**MASSACHUSETTS DEPARTMENT OF TRANSPORTATION**

**HIGHWAY DIVISION**

**10 Park Plaza, Boston, MA**

**STANDARDIZED**

**SCOPE OF SERVICES GUIDANCE**

**FOR PREPARING**

**WORK HOUR ESTIMATE FORMS**

**FOR CONSULTANT SERVICES**

JANUARY 2024

Revision Notes

**January 2024**

1. Section 100 was updated to reflect the Pre-25% process. The following tasks were relocated to Section 100 and edited as needed: 202 Public and Agency Outreach, 204 Prepare Traffic Volumes, 301 Project Initiation and Data Compilation, 303 Field Surveys, and 305 Field Reconnaissance. Task 201 Establish Purpose and Need was combined into new Task 301.
2. Task 101 was updated to include some of the scope of Task 301.
3. Tasks 102 was re-named and description was edited to discuss Project Scoping Meetings.
4. Tasks 109, 110, and 113 (previously 103, 104, and 105) were re-numbered.
5. Field Survey was removed from the front end of Section 200 and incorporated into the language for Task 103. Previous Task 303 (Plot Existing Layout Lines) was also incorporated into this task.
6. Task 105 Prepare Traffic Volumes was updated to reference the MassDOT 25% Traffic Guidelines for approval of analysis tools, since MassDOT’s “A Guide on Traffic Analysis Tools” is no longer in effect.
7. Task 151 was re-named and updated to reflect the new Environmental Review Checklist.
8. The following tasks in Section 150 were edited: 151, 152, 154, 156, 157, 163, 170, 171, 172, 173, 179, 180, 181, 182, 185.
9. Task 186 was changed from Reserved to Section 7 Consultation – Endangered Species Act.
10. Task 188 Noise Studies added.
11. Task 207 was edited to allow for documentation of alternative development; scope related to developing and evaluating the alternatives was relocated to Task 110.
12. Previous Task 212 Construction Cost was removed as this is accounted for in Section 300.
13. Previous Task 213 GreenDOT was removed. All Section 200 tasks were re-numbered due to this and the relocation of previous tasks 202 and 204.
14. All Section 300 tasks were reorganized and re-numbered due to the relocation of previous tasks 301, 303, and 305, and removal of 308 (Determine Roadway Cross Section).
15. New tasks related to utilities were added: 302 (Subsurface Utility Exploration (SUE)) and 320 (Preliminary Utility Design). Task 314 was re-named to remove “Utility Studies.”
16. New Task 324 25% Contract Plans was added.
17. Tasks 430 and 461 were added as new tasks related to Traffic Control Agreements.
18. Tasks to respond to submission comments were moved into the sections for the submissions of interest. Comment Resolution Meetings (CRMs) were also added to these tasks.

**April 2022**

1. Section 500 Right of Way and Task 501 Preliminary Right of Way Plans. Updated to clarify current requirements and to be consistent with current versions of the MassDOT CAD Standards and the Highway Division’s “Plan Preparation Guidelines for Consultants preparing Right of Way Plans”.
2. Task 502 Layout Plans and Order of Taking. Added that layout plans shall be prepared in accordance with the current versions of the MassDOT CAD Standards and Layout Plan Preparation Guidelines
3. Task 504 Final Right of Way Plans. Task description changed to Quality Control (QC) Review.

**December 2021**

1. Updated Task 302 (Utility Coordination) to include a new requirement for performing SUE-Level B services for certain projects.

**August 2020**

1. Updated various Tasks to include considerations for landscape design elements.
2. Task 323 (Preliminary Landscape Design) added.

**January 2020**

1. Updated Section 220 to reflect new Design Justification process.

**November 2013**

1. Updates for consistency with new Division II of the Contract Standard Provisions, Standard Task Descriptions, revised 05/2013, as further amended by the Contract Special Provisions, revised August 2013. A number of tasks were added and several are updated. All revisions relate to Contractor responsibilities.
2. Task 105 (Project Design Schedule Development and Monthly Updates) added,
3. Tasks 330, 428, 458 and 807 (Construction Contract Time Determination) added.
4. Tasks 331, 429, 459 and 808 (Incentives/Disincentives) added.
5. Tasks 423, 454 and 802 (Quantity and Cost Estimate (Weighted Average Bid Application) added requirement to track significant changes beyond the 25%, 75% and 100% estimates.
6. Tasks 427, 457 and 806 (Bottom Up Estimate and Reconciliation (if required)) added
7. Task 712 (Hydraulics Study and Report (Bridges over Water) shifted up and renumbered to Task 708, number 712 renamed to “reserved.”

