC (Transportation  
Management Plan – TRAFFIC OPERATIONS)**

The Transportation Operation (TO) Plan involves planned activities by the Department and Contractor to manage in part the volume of traffic and the planned response to incidents. It may involve contract provisions and/or Departmental actions through standard and non-standard emergency response procedures.

**406.07 MAINTENANCE AND PROTECTION OF TRAFFIC (Transportation  
Management Plan – PUBLIC INFORMATION)**

The Public Information (PI) Plan involves developing strategies to increase public awareness of the anticipated traffic impacts and provide timely information.

## **407 ROADSIDE DEVELOPMENT**

The Consulting Engineer shall consider aesthetics during the development of the plans for the project. Particular emphasis shall be given to screening the highway from unsightly areas such as junkyards and scrap metal processing facilities. Among the acceptable methods of accomplishing this screening are the placing of the highway in cut and the construction of earth berms.

Normally, the preparation of planting plans will not be included in the Consulting Engineer's assignment.

The roadside development shall be designed in accordance with the "Highway Design Manual" and applicable Department Policy Statements.

The Department has prepared guidelines for projects involving the Merritt Parkway. A document titled "Merritt Parkway Guidelines for General Maintenance and Transportation Improvements" is available from the Department.

## **408 SURVEY**

If survey is included in the assignment, the Consulting Engineer shall complete the survey assignment in accordance with the Department's current "Location Survey Manual" or as directed by the Project Engineer.

**408.01 PROGRESS SUBMISSIONS**

**Project Control:** All control shall be reviewed and approved by the Department prior to the submission of the base map data.

Horizontal Submission shall include:

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1. Control sketch of traverse network
2. Copy of traverse adjustment computations
3. Raw horizontal and angular field measurements

Vertical submission shall include:

1. All original computations for level run and sketch of level run
2. Original computations concerning adjustments, copy of field notes, etc.
3. Copy of computations concerning the adjustment of bench levels

**Cursory review of Mapping and Digital files:** The Consulting Engineer will provide one set of paper prints and electronic media (coordinate media type with your Project Engineer) for review by the Department following the approval of control survey.

**Final review of Mapping and Digital files:** The Consulting Engineer will provide one set of paper prints and electronic media (coordinate media type with your Project Engineer) for review and approval prior to certification.

**Final Submission**

1. Certified Mylars
2. Final Digital Files

**408.02 CHANGES IN FIELD CONDITIONS**

Regardless of the survey responsibility, the Consulting Engineer shall make periodic visits to the project site during all stages of design to detect changed field conditions. If survey is in the assignment, the Consulting Engineer shall perform or arrange for additional surveys needed to modify and correct the plans. If the Department performed the survey, the Consulting Engineer should notify the Department of the observed changes and request updated survey files.

The design plans must be adjusted as required to ensure that the plan and design details are those best suited to the latest existing field conditions.

**409 RIGHTS OF WAY**

The Department will be responsible for acquiring the necessary property, easements and rights for the project. The Consulting Engineer, with the approval of the Project Engineer, shall establish taking lines, non-access lines, easements and rights in accordance with the Department's "Policy and Procedures for Property maps," a copy of which can be obtained from your Project Engineer. The Project Engineer will also provide current samples for each type of property acquisition map required for the project.

The acquisition of right of way is a time consuming process; therefore, property requirements should be clearly defined as early in the Final Design Phase as possible. Depending on the complexity of the project and the experience of the consulting project engineer, it is advised to schedule a rights of way impacts meeting with staff from the Rights of

Way Office, Construction and the Liaison Project Engineer. This coordination meeting should take place after resolution of all Preliminary Design comments and well in advance of the Semi Final submission, so the determinations can be appropriately incorporated. At a minimum, all property requirements should be identified and shown on the Semi-Final Design Submission. The Project Engineer and the Consulting Engineer shall at this time compare each property acquisition map to the semi-final design plans and report any changes to the Office of Rights of Way immediately. Of particular concern, historically, is the proper identification of temporary property rights and easements required to perform the construction. The necessary temporary work areas and rights of access are largely dependent on storage of equipment and materials, staging, maintenance and protection of traffic, anticipated prosecution of progress constraints, etc. The proposed acquisitions must be consistent and appropriate for these Contract constraints and they must be reviewed and revised during Final Design if necessitated by the evolution of the contract staging and maintenance and protection of traffic issues.

#### **409.01 TITLE SEARCH**

The Department will perform a title search on the affected properties. A Design/R.O.W. meeting will be scheduled by the Project Engineer to identify properties requiring title search. A Mylar base survey plan with the proposed baseline shown shall be provided by the Consulting Engineer for this meeting. It is recommended that this meeting occur the same day as the Preliminary Design Review Meeting. The "Preliminary Schedule of Property Owners" (forwarded with the Preliminary Design Submission), the type of title search required, and the project schedule will be discussed.

One week prior to the actual commencement of title search activities, the Department will request confirmation from the Consulting Engineer that the "Preliminary Schedule of Property Owners" is accurate. Upon verification that the schedule of owners is correct, the document will be renamed "Schedule of Property Owners" and forwarded to the Department. Title search will not start until this document is received.

The completed title search will be forwarded to the Consulting Engineer. The current owner's names, property lines, easements and rights shall be transferred to the base survey plan. Property line dimensions should not be shown on the base survey.

#### **409.02 13A-57 MAPPING**

State Statute Section 13a-57 allows the Department to file layout plans with municipalities to "freeze" all zone changes within the project corridor. The procedures for filing layout plans are available from your Project Engineer. Layout plans are not required for all projects. The need for 13A-57 mapping will be established at the Assignment Meeting.

#### **409.03 PROPERTY MAPS**

Property maps must be prepared for all properties affected by land takes or easements, in accordance with the Department's "Policies and Procedures for Property Maps." (As Revised or Amended).

The Consulting Engineer shall review the affected sites in the field to determine if the survey mapping agrees with the current field conditions. Any changes should be reflected on the current ground survey file(s) as noted in Section 408 prior to the preparation of the property maps.

When the project design has progressed to the point where property impacts are defined and generally finalized (i.e. design 50%-70% complete), the consultant will submit one draft map for format approval for each type of property acquisition required for the project (e.g., types- total take, partial take, slope easements, drainage rights of way). Each map should be accompanied by a current plan view drawing (and cross sections if appropriate) for reference purposes.

Upon written approval as to format for each draft map, the Consulting Engineer will prepare the remainder of the property acquisition maps required for the project. A paper print of each property acquisition map will be submitted to the Department for approval. Once approved, the Consulting Engineer shall provide a reproducible and unsigned, property acquisition map for use in negotiations with the property owner. Any subsequent revisions to a property acquisition map, whether initiated by the Consulting Engineer or the Department, shall be so noted in the Revision block of the property requisition map.

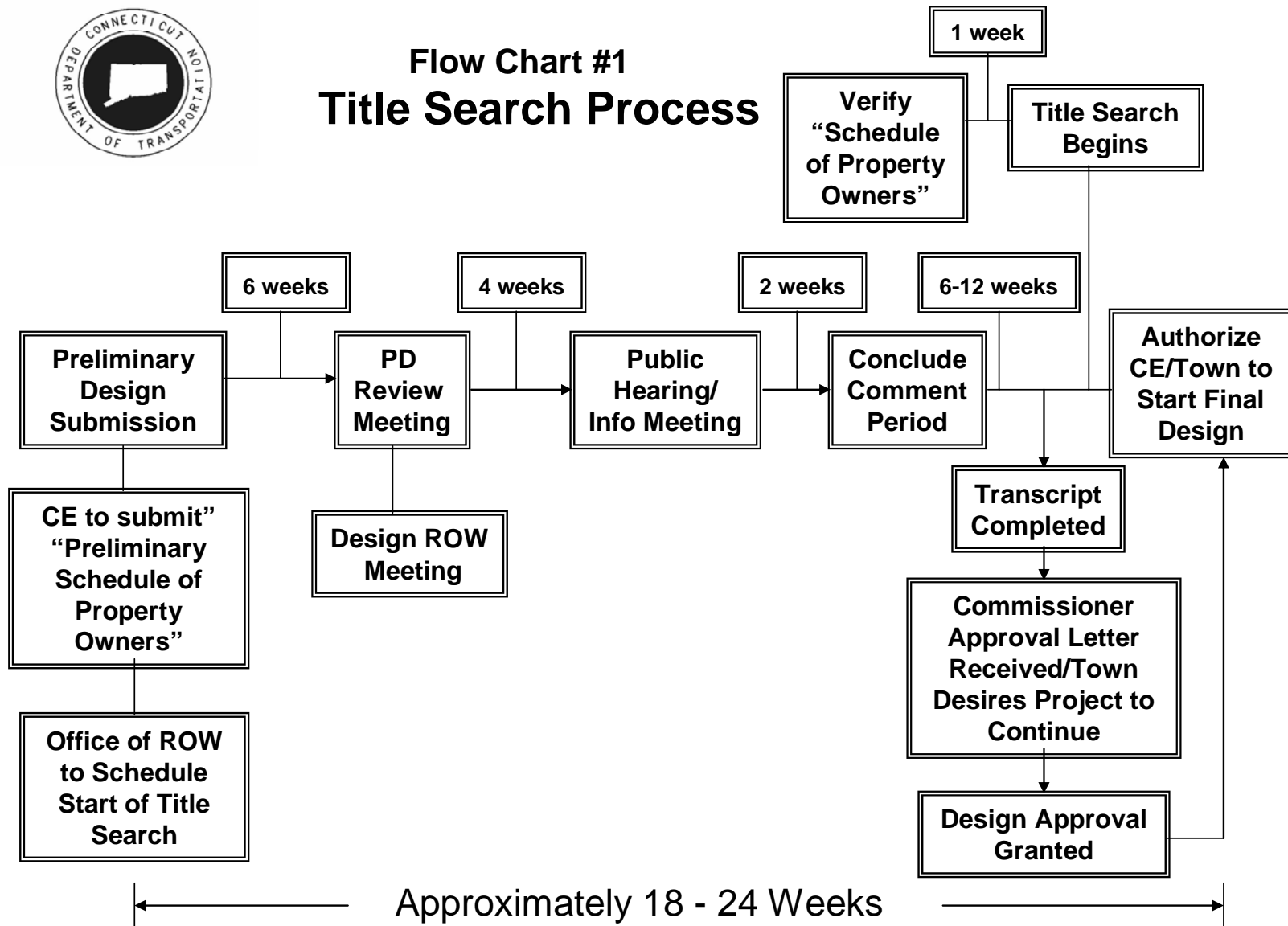
Upon completion of negotiations with the property owner, the Department will request from the Consultant a "fixed line photographic" matte Mylar (.003 inch thickness minimum) stamped with indelible red ink by the producer and subsequently "signed and sealed" by the registered land surveyor having prepared the map.