**May 2013**

1. Updates for consistency with new Division II of the Contract Standard Provisions, Standard Task Descriptions, revised 05/2013. No new or deleted tasks.
2. Section 150 Environmental updated throughout for consistency with laws, regulations and terminology.
3. Task 231 updated to properly assign responsibility for coordinating with FHWA to MassDOT. Previously, this was designated as the Consultant’s responsibility.
4. Section 900 updated to clearly indicate that the Consultant is entitled to rely on information provided when reviewing shop drawings. Also, this Section was updated to indicate that the Consultant is not responsible for site inspections, only for making observations.
5. Task 907 updated to indicate that the Consultant shall provide technical recommendations to resolve issues.

**March 2011**

1. Document Title changed.
2. Changes were made to reflect the creation of MassDOT.
3. The following Sections and Tasks were updated:
   1. Task 151 Early Environmental Coordination Design Submission Checklist. Added.
   2. Task 153 MESA Determination. Eliminated.
   3. Task 168 MESA and NOI Streamlined Review. Eliminated.
   4. Task 169 MESA Permit Application. Eliminated.
   5. Task 186 Coordination and Liaison. Consolidated with Task 155.
   6. Task 187 Impaired Waterbody Assessment. Added.
   7. Section 200 Functional Design Report. General section added and all tasks modified.
   8. Section 201 Establish Purpose and Need. Added.
   9. Section 202 Public and Agency Outreach. Added.
   10. Section 203 Evaluate Existing Conditions / Context. Revised.
   11. Section 204 Prepare Traffic Volumes. Previously named Traffic Count Analysis. Revised. Moved from Task 202 to 204.
   12. Section 205 Conduct Safety Analysis. Revised. Moved from Task 203 to Task 205.
   13. Section 206 Evaluate Signal Warrants. Revised. Moved from Task 204 to Task 206.
   14. Section 207 Operational Analysis for Existing Conditions. Previously named Intersection Analysis. Task 205 moved to Rask 207. Added/Revised.
   15. Section 208 Establishment of Basic Design Controls and Evaluation Criteria. Added.
   16. Section 209 Development of Alternatives. Previously named Proposed Geometrics. Added/Revised. Task 206 moved to Task 209.
   17. Section 210 Operational Analysis for Future Conditions. Added.
   18. Section 211 Preferred Alternative. Added.
   19. Section 212 Complete Streets. Added.
   20. Section 213 GreenDOT. Added.
   21. Section 214 Traffic Management. Added.
   22. Section 215 Conclusion and Recommendations. Added.
   23. Section 216 Report Preparation. Moved from Task 207 to 216.
   24. Section 230 Interchange Justification / Modification Report (IJR/IMR). Added.
   25. Task 314 Pavement Design. Reference documents updated.
   26. Task 320 Traffic Signals. Revised.
   27. Task 322 Traffic Management. Revised.
   28. Task 323 Early Environmental Coordination. Consolidated with Task 151.
   29. Task 326 Preliminary Construction Estimate. Construction Project Estimator requirement added.
   30. Task 327 Design Submission Checklists. Amended to include the Traffic & Safety Engineering Checklist.
   31. Task 352 Design Public Hearings. Language clarified.
   32. Task 407 Pavement Design. Reference documents updated.
   33. Task 423 Quantity & Cost Estimate. Calculation Book and Construction Project Estimator requirements added.
   34. Task 454 Finalize Estimate. Clarified Detail Sheet, Quantity Sheet, Summary Sheet and Calculation Book requirements. Construction Project Estimator requirement added.
   35. Section 500 Right of Way. Section overview language revised regarding Abutter’s Property lines.
   36. Task 606 Geotechnical Report. Reference documents updated.

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# GENERAL CONTRACT NEGOTIATION PROCESS

MassDOT’s Standardized Scope of Services and Workhour Estimate Forms for Consultant Services shall be used by MassDOT and Consultants to develop the scope, work hour estimate and fee for highway/bridge related projects. The Microsoft Excel Scoping Workbook includes tabs for work hour and fee calculations. The following process shall be used for developing a Scope of Services and securing Consultant Services.

1. **SCOPE OF SERVICES:** The first step in this process is to determine the appropriate scope of services. The project scope shall be developed in accordance with Chapter 2 of the *Project Development and Design Guide*. This will ensure that the proposed scope is complete and appropriate. Certain projects have repeated tasks. The Work Hour Estimate should not duplicate hours for the repeated tasks.
2. **INDEPENDENT ESTIMATE:** Every assignment requires an independent estimate prepared using the Standardized Scope of Services and Workhour Estimate Forms. The independent workhour estimate may be prepared by MassDOT staff (e.g. Bridge Project Development Unit, District Office, etc.) or may be prepared by a Consultant not affiliated with the assignment. The Project Initiation Form (PIF) will contain valuable information regarding some of the major tasks that will be required during the design phase. Information regarding the anticipated environmental permitting, right of way status and the potential need for design exceptions are all addressed in the PIF. It is particularly important during this phase that a strategy is developed for obtaining survey base plans, traffic counts, borings, test pits, pavement cores, concrete cores, steel coupons, etc. The project designer must have complete and accurate information regarding the existing conditions in order to develop an appropriate fee proposal and to make informed decisions during the design phase.
3. **INITIATION:** The Project Manager initiates the negotiations by transmitting to the Consultant a copy of the scope of services along with any additional pertinent information. The independent workhour estimate shall remain confidential.
4. **SCOPING MEETING:** Prior to requesting a proposal from the Consultant, it is strongly recommended that a meeting be conducted among the Project Manager, the Consultant and other Sections of MassDOT (if necessary) to discuss the scope. The negotiation of workhours can only be successful if both parties have the same understanding of the scope of the services to be provided. The Project Manager's Supervisor is encouraged to attend negotiation meetings.
5. **FEE PROPOSAL:** The Consultant is responsible for submitting a fee proposal based on the scoping meeting. If the submitted workhours for a specific task are more than 50% above the independent workhour estimate, the Project Manager should consult with the preparer of the independent estimate to determine the cause of the discrepancy. The workhours calculated in the independent estimate may require revisions based on the results of the pre-negotiation meeting, information made available after the initial estimate was prepared, miscalculation or because of new information learned. If, after these adjustments have been made, the aggregate amount of the workhours exceeds the independent estimate by more than 25% then the Project Manager shall request a re-submittal of the proposal.
6. **NEGOTIATION SESSION(s):** The Project Manager shall be responsible for promptly scheduling a negotiation session(s) with the Consultant. All negotiations shall be based on the number of workhours that are necessary to provide the services described for each task. Negotiations **shall not be based on meeting a specific dollar amount**. The actual final dollar amount of an assignment is determined by applying the information contained in the Consultant's HED 640 Form, the Consultants audited overhead rate and fee percentage to the agreed upon workhours, and by adding in any necessary direct costs.
7. **RIGHT TO APPEAL:** If the Project Manager and the Consultant are not in agreement, issues may be elevated through the chain of command at MassDOT in order to reach a resolution. If a Project Manager has encountered such an impasse, it should be brought to the attention of the Director of the Division. It is important that both MassDOT's Project Manager and the Consultant understand that either party has the right to elevate the discussion regarding assignment negotiations if agreement is not achieved**.**

# PART A – SCOPING WORKBOOK

### Workbook Tab 1.1 – Project Definition

This form is to be used to provide basic project and scope definition. The form is also intended to facilitate the assignment of scope elements to the party responsible e.g., by Consultant, by MassDOT, completed by others, etc. This Tab will be completed by MassDOT and provided to the Consultant at the onset of the scoping / negotiation process.

### Workbook Tab 1.2 – Environmental Scope

This form lists the regulatory thresholds for a variety of different environmental permits and is intended to identify which permits will be included in the Scope of Services. This Tab will be completed by MassDOT and provided to the Consultant at the onset of the scoping / negotiation process.

### Workbook Tab 1.3 – Work Hour Estimate

This form is used to tabulate work hours for specific tasks by the appropriate engineering titles. The titles along with typical ranges for the distribution of hours by percentage are listed below in *Exhibit A - Consultant Titles and Typical Description*. This form will be completed by the Consultant and used in the negotiation process with MassDOT.

### Workbook Tab 1.4 – Summary Table

This table summarizes the hours by task and staff classification and calculates the associated dollar amounts. It is intended that a direct relationship will exist between these dollar amounts and the Consultant’s Progress Reports.

### Workbook Tab Exhibit B – Budget Cost Plus or Lump Sum

These tabs present the total fees for Cost Plus and Lump Sum Agreements.