All rights and easements noted on the property acquisition maps shall be shown on the design plans in accordance with the "Policies and Procedures for Property Maps." The Consulting Engineer is responsible for the proper conversion of English and metric dimensions and for consistency between the final property maps and the final contract drawings. The configuration and controls of all taking lines and defined easements must appear on the final contract drawings exactly as shown on the property acquisition map.

In the event a property is to be acquired in total for the project, the Consulting Engineer will be required to prepare a second version of the property map referred to as an "internal use" or "excess property" map. This internal use map shall be submitted in MicroStation (.dgn) file format for use in the Department's GIS excess property inventory.

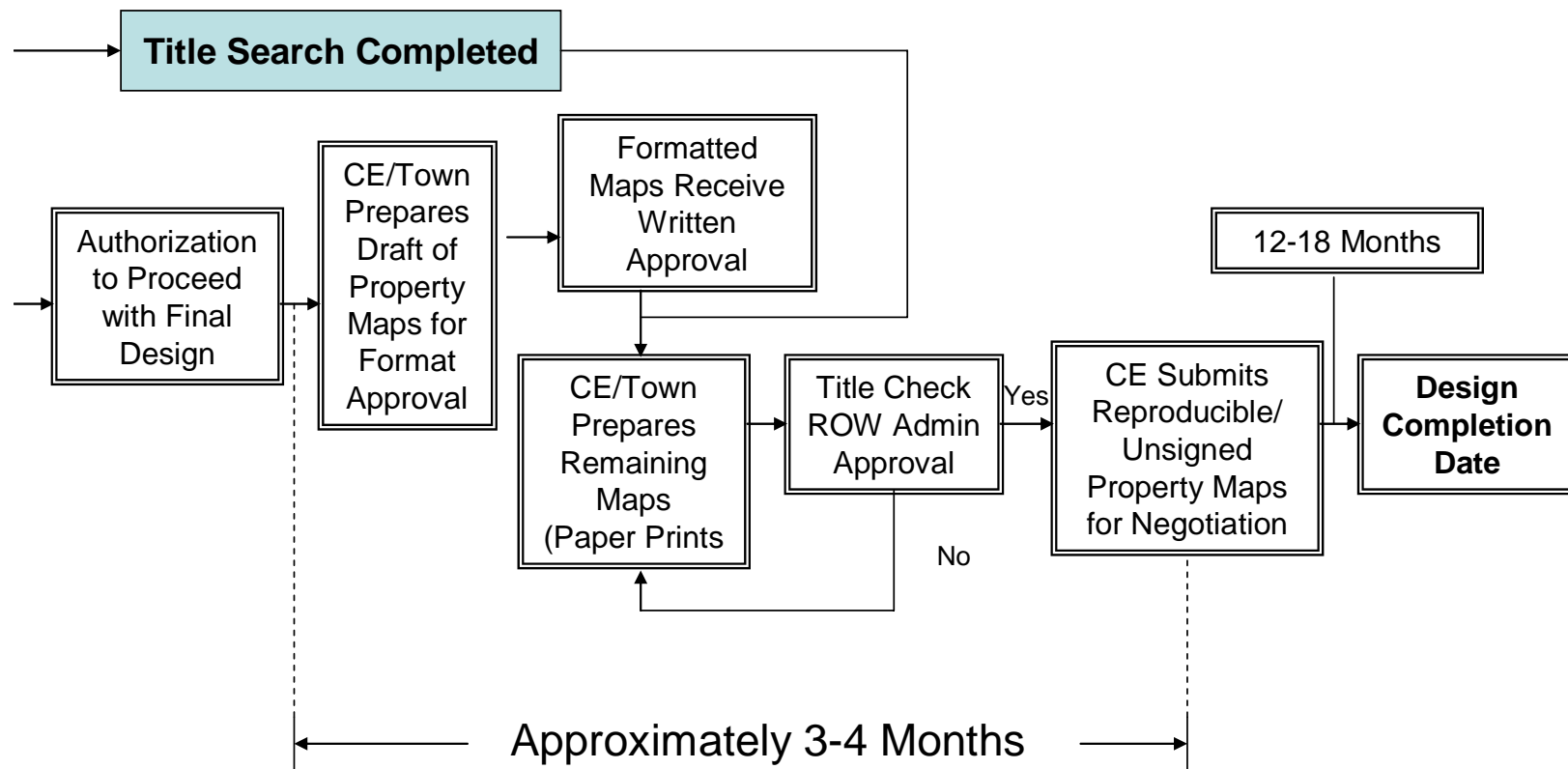


## Flow Chart #1 Title Search Process





## Flow Chart #2 Property Map Development



## **410 ENVIRONMENTAL PERMIT APPLICATIONS**

The Consulting Engineer is expected to prepare all necessary permit applications. It is recommended that coordination meetings take place with the Department's Office of Environmental Planning for the purpose of clarifying the specifics of the application process early in the Final Design phase. The Consulting Engineer may also be required to make presentations to regulatory agencies to obtain feedback before and during the actual permit process. Draft permit applications should be provided for Department review as soon as practical after major hydraulic, drainage and structural design elements have been resolved. Final permit applications should be available for submission to regulatory agencies as soon as possible after the Semi Final Plan Submission process (approx. 70-75% complete). More information pertaining to the breadth of permitting involvement that may apply to the project can be found in Section 800.

# CHAPTER 500

## SUPPORTIVE DOCUMENTS

## **501 SUPPORTIVE DOCUMENTS**

This section describes the written backup material that will supplement the Final Plans. The project specifications and estimates will become part of the Contract Documents, while the design computations and quantity estimates will be used to verify the information contained in the Final Plans. The number of copies of supportive documents to be submitted should be coordinated through the Project Engineer. Chapter 300 (Design Development) describes which documents or parts of documents shall accompany the plans for the various submissions.

## **502 COMPUTATIONS**

### **502.01 HORIZONTAL AND VERTICAL ALIGNMENT**

Horizontal geometry computations shall be submitted in a bound copy with the final design submission. These shall include all computations required to establish the horizontal geometry. They shall include computer printouts or handwritten computations as well as sketches to define each location.

All horizontal geometry computations shall include the following information:

1. Project Number
2. Town (where project is to be constructed)
3. Subject of computations
4. Names of persons that prepared and checked the computations
5. Date of preparation and date checked
6. Sketches as required to define locations

Vertical geometry computations (referred to as a grade list) shall be submitted with the Final Design submission. The grade list shall contain the following information:

1. Project Number
2. Town (where project is to be constructed)
3. Name of road that grade list applies to
4. Names of persons that prepared and checked the grade list
5. Date that the grade list was prepared and checked
6. Station and elevation of P.V.I.s, P.V.C.s, P.V.T.s, intersection of roadways, beginning of construction, end of construction, and any other point required to adequately describe critical controls along the baseline
7. Grade of all tangent sections
8. Station and elevation of all sections shown on the cross section sheets
9. Banking of road



### **502.02 DRAINAGE COMPUTATIONS**

The Consulting Engineer shall submit the final drainage computations. Their computations shall be based on the criteria established in the Department's current "Drainage Manual" and shall include all mapping and data utilized to perform the drainage design.

## **503 QUANTITIES**

The Consulting Engineer shall prepare and submit quantity computations for each project. The use of "Unassigned" quantities to round off or inflate (within reason) "hard to quantify" contract items is acceptable. The use of "Token" contract quantities, intended solely to establish a contract bid price, **is not allowed**.

The Consulting Engineer shall carefully evaluate the Contractor's need to borrow or stockpile material during each phase of construction; ensuring that the roadway excavation and embankment placement are properly coordinated with the provisions of the Maintenance and Protection of Traffic concept. In cases where balanced quantities are not possible within a phase, the Consulting Engineer will provide for this temporary quantity imbalance in the contract.

### **503.01 BREAKDOWN OF QUANTITIES**

Quantity computations shall be supportive of and in agreement with the Detailed Estimate Sheet as well as the Proposal and Federal Estimates of the Contract Documents. These computations shall be complete in detail, showing the breakdown of quantities, method of estimating and the specific locations where the computations apply. The quantity computations shall be prepared in such a manner that the nature, quantity and location of all construction work will be readily disclosed.

### **503.02 SUMMARY OF QUANTITIES**

A quantity summary sheet shall be prepared for each category of items.

The information on the quantity summary sheets shall be in agreement with the Detailed Estimate Sheet of the Final Contract Drawings.

The quantity computations shall indicate the names of the preparer and the checker, and the corresponding dates.

## **504 SPECIFICATIONS**

Items shown in the Contract Documents shall conform to the Standard Specifications, Supplemental Specifications or Special Provisions.

### **504.01 STANDARD SPECIFICATIONS FOR ROADS, BRIDGES AND INCIDENTAL CONSTRUCTION**

Construction items noted in the Contract Documents shall conform to the specifications outlined in the Department's Manual entitled "Standard Specifications for Roads, Bridges and Incidental Construction." This document is commonly referred to as simply the "standard specifications." They are the basic construction specifications that describe and define the requirements of those items most commonly used in highway construction.

These specifications undergo constant change as new methods, materials and technology become available. The vehicle for accomplishing permanent change to a standard specification is the supplemental specifications.

### **504.02 SUPPLEMENTAL SPECIFICATIONS**

The Supplemental Specifications add to, delete or otherwise revise the Standard Specifications.

The Supplemental Specifications are issued periodically in a package containing all the current supplements that have been issued since the last publication of the Standard Specifications. Contact your Project Engineer to ensure that you have the latest supplemental specifications.

### **504.03 SPECIAL PROVISIONS**

In those cases where neither the Standard Specifications, the Supplemental Specifications, nor notes on the plans are found to adequately describe a construction activity or pay item, a special provision must be prepared.

The special provisions for a particular project are usually prepared by the designer, as that person is most familiar with the item's requirements. An exception is where the use of a highly specialized item is proposed. In those instances, Department personnel may become involved to assist the Consulting Engineer in the preparation of the special provisions.

#### **Format**

It is essential that the format of the Standard Specifications or Supplemental Specifications be followed in preparing the special provisions. Consistency will assure that all essential elements are addressed and will simplify its interpretation.

Toward that end, the Department has developed MS Word "Format Files" for use by all parties in the creation of special provisions in the proper format. Furthermore, software files may be available to convert existing electronic files of special provisions into properly formatted contract specifications. The consultant will be required to submit final contract special provisions in electronic (MS Word) format.

The book of Standard Specifications is arranged in sections, each section dealing with a specific item or group of items.

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Each section is further divided into five subsections called articles. Each article is descriptive of its function. They are Description, Materials, Construction Methods, Method of Measurement and Basis of Payment. Any subpart of an article is a sub-article. For example, in the case of the bituminous concrete specification, the specification is Section 4.06 - Bituminous Concrete or Section M.04-Bituminous Concrete Materials. The article is the unit under the section, such as 4.06.03 - Construction Methods. The subarticle is such as 4.06.03-1 Samples; 4.06-01(b) Cessation of Supply; or M.04.01-3 (a) Job-Mix Formula.

Item numbers and names used on the title of a special provision shall conform to the Department's "Bid Master File" of item names and numbers. The letter "A" shall be affixed following the item number on all special provisions. This alerts the user of a special condition. Should no item number exist for a new item, the consultant shall request, through the Project Engineer, that a number be issued if possible.

1. Description

This fully describes the item or operation. It should be factually descriptive, concise and accurate. There must be room for only one interpretation.

2. Materials

In describing the materials to be employed to build this item, this article should refer to the materials section of the Standard Specifications, if possible. Next in line would be, in preferential order, AASHTO, ASTM, recognized national standard or industry standard. If standards are not available, the physical requirements necessary for the construction of a particular item should be specified and noted in this article. Brand names should only be used as a last resort and, where they are used, at least three manufacturers of a particular item should be specified. Should a proprietary material be required, a waiver should be requested in accordance with applicable Federal Regulations.

3. Construction Methods

A properly written section on Construction Methods may be written as one of the following: 1) a description of the result to be accomplished; 2) a detailed step-by-step description of construction; 3) a combination of 1) and 2) with either predominating. The use of 2) is to be avoided as much as possible. The use of 1) or 3) is advised, 1) being preferred to the extent practicable.

4. Method of Measurement

This article directs the measurement of the item in the unit of measurement by which the item will be paid. The unit used must be consistent with the type of construction used. For example, an item such as curbing, which is essentially linear in extent, will have a linear unit of measurement. No measurement or computation need be made in the case of a lump sum item.

5. Basis of Payment

This article describes the manner in which payment will be made for a particular item. It is based on the unit of measurement of the "Method of Measurement" article. The item name specified in this article shall correspond to the name used on the title of the special provision. Particular care must be taken to state exactly what will be paid for, what part of the operation or under what circumstances no payment will be paid, and what work will be paid for under other specific items.

### **Preparation**

The preferred method of preparing a special provision is by reference to an existing item in the Standard Specifications and by making appropriate modifications to fit the condition at hand. This helps assure that the essential elements are included. A second method involves developing an entirely new specification, including all of its articles. The object of either method is to convey to the user, in the briefest possible fashion, the directions required to complete construction of the item. In the case of an “end result specification,” a description of the final product should be available in the articles.

An amendment to an existing standard specification may be made by modifying only the portions required to adapt it to present need. When referring to an existing specification, the reference may be to a section, a specific article or a sub-article. In some cases, the desired result can be achieved by amending only a specific sentence.

### **504.04 RAILROAD**

The Consulting Engineer shall write special provisions to cover protective requirements of Railroad Companies where construction work takes place, on, over, under or immediately adjacent to a railroad right-of-way. They are subject to review by the affected Railroad Company. Required special provisions dealing with specific Railroad Companies’ requirements will be furnished by the Department’s Project Engineer to the Consulting Engineer as requested.

### **504.05 MUNICIPALITIES AND UTILITY COMPANIES**

These special provisions cover requirements of Municipalities and/or Utility Companies whose required work is included within the Department’s Contract Documents.

Each individual utility owner is responsible to write and submit needed special provisions to the Consulting Engineer. The Consulting Engineer shall review them for conformity to Department requirements and shall include them in the Contract Documents. Furthermore, the Consulting Engineer shall formulate and write additional special provisions as needed to supplement submissions made by the utility companies. They shall pertain to integrating the various individual requirements of the affected municipality or utility company. Those may include revisions to the limitation of operations due to utility work or contractor assistance such as temporary utility supports required for the utility construction.

### **504.06 CONTROL OF BID MASTER FILE**

In order to contain the number of new items assigned to the Bid Master File, the following procedure is to be followed:

Option 1: As projects are developed and units of work are identified, standard pay items from the “Standard Specifications for Roads, Bridges and Incidental Construction” and its supplements are to be used wherever possible.

Option 2: In the event that this is not practical, the item number and name of standard pay items should be used and a Special Provision written to provide all the essential elements

required for the construction of that item (Description, Materials, Construction Methods, Method of Measurement, and Basis of Payment). The item number needs a suffix A.

Option 3: If either of the two preferred options outlined above cannot be utilized, the use of existing non-standard item numbers and names contained in the Bid Master File should be used and a Special Provision written as previously discussed. The item number selected needs a suffix A.

Option 4: When it becomes necessary to add a new item to the file, prior approval from the Department is required. Plans and Specifications should not contain reference to any new items until such approval has been obtained. The new item number needs a suffix A.

If there are any questions concerning these guidelines, please discuss them with your Project Engineer.

## **505 PROPOSAL ESTIMATE**

A completed proposal estimate shall be submitted by the Consulting Engineer.

It is imperative that the item numbers on the proposal estimate correctly correspond to the Bid Master File. Furthermore, the quantities shall correspond to those shown on the detailed estimate sheet.

All proposal estimate data shall be kept confidential, to conform to the Department's policy of not divulging any cost data prior to accepting bids.

## **506 FEDERAL ESTIMATE**

On Federal-Aid projects, in addition to the proposal estimate, the Consulting Engineer shall submit a completed federal estimate.

The Federal Estimate shall be subdivided into sections as follows:

1. Roadway items
2. Bridge items (one section for each bridge over 6 m in length)
3. Federal Aid non-participating items
4. Railroad items
5. Utility items that are reimbursable and are included in the State's contract
6. Utility items necessary to accommodate public utilities on bridges
7. Bridges which provide grade separation over a highway and railroad

For construction contracts with multiple project numbers, federal estimates and corresponding section breakdowns must be provided per federal-aid project.

It is imperative that the proposal estimate and the total of all federal estimates add up to the same dollar figure.

## **507 DESIGN REPORT AND DESIGN STATEMENT**

The Consulting Engineer shall prepare a Design Report which will be submitted with each successive design submission. The cumulative requirements of the Design Report are outlined in Section 300.

The Consulting Engineer shall prepare and submit a Design Statement with the Final Plans for Review Submission and the Final Submission. The Design Statement shall be written in a brief narrative style. It is distributed within the Department (often with the final contract specification and plans) as an overview of construction issues and Department commitments.

The statement shall include, but not necessarily be limited to, the following information:

1. Date
2. Federal Aid Project Number
3. State Project Number
4. Town(s)
5. Construction district
6. Final maintenance responsibility of each road
7. Description of project
  - a. Beginning and ending stations, and length of project
  - b. Other roadway construction
  - c. Number of structures
  - d. Provisions for future construction (if any)
8. Reimbursable Funds: State amount reimbursable, the items involved, and by whom it will be paid
9. Exceptions to minimum design standards for all affected roadways
10. Public utilities affected by project
  - a. Date that each utility was informed of possible affect by the project
  - b. Date that final design plans were sent to each utility
  - c. Utility items included in the State's contract
  - d. Special considerations affecting utilities
11. Salvage: List all items to be salvaged and to where these items are to be transported (if appropriate)
12. Permits: Specify restrictions to the project due to permits that may affect the Contractor's operations

13. Remarks: Make recommendations concerning the project that would aid in the successful completion of the work. List commitments and major decisions as well as the reason why the decision was made during the design development that would be important to district forces during construction, especially decisions or commitments involving environmental issues, municipalities, utility companies and all right-of-way concerns.
14. Unusual design features including unusual foundation conditions.