Exhibit A – Consultant Titles & Typical Description

|  |  |
| --- | --- |
| CONSULTANT TITLES & TYPICAL DESCRIPTION | TYPICAL % |
| Principal in Charge (PIC) | 1 - 3 % |
| *Firm principal with signatory authority to bind firm in contracts. Represents the firm in contractual matters, ensures that controls are in place to maintain quality, ensures that adequate staffing is provided to meet project schedule and has overall knowledge of the project. Typically equivalent ASCE Grade VII-IX* |  |
| Project Manager (PM) | 10 - 15% |
| *Day-to-Day Manager of the Project. Maintains communication with MassDOT, involved municipality, state and federal agencies, utility companies and contractors. Coordinates efforts of the team and monitors schedule and budget. Also, prepares or reviews submission checklists and ensures review comments are addressed. May also function as Senior Engineer in respective discipline. Typically equivalent ASCE Grade V-VII.* |  |
| Senior Engineer (SE) | 15 – 25% |
| *Experienced engineer responsible for leading planning, engineering, design, permitting and plan production efforts in their respective discipline. Makes key technical decisions/judgments and ensures that the project development is in conformance with standards. Provides guidance and monitors progress of work by Engineers, Assistant Engineers and Technicians. Typically equivalent ASCE Grade V-VII.* |  |
| Engineer (Eng) | 25 - 35% |
| *Experienced engineer engaged in planning, engineering, design, permitting and plan production tasks. Responsible for performing engineering calculations and analysis, detailing designs, preparing reports and other project documentation. Assists Senior Engineer in overseeing the work of Assistant Engineers and Technicians. Typically equivalent ASCE Grade III – IV.* |  |
| Assistant Engineer (AE) | 10 - 15% |
| *Entry-level engineer with a minimum of an undergraduate degree in engineering or related technical fields. Involved in performing various tasks to support planning, engineering, design, permitting and plan production. Typically equivalent ASCE Grade I & II.* |  |
| Engineering Technician (ET) | 10 - 15% |
| *Staff primarily associated with CADD, Data Collection or other support of office and field activities. Technical education beyond High School such as CADD and/or other training.* |  |

*NOTE: Above percentage ranges will vary depending on size and complexity of project. For small and more complex projects the more experienced personnel will often be at the higher end of the above percentage ranges*.

# PART B – TASK DESCRIPTIONS

The following information provides a comprehensive description of tasks that may be required to design a MassDOT project. It is understood that certain projects may have specific circumstances that will require that additional tasks be defined and negotiated. Additional tasks shall be numbered consistent with the appropriate Section and added to the Work Hour Estimate Form.

## SECTION 100 PROJECT DEVELOPMENT ENGINEERING

The broad purpose of the Project Development Phase is to conduct an analysis in accordance with Section 2.2, *Step II: Planning* in the *Project Development and Design Guide* to refine the scope of a project through the Pre-25% Scoping Procedure. This analysis evaluates alternatives for a proposed transportation project and arrives at a preferred alternative or a range of reasonable alternatives to be advanced into the environmental review process, establishing the basis for a 25% design submission. For Project Development requirements related to Structural Engineering, the Consultant shall review Section 700.

As part of the Project Development Phase, the Consultant shall prepare a purpose and need discussion for the proposed transportation project. The purpose and need discussion shall clearly identify and describe the transportation problem(s) or other needs that the proposed transportation project is anticipated to correct, in terms understandable to the general public. The purpose and need discussion shall form the basis for the selection of reasonable alternatives, including the no-build alternative. Elements relevant to all agreed upon alternatives should be developed using location specific data to compare the present, future no-build, and future build conditions.

The Consultant shall become familiar with the topographic, environmental and other physical characteristics of the study area, including existing utilities. The general location of environmental resources, cultural and historic resources, major topographic features, landscape resources and neighborhood features, and utilities that the proposed transportation facility may affect shall be graphically depicted. The Consultant shall also be responsible for acquainting itself with the details of the existing transportation facilities, previous studies, and for collecting necessary data and information, unless otherwise specified in the Scope of Services in the Special Provisions.

The Consultant shall initiate early coordination with the appropriate federal, state, and local agencies to present the proposed project to them, to consider the plans and suggestions of these agencies in the development of the alternatives analysis, and to develop a consensus on the range of alternatives to be studied.

The evaluation of each alternative shall take into account factors affecting construction cost, such as foundation problems, construction difficulties, major utilities affected, landscape and environmental impacts, and environmental mitigation. As detailed in the Scope of Services, the Consultant shall also ascertain known economic and social impacts on communities in the project area for alternatives evaluated. For each endorsed alternative, the evaluation shall consider existing and known future land uses, transportation facilities, cultural resources, aesthetics, natural resources, and other factors that may influence the proposed project.