## **508 CONTRACT TIME ANALYSIS**

The contract time analysis shall be made by the Consulting Engineer and shall be submitted to the Department for review at various stages of project development. At the Semi Final Design Submission, the Designer is to develop a listing of contract activities that represent the "Major Elements" of the contract. At a minimum, that listing should include a breakdown by individual structures, stages, including major components of each. It should also include elements such as winter shutdowns, permit windows, specific milestones, long lead time fabrication and procurements, third party work, etc.

At the Final Design Submission, the Designer is to develop a bar chart schedule based on the previously established list of contract activities, utilizing an anticipated start of construction, duration of time available to work in each construction season, the various construction operations, the time required by the Contractor to perform the major construction elements and operations, resulting in the number of calendar days to be allowed for the project. A final Contract Calendar Day Bar Chart with and without durations (a template) will be required with the Final Plan Submission. The template will be part of the contract documents and the Contractor will be required to develop a calendar day chart from the template prior to the award.

# CHAPTER 600

## COORDINATION WITH UTILITIES



## **601 COORDINATION WITH UTILITIES**

The Consulting Engineer shall be responsible for coordination activities with public, private and municipal utility owners (here after referred to as “the Utility”) that have facilities within the limits of the assignment. Existing utility facilities located in the roadway right-of-way that would be disturbed by the proposed design shall be relocated or adjusted. The Utility will be directed to prepare their own plans for the necessary facility relocations or adjustments.

The Consulting Engineer shall forward a copy of all correspondence received or sent regarding utility matters to the Department’s Project Engineer and Utilities Section representative.

The Consulting Engineer’s final submission must include all necessary final utility plans, specifications and estimates (if applicable). Should any utility design not be received by the Consulting Engineer prior to final submission, the Consulting Engineer must submit thorough documentation of continued efforts throughout the life of the assignment to procure the utility design in a timely fashion. If difficulty in achieving cooperation is encountered with a Utility, the matter should be brought to the attention of the Project Engineer. If the utility design plans are not satisfactory, the final submission will not be considered complete until such time as the Department has received a satisfactory utility design.

## **602 IDENTIFICATION OF AFFECTED UTILITIES**

Immediately after the Preliminary Engineering Stage has been completed, or as soon as the information becomes available, the Consulting Engineer shall forward to the Department a list of all Utilities with facilities within the project area. The Department will notify the affected Utility companies providing the name and address of the Consulting Engineer and directing them to coordinate all design activities through them. The Consulting Engineer will be given a copy of each notification letter.

## **603 SUBMISSION OF PLANS TO UTILITIES**

After receiving a copy of the Department’s notification letter, the Consulting Engineer shall begin coordination with the affected Utility companies.

After the Preliminary Design has been developed, the Consulting Engineer shall forward to each Utility, one set of “dated” plans, together with cross sections as available in the area of the utility involved. These plans shall show drainage layouts and the taking and non-access lines. Furthermore, Utilities shall be advised that the plans are preliminary, and that drainage has not yet been finalized.

The plans provided to the Utilities should indicate the limits of federal participating and non-participating sections. Additionally, if it is proposed to have multiple construction contracts (i.e. various project numbers), the limits of the various contracts should be identified on the plans.

## **604 DESIGN/UTILITY MEETING**

With the transmission of the dated plans to the Utilities, the Consulting Engineer shall confirm a meeting with the engineering representatives of each Utility, individually or collectively, to discuss and coordinate the Department's proposed design with that required from the Utility. Three to four weeks time should be provided between the transmission of the plans and the scheduled meeting to allow for receipt of the plans and analysis of information provided. The Department's Project Engineer and a representative of the Department's Utility Section shall also be invited to these meetings.

A report of the meeting shall be submitted to the Department for review and approval prior to being submitted to all utilities.

The Consulting Engineer will ensure that the following subjects are addressed at the Design/Utility meeting:

### **604.01 NOTICE OF ENVIRONMENTAL PERMITS**

The Consulting Engineer will ensure that a copy of the "Notice of Environmental Permits Involving Utility Relocations", which can be obtained from the Department, is distributed to all represented Utilities. The Consulting Engineer will ensure that the meeting minutes reflect that this document was distributed, and any Utility invited to the Design/ Utility meeting not in attendance will receive a copy of the report of meeting and the Notice of Environmental Permits document.

### **604.02 CONSTRUCTION CONFLICTS**

The Consulting Engineer will describe potential construction conflicts or any aspect of the project which may necessitate utility relocation work.

### **604.03 TEST PITS**

The purpose of taking test pits is to accurately determine the location of underground utilities. This information should be used to prepare or adjust the design, wherever feasible, to avoid conflicts with existing utilities. This can result in significant cost reductions for the relocation or adjustment of underground utilities.

At the Design/Utility meeting, the Consultant shall identify where test pits may be required. A copy of plans depicting suggested test pit locations should be provided to each affected Utility. The Utilities may then request additional test pits and a complete set of plans depicting all suggested test pit locations shall be provided to the Department.

If the Consulting Engineer is responsible for survey for the project, the engineer should coordinate with the Utility to determine the precise location, size and elevations of the facilities in the field when the test pit is excavated. Should the Utility require accurate location of the test pits prior to excavation, the Consulting Engineer will provide such. The location of existing underground utilities shall be plotted on the cross sections based on actual test pit data only.

#### **604.04 ENGINEERING COST ESTIMATES**

The Consulting Engineer will ensure that all affected Utilities are directed to provide separate cost estimates for their preliminary engineering services and test pits. This information must be forwarded to the Utilities Section to prepare the necessary reimbursable agreements. It is important that this activity be initiated at the Design/Utility meeting so that the agreements are in place when the Utilities' engineering services are required.

#### **604.05 TIME AND MATERIAL CONSTRAINTS**

The Consulting Engineer will inquire of the Utilities regarding long lead time materials or time sensitive construction activities (e.g. splicing), which may require notification to the contractor regarding construction sequencing, contract time extensions or early utility authorizations to minimize contractor delays.

#### **604.06 UTILITY WORK BY DEPARTMENT'S CONTRACTOR**

Should the Utility Company desire that its reconstruction work be performed by the Department's contractor, a formal request should be made by the Utility to the Manager of Consultant Design. If such a request is approved, the Consulting Engineer will ensure that the utility plans, specifications and estimates are included in the construction contract in a manner that is consistent with the project plans, specifications and estimates.

#### **604.07 UTILITY PLANS, SPECIFICATIONS AND ESTIMATES**

The Consulting Engineer shall establish target dates for utility plans, specifications and estimate submittals at the Design/Utility meeting. The target dates should allow ample coordination time to ensure that test pit data is obtained, design adjustments are made where feasible and utility relocations can be designed. The Consulting Engineer will forward either design plan mylars or electronic files (as requested by the utility) to be used to design utility relocations. The plans for utility relocation work not included in the construction contract will be provided in the construction plans for the Contractor's information only.

After the Utility has designed the relocation and estimated the costs, this information will be forwarded to the Consulting Engineer who will in turn review the relocation to ensure that all conflicts are eliminated and that adequate provisions are made regarding constructability issues. Once the Consulting Engineer is satisfied that the utility plans, specifications and estimates adequately resolve utility conflicts, the engineer will keep the hard copy of the plans (conventional or electronic) and forward a set of prints along with all specifications and estimates to the Department to facilitate writing utility agreements.

It is not practical to assume that all the aforementioned concerns can be completely addressed at one meeting. Subsequent meetings should be anticipated to track progress of utility plan submittal dates. Should project design plans or schedules change, the Utilities shall be informed of such changes by the Consulting Engineer.

## **605 COST SHARING**

The cost of adjusting or relocating utilities shall be computed in accordance with the guidelines contained in the Department's "Public Service Facility Policy and Procedures for Highways in Connecticut." The Department will be responsible for establishing the participation percentage in advance of the utility meeting.

The following chart outlines the general parameters for the sharing of costs between the Department and the Utility.

### **PERCENTAGE OF PARTICIPATION IN HIGHWAY RELOCATION PROJECTS**

#### **NON-FEDERAL FUNDED**

GENERAL STATUTES OF CONNECTICUT SECTION 13a-126	STATE ROADS UNLIMITED ACCESS HIGHWAY	STATE ROADS LIMITED ACCESS HIGHWAY
PRIVATE UTILITY COMPANY	50%	100%
MUNICIPAL UTILITY COMPANY	50%	100%

#### **FEDERAL FUNDED**

GENERAL STATUTES OF CONNECTICUT SECTION 13a-98f	STATE ROADS	LOCAL ROADS
PRIVATE UTILITY COMPANY	SEE "NON-FEDERAL FUNDED" CHART ABOVE	0%
MUNICIPAL UTILITY (TOWN OR CITY)	FUNDING DISTRIBUTION EQUAL TO CONSTRUCTION PERCENTAGES	FUNDING DISTRIBUTION EQUAL TO CONSTRUCTION PERCENTAGES
OTHER MUNICIPALITY (EX. METRO. DISTRICT COMM., SO. CENTRAL CT. REGIONAL WATER AUTHORITY, ETC.)	100%	100%

The Consulting Engineer shall be familiar with the cost-sharing guidelines so as to be duly informed as the Department's representative. The Consultant will not be responsible for preparing or administering engineering or construction agreements with the Utilities.

## **606 RAILROAD INVOLVEMENT**

The Consulting Engineer shall determine, as early as possible, the locations where railroad facilities will be involved or disturbed by construction. A list of such locations, together with the

plans and the name of the owning Railroad, shall be furnished to the Department so that an official notice may be sent to the Railroad requesting a Preliminary Engineering Estimate of work.

The Department will review the Railroad estimate, prepare the Railroad-Highway Agreement, request necessary funding, and when funds are in place, authorize the Railroad to proceed with preliminary engineering. Following this, the Consulting Engineer shall commence design communications with the Railroad in accordance with procedures outlined in Section 403 of this manual and in the Department's "Bridge Design Manual."

### **606.01 RAILROAD MEETING AND CLEARANCES**

The Department shall arrange a Field Meeting with representatives of the Railroad, Consulting Engineer, and Department soils, traffic and design units. They shall investigate the site, determine controls, establish clearances, determine necessity for clearance diagrams and other pertinent items.

Following the meeting, the Consulting Engineer shall begin Structure Type Studies, as outlined in Section 303.05 of this Manual and the "Bridge Design Manual."

For highway bridges over the railroad with less than 25 feet clearance, the Consulting Engineer shall develop clearance diagrams and "Approval of Railroad Clearance" forms. These will be forwarded to the Department for their review and approval. The Department shall secure further signature approvals from the Railroad and the FHWA (when applicable).

The Consulting Engineer shall prepare a Railroad Regulatory Agency plan for submission to the Department, which shall prepare necessary petitions and attend the Regulatory Hearings as required.

The Consulting Engineer shall arrange a structure utility meeting during the Structure Layout for Design review process. The involved Utilities and Railroad shall attend and their needs established and incorporated into the design by the Consulting Engineer. The Consulting Engineer shall send plans to the Railroad and Utilities for review and comment pertaining to those requirements.

### **606.02 TRANSMITTAL OF PLANS TO RAILROAD FOR AGREEMENT**

Just prior to completion of Final Plans for Review, the Consulting Engineer shall provide the Department with the following material:

1. Completed structure plans, highway plans, profiles and cross sections of the area of the proposed crossing
2. Railroad special provisions (obtained from the Department) and all special provisions for contractor work on the railroad facility
3. Estimates of contractor work on the Railroad facility

The number of plans, specifications and estimates required varies with each Railroad company; therefore, contact your Project Engineer to determine the number of copies required.

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**CONSULTING ENGINEERS CONTRACT ADMINISTRATION AND  
DESIGN DEVELOPMENT MANUAL**

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The Department shall transmit the material to the Railroad for review and completion of the special provisions, and request the Railroad to determine force account work and submit necessary plans and estimates for that work.



# CHAPTER 700

## COMPLETION OF PLANS



## **701 COMPLETION OF PLANS**

All plans shall be prepared in MicroStation CADD format in accordance with the Department's "Digital Design Environment Guide."

A complete set of plans shall consist of some or all of the following sheets. Certain sheets can be combined or eliminated depending on the scope of the project. Furthermore, additional sheets may be required to sufficiently describe construction activities.

- Title Sheet (s)
- Index Plan and Profile Sheet(s)
- Detailed Estimate Sheet(s)
- Typical Cross Sections, Miscellaneous Details, Drainage Details and Intersection Grading Sheet(s)
- Plan Sheet(s)
- Profile Sheet(s)
- Structure Sheet(s)
- Traffic Sheet(s)
- Maintenance and Protection of Traffic Sheet(s)
- Turfing Sheet(s)
- Railroad Sheet(s)
- Sedimentation and Erosion Control Sheet(s)
- Cross Section Sheet(s)
- Utility Sheet(s)
- Standard Drawing Sheet(s)

Each sheet shall show in the lower right hand corner the town, project number, the year in which the project is to be advertised, sheet number, total sheets and the name of the highway. An electronic plan border reference file is available from the Department.

Sheets shall be numbered consecutively in the approximate order shown above with the plan sheet immediately succeeded by the profile sheet of corresponding stations.

Utility informational sheets and Standard Drawing sheets will have their own separate numbering system based on alphabet lettering and special designated numbering.

A statement "THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE TRUE CONDITIONS OR ACTUAL QUANTITIES OR DISTRIBUTION OF QUANTITIES OF WORK WHICH WILL BE REQUIRED" shall appear on sheets containing estimated quantities, such as detailed estimate sheets, and

bridge sheets showing estimated quantities. The statement also applies to boring sheets and certain bridge substructure sheets. It is not to be utilized on all construction drawings.

## **702 TITLE SHEET**

The first sheet of a set of plans is the Title Sheet. The title sheet shall show the project location on a State map located in the upper left-hand corner. An enlarged map showing the project location shall be shown in the upper right-hand corner. It may be digitized from a town map, providing it is of a magnitude that conveniently shows all town roads in the project area. State and Federal project numbers, as well as beginning and ending stations, shall also be noted on this location map.

The title sheet shall show (as a minimum) the following:

- Descriptive title of project
- Beginning and ending stations
- Town in which project is located
- Length of project to one millimeter
- Design scales used
- State and Federal project numbers
- Note stating responsibilities for future maintenance
- Standard specifications that shall govern construction
- Datum on which elevations are based
- Assumed design speed
- Highway classification
- Design year ADT and DDHV
- Descriptive "List of Drawings" with sheet numbers (including Utility information sheets)
- A listing of all Standard Sheets applicable to the project
- Designing company's name, including signature of an officer and a Connecticut Seal with Professional Engineer's number
- FHWA approval block with date

## **703 INDEX PLAN AND PROFILE**

An index plan plotted to a scale of 1"=200' and an index profile plotted to a horizontal scale of 1"=200' and a vertical scale of 1"=20', shall be prepared for any design project requiring three or more 1"=40' scale plan sheets.

The index plan shall show existing survey coordinates, roads, houses, street and property lines, railroads, streams, channel encroachment lines, bridges, box culverts, pipe culverts 48" or larger in diameter, town lines and other important topographical features. These features will be subdued in comparison to the proposed new design.

The proposed design shall be more prominent in delineation over the existing features. As a minimum, the proposed new design shall show the following:

- Proposed baselines and centerlines showing roadway names with stations listed at 500-foot intervals
- Stations at PC, PT, PCC, and at crossroads listing equalities
- List of baseline/centerline radii
- Bearing of baseline/centerline tangents
- All proposed roadway edges
- Bridges, listing stations and lengths
- State and Federal project numbers
- Beginning and ending stations with coordinates
- Soil test boring locations and numbers
- Boxed outline of 1"=40' scale plan sheets with respective sheet numbers
- River/channel work with stationing
- Local sensitive areas, including wetlands

The index profile shall depict the existing groundlines for each roadway. The proposed construction shall show the gradeline, percentage of grades on tangents, station and elevation of PVC, PVT, PVI, the length of vertical curves, bridges, box culverts, and beginning and ending stations with elevations.

The index plan and profile may be on separate sheets or on a combination sheet according to the complexity and length of the project. The important consideration is for a clear presentation.

## **704 DETAILED ESTIMATE SHEET**

The Consulting Engineer shall complete a tabulation of all items and quantities that appear in the Proposal Estimate, locating each item by station, noting where it is applied on the project. The contract item quantities shall be listed in 500-foot increments.

Grading quantities shall be tabulated under the heading of earthwork. They shall be listed in 500-foot increments under the appropriate heading of earth, rock or borrow. The earthwork summary shall consider earth shrinkage, rock swell, unsuitable material, pervious structure backfill, bedding material and borrow requirements, all in accordance with the applicable subsections under Section 200 (Earthwork) of the Standard Specifications.

Drainage items and quantities shall be tabulated under the separate heading of Drainage. Pipe culverts, catch basins, under-drains and related items shall be listed by station and drainage run, totaled to agree with the Proposal Estimate.

Guide railing and fencing requirements shall be tabulated by station and shown under a separate listing. They shall be listed in 500-foot increments.

Pavement and other roadway items shall be listed under the Miscellaneous heading with appropriate station locations. They shall be listed in 500-foot increments.

Bridges, other structures, curbing, traffic signals and light standard requirements shall all be shown under their own listing. They shall be listed in 500-foot increments excepting bridges and structures which shall be listed by Bridge Number/Structure Number.

Every item and quantity listed in the Proposal Estimate must be accounted for on the Detailed Estimate Sheet and accurately located by station.

When necessary, more than one Detailed Estimate Sheet shall be used in a set of plans.

## **705 TYPICAL CROSS SECTIONS**

Project typical cross sections shall be drawn to show the typical lane configuration and pavement structure at various locations throughout the project.

The Typical Cross Sections shall provide a clear concise visual picture showing dimensions, elevations and notes that are unique to that section of the project, allowing only one interpretation by the State's contractor.

Typical sections are not required to be drawn to any specific scale. The prime importance is clarity and preciseness of the information detailing the "picture." To this end, a legend shall be noted on the first typical sheet providing detailed information.

A roadway Typical Cross Section shall be drawn for each roadway and shall show a normal as well as a superelevated section in cut and fill condition. Partial roadway sections shall be drawn for any deviations from normal. They may show a change in roadway pavement requirements, roadway or shoulder width deviations, sidewalk, guide railing, concrete barrier, slope conditions or any other conditions unique to the project.

Typical Cross Sections shall depict the proposed pavement and shoulder composition, median, slopes, curbs, point of application of grade and superelevation, guide rail and other critical controls.

## **706 MISCELLANEOUS DETAILS**

Any construction activity or contract item used on the project that is not detailed in the Standard Drawings or elsewhere in the contract plans shall be detailed by the Consulting Engineer on a Miscellaneous Detail sheet.