The Consultant shall demonstrate that endorsed alternatives have been investigated to an appropriate level of detail before an alternative is eliminated or advanced to a further level of analysis. The endorsed alternatives shall be developed with a view toward producing a context sensitive project consistent with public safety and the interests of the communities in the project area. Endorsed alternatives shall be available for review by MassDOT.

As specified in the Scope of Services, the Consultant shall develop a broad-based public outreach program intended to fully involve the public with the purpose and need of the project, project status, and potential effects of the project. The program is to obtain input from the study area residents, businesses, elected officials and other stakeholders. The public outreach program shall include presenting the project at public meetings or open houses using graphics or other visual aids to help explain the various alternatives. Use of community focus groups to assemble issues, develop evaluation criteria, and obtain consensus should also be considered. Various aspects of the project, such as the project area, environmental constraints and impacts, traffic data, and alternative cross sections shall be described at the public meetings.

### 101 Project Initiation and Data Compilation

If not already initiated, complete the required steps to submit the project for approval by the Project Review Committee (PRC). Prepare a general description and definition of the project, developing the project’s Purpose and Need and general Scope of Work.

Compile and review all available documents of existing features and planned projects in the vicinity of the proposed work. Included, as part of this task, is the investigation of utility installations, previous subsurface explorations, traffic data, and right of way research.

### 102 Preliminary Project Scoping

For municipally-led projects, consult with the MassDOT Project Manager to determine if a Project Scoping Meeting (PSM) is needed. If so, assist in meeting preparation and facilitation by completing the Pre-25% Scoping Checklist based on information gathered during project initiation and project area scoping. Gather input from meeting attendees on potential risks, project limits and scope, and design elements. The PSM meeting may occur in coordination with a site visit if desired.

Prepare an overview that evaluates the project area in light of the project’s purpose and need including but not limited to traffic, safety, environmental, utility, and ROW impacts, to determine any additional studies that are beyond the Scope of Services that may be required. Also, examine planning any applicable criteria, degree of citizen and agency involvement and other issues and factors that may influence the design of the project provided by the Engineer.

### 103 Field Surveys

Complete or partial field surveys may be made by either MassDOT or the Consultant or partially by each, as designated in the Scope of Services and Special Provisions. Surveys shall be made as necessary for the preparation and completion of preliminary and final designs, contract plans and layout plans for the project following the current *MassDOT* *Field Survey Guidelines and Baseplan Requirements, Massachusetts Highway Department Survey Manual (Survey Manual), MassDOT CAD Standards Manual, and/or* *Specifications for Aerial Surveys and Mapping by Photogrammetric Methods for Highways*. For projects including bridges, the project should follow requirements in the *MassDOT LRFD Bridge Manual, Subchapter 1.1*.

The Surveyor shall visit the site and conduct preliminary surveys following all MassDOT Guidelines and requirements as described in the first paragraph. All surveying field notes shall be recorded in MassDOT field notebooks. Field notebooks shall be obtained from the respective district survey office and returned to that same office when the survey work is complete.

The Consultant shall contact the various utility companies and authorities, whose facilities may be affected by the proposed construction, to request from such companies and authorities the locations of existing facilities, together with proposed changes, if any.

Plot and calculate all existing layout line geometry and note all property owners.

Horizontal and vertical control, including control for remote sensing, shall be of the accuracy and datum as specified in the *Survey Manual*. Primary control and all main base line surveys shall be computed and adjusted according to the guidelines set forth in the *Survey Manual*. The Consultant shall submit a copy of the traverse closure computation to the District Survey Supervisor for review. Work which does not conform to MassDOT standards will be rejected, and the Consultant will be directed to perform the work correctly at its own expense.

The Consultant shall include in the survey notebooks adequate ties to all horizontal and vertical control points so that these points may be reproduced accurately. The Consultant shall also furnish tie–sheets of these points.

All field survey work performed by the Consultant shall be subject to inspection by MassDOT during and after actual survey. The Consultant shall keep the local Highway Division District Office aware of the location of its survey crews. District Survey Supervisors and their superiors, as well as representatives of the Boston Survey Section, may make field inspections, as necessary, to ensure proper procedures are employed by the Consultant, and may require changes or additions subject to approval of the Survey Engineer.

Surveys made by remote sensing methods may be used upon MassDOT approval but must be supplemented by necessary ground survey to obtain information not available or not sufficiently accurate.

Data from field surveys shall be plotted on base plans, profiles, and cross sections in accordance with current practices of MassDOT and to the scales directed by the Engineer. All field surveys, and plotting of such data, including base lines, details, and cross sections shall be performed in accordance with the *Survey Manual,* the *MassDOT* *Field Survey Guidelines and Baseplan Requirements,* and current MassDOT CADD standards. A CADD file of the completed survey should be sent to the MassDOT Survey Section for record-keeping.

### 104 Survey Coordination and Verification

Coordinate ground survey effort, review survey controls and closures, baseline ties and overall quality of survey. Coordinate with the District Permits section for access requirements.

Perform a field review of base plan information. Verify the location of existing features, note legends on all warning, regulatory and route marker signs. Verify that the plans provide sufficient information regarding existing drainage and sewer systems, and other underground and overhead utilities. Verify that the cross sections include existing features such as walls, hydrants, poles, trees, sills, wells, ledge, layout lines, etc. Verify that profiles include station equations, cross culverts, bridge structures, sills, high-tension lines, benchmarks, etc. Consult the Pre-25% Checklist to ensure that the survey provides all required data in the Pre-25% Services section.

### 105 Prepare Traffic Volumes

Traffic data collection efforts shall be in accordance with the Traffic and Safety Engineering 25% Design Submission Guidelines and the direction provided by MassDOT Traffic & Safety at the Pre-25% Scoping Session. Obtain appropriate traffic counts for the study area, including any necessary pedestrian and bicycle counts, and provide an assessment of data to determine factors for background growth and seasonal adjustments. Prepare the future design volumes.

### 106 Field Reconnaissance

Perform site investigations to observe the general site conditions, traffic patterns, traffic management, potential detour routes, wetland and cultural resources, vegetation, proximity of abutters and other relevant features. Take photographs and/or videos of existing facility and surrounding environment.

### 107 Road Safety Audit

Determine if a Road Safety Audit (RSA) is required based on Top 5% High Crash Intersections and Segments and the Road Safety Audit Guidelines. Consultant should perform all tasks as outlined in the Road Safety Audit Guidelines, including pre-meeting coordination, facilitation of the RSA, and post-meeting documentation, including producing an accessible report after content is approved. Safety analysis should be performed under Section 200.

### 108 Intersection Control Evaluation

Coordinate with the MassDOT Project Manager for the results on previously completed Intersection Control Evaluation (ICE) applicability for a project that includes intersections. Follow the ICE procedure and Pre-25% Procedure outlined in the Engineering Directive and PSM checklist to complete and submit ICE forms, if needed, at the appropriate times.

For intersections where a signal is a viable control, collect, tabulate, and analyze traffic count data with respect to the MUTCD Traffic Control Signal Needs (Warrants) based on the existing geometric conditions to determine if signals are justified. Warrant analysis shall follow the requirements of the Traffic and Safety Engineering 25% Design Submission Guidelines.

### 109 Reasonable Alternative(s) Identification

Identify project alternatives that meet the project’s purpose and need, and use intersection controls that have been approved through the ICE process. Determine which of these alternatives are feasible and reasonable. All reasonable alternatives will be evaluated during this task, including alternatives discussed during the Project Scoping Meeting.

### 110 Conceptual Design and Alternatives Analysis

Evaluate the project alternatives identified under Task 109 to compare the advantages and disadvantages of each, using supporting data and analysis. Those alternatives that are eliminated from further study shall be graphically illustrated and should be accompanied by descriptions of the locations with statements as to why further consideration is not warranted.

Alternatives should be developed to comparable levels to allow for evaluation using the design guidance provided in the MassDOT *Project Development and Design Guide* and applicable Engineering Directives. Coordinate with MassDOT Project Managers to determine if a decision matrix is needed to select a preferred alternative and develop the matrix using factors deemed necessary for consideration for the project, including but not limited to safety, operations, environmental, ROW, mobility, cost effectiveness, utility impacts and constructability.

### 111 Over-the-Shoulder Deliverables and Meeting

Attend Pre-25% Over-the-Shoulder (OTS) Review Meeting and prepare required meeting deliverables as determined at the Project Scoping Meeting (PSM). These documents should be submitted in advance of the meeting to allow for a more robust discussion but comments received will not require formal written responses.

Document the consensus on a preferred alternative in meeting minutes and compile those with all required Pre-25% OTS Meeting Deliverables into one document, to be submitted to the Project Manager to be uploaded into future design submissions.

### 112 Public and Agency Outreach

Attend coordination meetings, as scoped with MassDOT, the community, utility owners, local commissions and others. Prepare and distribute minutes of the meetings.