Guide rail, curbing, special pavement requirements, sidewalk treatment and other such miscellaneous details shall be drawn on these sheets.

## **707 DRAINAGE DETAILS**

All drainage items, including structures, ditches, channels or a series of items constituting a completed drainage structure, not shown on a Standard Drawing, must be shown and detailed on a drainage sheet.

The details do not need to be drawn to a particular scale but must be of a size clearly indicating all information without a cluttered effect. All pertinent dimensions and notes must clearly be shown on the detail. Stations and/or a description must be noted stating where the detail applies on the project.

## **708 INTERSECTION GRADING PLANS**

Roadway intersection grading plans shall be drawn to a suitable scale on a separate sheet.

Roadway contour details through the intersection shall be shown. Depending on the percent of grade, contour intervals may vary from 0.1 feet to 1.0 foot intervals. Catch basins shall be shown at the appropriate low points and top of grate elevations noted.

## **709 SURVEY TIES - CURVE DATA**

Project centerline and baseline survey ties, coordinates, bench marks, bearings, distances and curve data shall be shown on the plan sheet where they apply.

On lengthy complicated projects consisting of three or more 1"= 40 feet scale plans, the basic survey data shall be shown on an index plan base map. In addition, a separate sketch showing details of the control points shall be shown on a separate control sheet or curve data sheet. These sketches shall show details of the control point ties such as drill holes, PK-nails, telephone pole ties, tree ties, north arrows and all other pertinent points used to describe such control points.

Curve data sheets shall show the curve number, coordinates, stations, PC, PT, PI, Radius and other clarifying details.

## **710 SUBSURFACE BORING DATA**

Specific procedures for obtaining bridge and roadway borings are covered in the "Soils and Foundations Guide for Design by Consulting Engineers." Any boring not labeled as a bridge boring should be located on the roadway (1"= 200 feet) index plans with plots of the borings on sheet(s) specifically set up for this information. A sample roadway borings sheet can be obtained from your Project Engineer.

The plotted borings should have elevations as well as stations and coordinates. Furthermore, any previous/existing subsurface data acknowledged and used in the design of the project should be shown on plans, with its vintage stated.

## **711 PLAN SHEETS**

Final design plan sheets will be submitted in accordance with the Department's digital and drafting standards.

Match marks on sheets shall be perpendicular to the centerline at an even 50-foot station with no duplication of features on following sheets.

In heavily detailed urban areas where the amount of existing and proposed data detail on a single sheet would be cluttered or difficult to interpret, duplicate complementary plan sheets shall be prepared. These complementary sheets can show proposed design detail, or right of way detail, and exclude some or all existing topographic detail. However, suitable boxed-in notes cross referencing each sheet must be clearly marked to eliminate omission and confusion. The Consulting Engineer may request that the scale of the plan sheet be changed. The Department will advise the Consulting Engineer on a case-by-case basis.

Each plan sheet shall include a curbing tabulation block.

Each plan sheet shall also include top of frame and invert elevations for each storm drainage structure shown on the plan. Proposed drainage structures shall be identified by station and offset, left or right, of the baseline or centerline. The top of frame and all invert elevations shall be shown to the nearest 0.1 foot. Depending on the complexity of the drainage design, this information can be included in a tabulation block or by leader lines from each structure.

The Consulting Engineer shall incorporate onto the final plans all Right of Way information. This information consists of, but is not necessarily limited to, proposed right-of-way lines with all pertinent dimensions, existing property lines, existing highway and street lines, property owners' names on each individual parcel, existing and proposed easements of all kinds, and proposed rights as to drainage, slope easements and incidental construction.

All pertinent property notes on construction drawings are to be worded in the present tense rather than future tense as is the case on Property Maps. For example, use "Required" rather than "To Be Acquired."

The Consulting Engineer may be assigned the preparation of Property Maps. It is important that information shown on Property Maps be promptly transferred to the construction drawings so updated prints of the drawings can be used in connection with appraisals or property negotiations.

Should discrepancies become evident between existing property lines as shown on construction drawings based upon the original survey and those shown on the Property Maps, the latter, being based upon actual title search information, shall take precedence, and the construction drawings shall be revised accordingly.

## **712 PROFILE SHEETS**

Stationing on the profile sheets shall duplicate stationing on corresponding plan sheets. The roadway profile shall be approximately in the center of the profile grid for full length of the sheets. It shall also be placed so that even 10 feet of elevation coincides with the heavy solid horizontal lines and 100-foot stations coincide with the heavy solid vertical line. The ground line shall be shown as a light solid line and the proposed grade shall be shown as a heavy solid line. The points of curvature and tangency of vertical curves shall break the solid line with small circles. These points as well as PVI's, high points and low points shall be depicted by station and elevation. The gradient between vertical curves shall also be shown. Basic elevations shall be shown at 10-foot intervals in the right and left margins of the sheet on the heavy horizontal lines. Horizontal 100 foot stations shall be shown on the lower border.

Bridges shall be shown indicating beginning and ending stations, elevation and length. Existing drainage shall be shown in dashed line; proposed new drainage shall be shown in a solid heavier line. Depth of subbase shall be specified and shown along the bottom of the sheet. Proposed walls and foundations shall be shown with elevations.

## **713 STRUCTURE SHEETS**

Sheets showing the detailed design of bridges, box culverts, retaining walls or other roadway structures shall be prepared in accordance with the Department's "Bridge Design Manual."

The plans for individual bridges and retaining walls shall be prepared as "self contained" sets. The details shall be drawn to scale and presented on sheets specific to the various components of the structure. For example, there will be a general plan, a foundation plan, an abutment plan, pier plans, framing plans, etc.

## **714 TRAFFIC PLANS**

Traffic design requirements shall be shown on the 1"=40' scale project plans wherever possible. In instances where numerous detailed traffic requirements are needed, separate sheets shall be included.

### **714.01 PAVEMENT MARKING PLANS**

On minor projects, pavement marking details can be shown on the 1"=40' scale plans or the Traffic Signal Plans.

On major projects, separate 1"=200' scale drawings detailing a legend, dimensions and notes shall be prepared by the Consulting Engineer. Separate enlarged details shall be made to supplement and clarify the small scale plans.

### **714.02 SIGNAL PLANS**

Traffic signals and intersectional traffic movement volumes and turning movements shall be shown on a separate traffic signal plan sheet in accordance with the Department's "Manual on Traffic Control Signal Design." All required phasing, timing and needed details will be tabulated in a box form to provide clarity for construction. Blank traffic control signal plan sheets (electronic files) will be supplied to the Consulting Engineer by the Project Engineer upon request.

Sketches showing details of each intersection, with pavement markings, and other needed information, will be drawn on this sheet. Arrows designating movements and symbols in the legend shall be provided for explanations and clarity.

### **714.03 SIGNING PLANS**

The Consulting Engineer shall coordinate signing requirements with the Department. They shall be responsible for determining exact locations of the proposed signing in conjunction with the Department. All signing details and locations shall be included in the project plans and documents.

### **714.04 ILLUMINATION PLANS**

Project illumination requirements shall be coordinated by the Consulting Engineer through the Department. If so determined, the Consulting Engineer shall design illumination and show all details on Illumination Plan Sheets.

## **715 DETOUR PLANS**

Roadway detour details shall be clearly shown on the project plan sheets, index plan sheets, stage construction plan sheets or on separate detail sheets.

Detours utilizing town roads must be coordinated by the Department through the involved towns. Hence, the Consulting Engineer shall alert the Department if it is proposed to utilize town roads for detours.

The Department will arrange meetings with towns and write agreements for town road detours. The Consulting Engineer will be responsible for all design requirements for the inclusion of detours into the project documents.

## **716 STAGE CONSTRUCTION PLANS**

When applicable, the Consulting Engineer shall detail the project stage construction on separate sheets. These will be made to a suitable scale. All notes, dimensions and intent shall clearly be shown whereby only one interpretation can be made by the Contractor.

Method of removal of temporary roads and bridges will also be clearly stipulated.

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## **717 TURFING PLAN**

The base sheet index plan plotted to a scale of 1"=200' shall be used to prepare the turfing plan. This plan sheet shall show beginning and ending stations and the project number.

A legend will be made on the first sheet. The legend, with appropriate symbols, shall specify where the following apply:

1. Furnishing and placing topsoil
2. Turf establishment
3. Sodding

On smaller projects, the turfing requirements may be detailed on a typical cross section sheet and/or on the 1"=40' scale plan sheets.

## **718 SEDIMENTATION AND EROSION CONTROL PLAN**

Sedimentation and erosion controls shall be shown on 1"=40" scale plan sheets in the areas that they apply.

In certain instances, sedimentation basins or other sedimentation control devices shall be detailed on a separate sheet showing all pertinent dimensions and notes. Details do not need to be drawn to any particular scale but must be of a size clearly indicating all information without a cluttered effect.

## **719 CROSS SECTIONS**

Ground lines, house foundations, curbs and driveways, stations and datum elevation shall be shown for each cross section. The proposed centerline grade elevation and super-elevation (when applicable) shall be noted. Surface rock shall be indicated by cross-hatching; substrata rock shall not be shown unless verified by soil borings. Templates showing the proposed roadway section, and structures shall be shown. The lines shall be sufficiently heavy to show clearly on reproducible half-size prints. The location of existing underground utilities shall be plotted on the cross sections based on actual test pit survey data only.

Some of the details shown on a typical cross section template may be eliminated on the actual cross sections. The eliminated details would include the intermediate limits of pavement and base courses, thereby showing only the bottom line of the roadway subbase course, the upper surface of the pavement and curbing, the shelf area to the hinge point and the side slopes. Also indicated by a "crow's foot" is the elevation of the centerline of the proposed roadway. The details of base courses, pavement, shoulders, curbs, railings, etc. will be shown on the typical section sheets. Although it will not be necessary to show the pavement and shoulder details on most cross section templates, there may be cases where special treatment of shoulder cross slopes is required. An example of this might be the shoulder area between mainline pavement and ramp pavement. In these instances, full shoulder and pavement detail should be shown.

## **720 UTILITY PLANS**

### **720.01 CONSTRUCTION WORK PERFORMED BY UTILITY COMPANY**

When public utility facilities are disturbed by the proposed project construction work, the utility owner is responsible to prepare design plans showing the reconstruction/relocation, and is responsible to perform the construction work with its own forces. The Consulting Engineer shall coordinate the Utility owner's design requirements with the Department's design as specified in Chapter 600 and elsewhere in this Manual.

The Consulting Engineer shall incorporate the Utility's design plans into the Final Contract Documents for the Contractor's information only. These sheets will follow the last sheet of the Department's design plans. They shall use a letter designation as a numbering sequence. Each utility will be designated a separate alphabet letter.

To avoid confusion by the State's Contractor, the Consulting Engineer will place a note on each Utility's plans stating that the work is to be performed by the named Utility Company.

If an aerial facility is involved, a note is to be made on the project plan sheets concerned, indicating the voltage and the minimum vertical clearance of wires or cables crossing over the roadways of the project.

Other applicable special utility requirements are to be noted and flagged on the Department's plans.

The Consulting Engineer shall not make any changes to a Utility's design plans. The utility design shall be the Utility Company's individual responsibility. Overall review and coordination shall be the Consulting Engineer's responsibility.

### **720.02 CONSTRUCTION WORK INCLUDED IN THE DEPARTMENT'S PROJECT**

When approved by the Department, required utility relocation work shall be included in the Department's Final Contract Documents. The design shall be prepared by the involved utility owner unless specifically directed otherwise by the Department.

The design information, plans, special provisions and estimates shall be incorporated into the Department's Contract Documents by the Consulting Engineer and will be constructed by the State's Contractor. Where the work is minimal, it shall be shown on the Department's plan sheets. Where the work is of greater magnitude, separate utility sheets shall be added and consecutively numbered with the Department's plan sheets. All work will conform to the Department's requirements.

## **721 STANDARD DRAWINGS**

The Consulting Engineer shall be familiar with the Department's Standard Drawings. Standard drawings needed on a project shall be identified in the List of Drawings on the title

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**CONSULTING ENGINEERS CONTRACT ADMINISTRATION AND  
DESIGN DEVELOPMENT MANUAL**

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sheet. The standard drawings identified on the title sheet will be included in the Contract Plans by the Department.

# CHAPTER 800

## ENVIRONMENTAL ACTIVITIES

## **801 INTRODUCTION**

This section describes the Consulting Engineer's involvement in fulfilling the various permit requirements which the Department is subject to by State Statutes and Federal regulations.

The Consulting Engineer should be aware of the environmentally sensitive areas within the project early in the design process and consider mitigating measures and alternatives as design progresses.

The Consulting Engineer will be required to prepare and submit to the Department in a specified format all the necessary information required for submission of the various permit applications.

The Department will compile the application packages and transmit them to the appropriate regulatory agencies for approval. The Consulting Engineer may be required to incorporate modifications to the contract documents as necessary to comply with State or Federal Regulatory reviews.

At various stages of the design, the Consulting Engineer will be required to make periodic submissions, attend review meetings and respond to written comments.

It must be recognized that the Environmental Permit requirements are constantly being revised and, therefore, close coordination with the Department is required.

The Department's Office of Environmental Planning (OEP) has prepared a document entitled "Water Resources Coordination and Permit Processing Manual". The Consultant should review this manual prior to starting design activities in order to become familiar with the regulatory programs and requirements.

## **802 WETLAND DELINEATION/MITIGATION**

The following activities are associated with the various Environmental Permits and shall be performed by the Consulting Engineer as an integral part of the design of the project.

### **802.01 WETLAND DELINEATION**

Prior to the Preliminary Design, the Consulting Engineer will review, identify, verify and delineate any inland wetlands, tidal wetlands and watercourses which will be impacted by the project. Identification of inland wetlands, as regulated by Connecticut, will be based upon soil type as defined in Section 22a-38 of the General Statutes of Connecticut, and boundaries will be field verified by a State certified soil scientist. Identification of watercourses, as regulated by Connecticut, will be based upon the definitions contained in Section 22a-38 of the General Statutes of Connecticut.

Identification of Tidal Wetlands will be based upon the definitions contained in Section 22a-29 of the General Statutes of Connecticut.

The Consulting Engineer will identify, verify and delineate Army Corps regulated waters of the United States and wetlands based upon the definitions contained in 33 CFR 3.23.2(a) through (f). A technical report has been prepared by the Federal Resource Agencies entitled "Federal Manual for Identifying and Delineating Jurisdictional Wetlands, 1987" to assist in determining the limits of Corps regulated areas. The Consulting Engineer will submit the required Army Corps' "Wetland Delineation Data Sheets" with the application package, along with the transect locations shown on a plan.

Field verified wetlands, waters and watercourses will be accurately depicted on design plans and index plans and will be submitted to the Department with the Preliminary Design. This information will also be incorporated into the Final Design plans.

Wetlands and watercourses will also be evaluated as part of an Environmental Assessment report as required by DEP (see applicable DEP instruction sheets, ref. sec. 804.01 - Jurisdiction). Information for this assessment should be obtained by the individuals responsible for delineating wetlands.

The Consulting Engineer is encouraged to schedule a Permit Coordination meeting, early in the Final Design phase, with staff of the Office of Environmental Planning to foster the exchange of project information and determine permit application requirements.

### **802.02 MITIGATION AND WETLAND CREATION**

The Consultant is to identify and consider any feasible way of minimizing wetland impacts during the preliminary design phase.

The need for creating new wetlands, enhancing, restoring or preserving existing wetlands to compensate for unavoidable impacts will be evaluated by the Department. The Consulting Engineer will be directed by the Department to develop a wetland creation design, including grading/planting plans and specifications, if necessary.

### **802.03 FISH PASSAGE**

Provisions for fish passage shall be considered as a form of mitigation of impacts associated with crossings and relocation of watercourses. The Project Engineer shall arrange for the Consulting Engineer to meet with a fish biologist from DEP and a representative from the Department's Hydraulics and Drainage Unit at the project site to review all streams and determine which crossings and channels will be designed for fish passage. This meeting will be held prior to the completion of Preliminary Design and prior to the hydraulic designs. Facilities for fish passage will be described as part of the required permit application phase. The Consulting Engineer will utilize CT DEP's Inland Fisheries Division, Habitat Conservation and Enhancement Program, Stream Crossing Guidelines, dated February 26, 2008.

## **803 DEPARTMENT OF THE ARMY**

The Department of the Army Permit program regulates:

1. The discharge of dredged or fill material in all waters of the United States, including wetlands pursuant to Section 404 of the Federal Water Pollution Control Act Amendments of 1972, now known as the Clean Water Act.
2. The obstruction or alteration of navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Act of 1899.

Regulated activities that are minor or routine with minimum impacts may qualify under pre-authorized general permits. The Consulting Engineer shall complete and submit the ACOE Programmatic General Permit Inland Wetland Category Determination Form. Regulated activities of a larger nature will require an individual permit and an application package shall be prepared by the Consultant if it was part of the project assignment. For ACOE Individual permit applications, the Mitigation Checklist must be completed in accordance with ACOE Guidance documents. A copy of the most current application form will be provided by the Department.

## **804 CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION REGULATORY PROGRAMS**

### **804.01 JURISDICTION**

The Consulting Engineer may be required to prepare an application package for any of the following regulatory programs:

- 804.02 Tidal Wetlands
- 804.03 Structures and Dredging
- 804.04 Coastal Zone Management Consistency
- 804.05 Inland Wetlands and Watercourses
- 804.06 Stream Channel Encroachment Line
- 804.07 Water Diversion
- 804.08 Flood Management
- 804.09 Discharge of Stormwater and Dewatering Wastewaters Associated With Construction Activities

A project may require a permit application package that includes a combination of the above types of permit requests. This package should be coordinated and assembled in accordance with the following requirements established by DEP.

The Tidal Wetlands Permit as well as the Structures and Dredging Permit and Coastal Zone Management Consistency Review are administered by DEP's Office of Long Island Sound Programs. The application instructions [DEP-OLIS-INST-100] contain specific information on the preparation of the permit application [form DEP-OLIS-APP-100].

The Inland Wetlands and Watercourses Permit, Stream Channel Encroachment Line Permit, Water Diversion Permit and Flood Management Approval are administered by DEP's Bureau of Water Management, Inland Water Resources Division. The application instructions [DEP-IWRD-INST-100] contain specific information on the preparation of the application [forms DEP-

IWRD-APP-101, 102, 104 and 105]. The General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities is administered by DEP's Bureau of Water Management, Permitting, Enforcement and Remediation Division [form DEP-PERD-GP-015].

#### **804.02 TIDAL WETLANDS**

Sections 22a-28 through 35 of the General Statutes of Connecticut regulate any impact to vegetated Tidal Wetlands, such as draining, dredging, dumping and removing or depositing material. All areas must be field verified and areas of vegetation type identified and depicted on plans.

#### **804.03 STRUCTURES AND DREDGING**

Sections 22a-359 through 363, as amended by Public Act 87-495, and 22a-383 through 390 of the General Statutes of Connecticut regulate structures and dredging in tidal, coastal and navigable waters. The landward limit of the State's jurisdiction has been defined as the High Tide Line (HTL) in a 1987 revision to the "Structures and Dredging Act." This line is coincident with the Corps of Engineers jurisdictional boundary for coastal areas. The HTL must be determined/surveyed for each project. The plans must also indicate the Mean Low Water and the Mean High Water lines.

#### **804.04 COASTAL ZONE MANAGEMENT CONSISTENCY**

Sections 22a-90 through 22a-112 as amended of the General Statutes of Connecticut regulate State actions within the "Coastal Boundary" defined by Section 22a-94. Coastal boundary maps are available at the town clerk offices, DEP's Coastal Resources Management Division, DEP's Natural Resources Center and also from the Project Engineer.

If any portion of a proposed project falls within the established coastal boundaries, a DEP Coastal Area Management (CAM) Consistency Review Worksheet will be required. A separate CAM application will not be required if obtaining other Coastal Permits (SD/TW/COP). Copies of this worksheet are available from DEP's Office of Long Island Sound Programs or the Project Engineer. The proposed construction activity is to be consistent with the applicable statutory policies listed in Section 22a-92 of the General Statutes of Connecticut, as amended, and must demonstrate that all reasonable measures mitigating adverse impacts on coastal resources and water dependent development have been incorporated into the proposal. In particular, the use of stormwater pretreatment measures should be investigated. The Department will prepare the worksheet based on information provided by the consultant and submit the consistency determination to the DEP.

#### **804.05 INLAND WETLANDS AND WATERCOURSES**

Sections 22a-36 through 22a-45 of the General Statutes of Connecticut require that an Inland Wetlands and Watercourses Permit be obtained for activities to remove or deposit material, obstruct, construct, alter or pollute any wetland or watercourse. The Inland Wetlands Permit application will be transmitted by the Department to DEP. If a project does not involve

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State roads or lands, the permit may be processed through the local wetlands agency. Note: This applies to Inland Wetland Permits only.

In addition, DEP has adopted a General Permit for Water Resource Construction Activities. Certain activities which result in minor impacts to designated inland wetlands are eligible for this program.

#### **804.06 STREAM CHANNEL ENCROACHMENT LINE**

Sections 22a-342 through 22a-348 of the General Statutes of Connecticut require that activities riverward of the established encroachment lines have a Stream Channel Encroachment Line Permit. These activities include:

1. Placement of fill
2. Construction of any structure
3. Storage of any construction material
4. Excavation or grading
5. Any other activity deemed by the Commissioner (DEP) to pose a threat to life or property, riverward of the established lines

Stream Channel Encroachment Lines (SCEL) have been established on a number of rivers and watercourses in Connecticut. If applicable, the SCEL are to be shown on the plans and the permit application plates. A listing of regulated areas have determined by OEP. Encroachment line maps have been produced whereby the encroachment lines can be located by ground survey. Copies of the maps are on file with the town clerks of the respective towns, the Department's Hydraulics and Drainage Section, and at the office of DEP's Inland Water Resources Division. Hydraulic reports used to establish the encroachment lines are also available for review at the Inland Water Resources Division.

Hydraulic design documentation will be provided by the Department's Hydraulics and Drainage Section or by the Consulting Engineer, as defined in the "Assignment of Work" package.

The Consulting Engineer shall provide all environmental information required for this application in accordance with the Stream Channel Encroachment Line application instructions and State statutes.

The Consulting Engineer shall submit the required Stream Channel Encroachment Line information to the Department for review. This information should be provided as soon as possible following the Preliminary Design phase of the project. The Department will submit the final package to DEP.

#### **804.07 WATER DIVERSION**

Sections 22a-365 through 22a-378, as amended, of the General Statutes of Connecticut require that any activity which causes, allows or results in the alteration, modification or diminution of the volume of water that would occur in the ground or surface water at any given point at any moment constitutes a diversion. In particular, the construction or alteration of

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dams, storm drainage or flood control systems, or stream reallocations and bypass channels which collect water from a drainage area of 100 acres or more in size, will require a Water Diversion Permit.

The Department has been exempted from the requirement for filing for a Water Diversion Permit if the project is reviewed under the provisions of the Inland Wetland or Structures and Dredging Regulations and involves the modification of an existing roadway culvert.

### **804.08 FLOOD MANAGEMENT**

The Connecticut Flood Management regulations for state agencies are found in Sections 25-68 (b-h) of the General Statutes of Connecticut. Any activity within or affecting a flood plain will require a submission to DEP assuring that the activity is consistent with all applicable standards and criteria in Section 25-68d of the General Statutes and Sections 25-68h-1, 2, 3 of the Administrative Regulations. The established flood plain limits are based on the Federal Emergency Management Agency's Insurance studies. Maps showing these boundaries are available from DEP's Inland Water Resources Division or the Department and can be found online at [www.msc.fema.gov](http://www.msc.fema.gov). The 100 and 500 year flood limits and floodway boundaries are to be shown on the plans where applicable.

In particular, no filling, dumping or construction will be allowed which would increase the base flood by more than that which is indicated in the Flood Insurance studies (one foot maximum) or adversely affect the hydraulic characteristics of the flood plain. Other restrictions are listed in the regulations and should be addressed as necessary.

Section 25-68h-3 of the regulations enumerates the requirements of the Stormwater Management Standards. These standards must be applied as necessary to ensure that the project has been designed to minimize any adverse effects resulting from an increase in stormwater runoff. This section of the regulations also contains guidelines for the design of stormwater detention facilities, storm drainage systems, open channels, culverts and bridges. Hydrologic studies will be required to evaluate the probable impacts of the project.

The Consultant may also be required to submit a hydraulic report including: narrative of the proposed activity, water surface profiles, data sheets, computer programs, summary and appropriate plans. Refer to "Model Hydraulic Analysis" (DEP-IWRD-GUID-001) for specific guidance regarding the character of hydraulic studies. The Department will review the Consultant's submission and then will forward the documentation to DEP.

### **804.09 DISCHARGE OF STORMWATER AND DEWATERING WASTEWATERS ASSOCIATED WITH CONSTRUCTION ACTIVITIES**

When construction activities will result in the disturbance of a total of one acre or more of land within the project limits, the Department must ensure compliance with all conditions of DEP's General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities (GPSD). "Construction Activities" as defined in the GPSD include, but are not limited to, the following: clearing, grubbing, grading, excavation, placement of fill, and dewatering activities.

The Consulting Engineer will incorporate a Stormwater Pollution Control Plan within the contract documents in order to ensure compliance with the conditions of the GPSD. The Stormwater Pollution Control Plan addresses pollution caused by soil erosion and sedimentation during and after construction as well as the long term use of the facility after construction is completed. A copy of the GPSD will be included in the contract special provisions. The Consulting Engineer will be required to sign the Engineering Certification statement contained in the GPSD form. The Department will be the Registrant and Permittee for the purpose of filing the registration.

The Consulting Engineer must be familiar with the requirements outlined in the GPSD. The GPSD requires that the Consulting Engineer follow the fundamental aspects of the document, "Connecticut Guidelines for Soil and Erosion and Sediment Control," prepared by the CT DEP. Chapters 400 and 500 of this document present an outline for the preparation of the required stormwater pollution control plan. The Consulting Engineer should also be familiar with the Department's document, "On-site Mitigation for Construction Activities," prepared by the Department's Office of Environmental Planning. Depending on the particular site conditions and construction scope, the Consulting Engineer must design a plan which adequately addresses erosion control measures throughout the project life, including the post construction condition. Opportunities to provide primary treatment options must always be investigated, and secondary treatment measures may only be used after other options are determined not feasible. In all cases, stormwater improvements should be incorporated into the project design to the greatest extent possible.

The Consulting Engineer should incorporate appropriate drainage details for sedimentation control measures in the contract drawings and also include any special provisions as necessary. The Consulting Engineer should address the requirements for temporary access and staging areas in the plan and in the contract drawings. The contract must show the stages of construction and temporary sediment control measures for each of these stages. The required map showing the existing and proposed outfalls will be submitted to the Department along with the signed registration form. The Consulting Engineer will submit the required narrative and supporting documentation for review prior to final submission. Every effort shall be made to ensure that the Stormwater Pollution Control Plan is incorporated into the contract documents.

The Consulting Engineer is advised that the certification statement submitted only covers the information prepared by the firm. It will be the responsibility of the Department to ensure compliance with the GPSD for any revisions made during construction which were not prepared by the Consulting Engineer. The Department will provide the required inspection services as described in the GPSD.

## **805 UNITED STATES COAST GUARD**

The United States Coast Guard Bridge Permit program regulates the location and plans of bridges and causeways over navigable waters pursuant to Section 9 of the River and Harbors Act of 1899 and the General Bridge Act of 1946.

When any project requires the construction of or a modification to a bridge over a navigable waterway, the Consulting Engineer should request the Department to obtain an official determination from the Coast Guard of its jurisdiction. When it has been determined that the

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Coast Guard has jurisdiction, the Consulting Engineer shall prepare a permit application package.

The Coast Guard has a specialized permit application format. The Consulting Engineer shall follow the information contained in the "Bridge Permit Application Guide" as published by the Coast Guard. The Consulting Engineer will provide the Department with a draft "Letter of Application for Permit" as described in Appendix D, and Mylar plates and additional information, as necessary and listed in Appendix E of the above noted document.

The Department will prepare the final application letter to the Coast Guard with the information provided by the Consulting Engineer.