There may also be an optional public information meeting if needed after the Over-The-Shoulder (OTS) meeting to be determined during project scoping. Coordinate with the MassDOT Project Manager on requirements for the meeting. All hearing documents must be fully accessible and meet all ADA and WCAG requirements for being posted on mass.gov.

### 113 Project Design Schedule Development and Monthly Updates

Develop and submit for approval a project design schedule, and provide updated schedules to the MassDOT Project Manager as needed, in accordance with current MassDOT Highway Division requirements.

## SECTION 150 ENVIRONMENTAL

The Consultant shall be responsible for advising MassDOT regarding the requirements of both the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA) for the purpose of implementing the proposed project. The Consultant shall produce any and all documents required for submittal under each/either act(s) (the “Environmental Document(s)”). The MassDOT Environmental Section should be consulted regarding NEPA and MEPA requirements.

NEPA is codified at 23 CFR 771, which prescribes the policies and procedures of the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) for its implementation. The Consultant should refer to FHWA’s guidance document for preparing environmental and Section 4(f) documents found in FHWA’s Technical Advisory 6640.8A, dated October 30, 1987. MEPA is found at Massachusetts General Laws, Chapter 30, Sections 61 through 62I, with implementing regulations found at 301 CMR 11.00.

Sufficient information shall be presented in the Environmental Document(s) to demonstrate that a comprehensive examination has been made of the social, economic and environmental effects of the proposed project. The comprehensiveness of the evaluation shall vary depending on the complexity of the project and the level of environmental documentation required. Projects requiring major filings, such as an Environmental Impact Statement (EIS) or Environmental Assessment (EA) in accordance with NEPA, or an Environmental Impact Report (EIR) in accordance with MEPA, will require the most comprehensive level of evaluation. In these cases, the Consultant must provide a detailed, project‑specific scope of the services. Environmental documents such as Environmental Notification Forms and Categorical Exclusion Determinations require a less comprehensive, although still thorough, evaluation. The Environmental Document(s) shall be written in a concise manner and presented in a format and language that will be readily understandable to the public.

Generally, an EIS or EIR shall discuss the purpose and need of the proposed project. It shall also describe the proposed project; alternatives to the proposed project; the affected environment in the project area; probable impact of the proposed project on the environment; steps to be taken to avoid, minimize, and mitigate harm; and coordination with and input from federal, state, and local agencies and the general public.

The basic approach to be employed in the development of a major Environmental Document(s) shall be as follows:

1. Establishment of a clear purpose and need for the proposed project;
2. A comprehensive data collection program of existing social and natural environmental resources in the project area and coordination with the general public and local, state, and federal agencies, as required;
3. Examination of data to establish baselines to be used as reference for environmental impacts and against which the ability of various alternatives to meet the stated purpose and need can be measured;
4. Preliminary evaluation of the proposed project to meet purpose and need and identify environmental impacts and possible problem areas;
5. A more detailed analysis of environmental impacts, methods to avoid and minimize those impacts to the greatest extent practicable, and establishment of the indirect and cumulative environmental impacts;
6. Preparation of the Draft Document(s), with copies to be distributed to various public agencies, the general public, and others for comment; and
7. Upon receipt and evaluation of comments following a public hearing, preparation of a Final Environmental Document(s) with copies, as required, for distribution.

This approach will assure that all major Environmental Documents fulfill the previously established purpose and need by providing a comprehensive evaluation of a wide range of environmental considerations. This approach will also allow periodic reviews and modifications to the study as more information becomes available.

The Consultant shall also prepare permit or approval applications, with supporting documentation and plans, to satisfy the requirements found in the following state and federal environmental laws and their associated regulations, or their current versions, as necessary, or as specified in the scope of services in the Special Provisions:

* Massachusetts Wetland Protection Act (MGL c. 131 § 40);
* Massachusetts Endangered Species Act (MGL c. 131A), if requested;
* Article 97 (MGL c. 21A § 2);
* Chapter 91 Public Waterfront Act (MGL c. 91);
* Section 401 of the Clean Water Act – Water Quality Certification (33 USC § 1341, administered by state regulation found in 314 CMR 9.00);
* Section 402 of the Clean Water Act – National Pollution Discharge Elimination System (NPDES, 33 USC § 1342);
* Section 404 of the Clean Water Act – U.S. Army Corps of Engineers (33 USC § 1344);
* Section 10 of the Rivers and Harbors Act of 1899 (33 USC § 403);
* Coastal Zone Management Act (16 USC §§ 1451-1464);
* Section 9 of the Rivers and Harbors Act of 1899 – Coast Guard Bridge Permit (33 USC § 401);
* Wild and Scenic Rivers Act (16 USC §§ 1271-1287);
* Section 106 of the National Historic Preservation Act (54 U.S.C. 306108), if requested;
* Section 4(f) of the DOT Act (49 USC § 303), if requested;
* Section 7 of the Endangered Species Act (16 U.S.C. § 1531 [et seq.](https://en.wikipedia.org/wiki/Et_seq.)); if requested; and
* Essential Fish Habitat Assessment provisions of the Magnuson-Stevens Fishery Conservation and Management Act ([16 U.S.C. 1801 et seq.](https://www.fisheries.noaa.gov/resource/document/magnuson-stevens-fishery-conservation-and-management-act))

The following task descriptions included in this Section provide a basic description of the various actions to be taken in the environmental permitting process. MassDOT’s Environmental Section should be consulted regarding all environmental permitting requirements.

### 151 Early Environmental Review Checklist

Complete the sections identified for consultant input within the current version of the Environmental Review Checklist (ERC). This involves reviewing and confirming the permitting requirements and environmental criteria identified by the MassDOT Environmental Representative during Scoping and Pre-25% Design reviews. This also involves ensuring that coordinating with local, regional, state, and federal resource agency staff has been completed. This effort provides project stakeholders with an opportunity to comment on the presence of environmental resources in the project area, their extent, and potential significance. Documentation that an adequate level of consideration has been made to avoid and minimize impacts to identified environmental resources shall be presented. Completion of the early coordination requirements ensures necessary deliverables outlined in the ERC have been prepared and design plans are adequate for environmental review. Written responses are required for each item, and supporting documentation must be included. The ERC should be used to inform the tasks below.

### 152 Historic/Archaeology – Federal Section 106 and State Register Review

Provide information in accordance with the requirements of Section 2.4.2.5, *Environmental Requirements for Preliminary (25 Percent) Design Submission* of the *Project Development & Design Guide* as itemized in the Environmental Review Checklist (ERC). Check mass.gov for the most recent version of the checklist, a template for the standard local historical commission/tribal historic preservation officer solicitation letter; and an updated contact/address list. Be available to meet with MassDOT’s Cultural Resource Unit (CRU) staff, and with local and state historical commission representatives, as agreed upon between MassDOT and the Consultant.

### 153 Reserved

### 154 Hazardous Materials Research/Review

Provide an assessment of potential hazardous material-related impacts in accordance with the requirements of the following:

* Section 2.4.2.5 and Appendix 2-A-7, *Environmental Requirements for Preliminary (25 Percent) Design Submission of the Project Development & Design Guide*, as itemized in the latest version of Environmental Review Checklist (ERC),to the MassDOT Hazardous Materials Unit for review.
* 310 CMR 40: Massachusetts Contingency Plan (MCP) and applicable Policies, Guidance, and Technical Support Documents issued by the Massachusetts Department of Environmental Protection (MassDEP).
* Environmental Protection Agency (EPA) Toxic Substance Control Act (TSCA) and Construction Dewatering Regulations.
* Also include responses to comments from local and state agencies and attend meetings, as agreed upon between MassDOT and the Consultant.

The hazardous materials assessment shall be submitted as part of the 25% design submission and include, but not be limited to, a desktop review of potential surface and subsurface impacts (soil, sediment, groundwater, and surface water) within the proposed project area, and components of above-ground and below-ground building and construction materials (including but not limited to lead-based paint, asbestos, polychlorinated biphenyls (PCBs), mercury, and preserved/treated wood). In addition to the identification of potential impacts, the assessment shall also include an analysis of impact locations and volumes of impacted media to be encountered based on existing available information, and the inclusion of the appropriate Special Provisions to accompany the applicable items in the design estimate.

The approach to be employed in the development of a Hazmat Submittal(s) shall include, but not be limited to:

1. Reviewing online MassDEP database search tool, MassMapper Interactive Map, aerial photographs, Sanborn maps, historic fill maps, etc. to evaluate the presence of EPA Superfund Sites, MassDEP Brownfields, and/or other potential local and adjacent sources of contamination (e.g., dry cleaners, tannery, dump ground, underground storage tanks, former landfill, active landfill, auto shredding, etc.) located within and/or immediately adjacent to the proposed project area.
2. Evaluation of available existing geotechnical and chemical testing data (soil, groundwater, surface water, and/or sediment) and evaluation of applicable MassDEP reporting exemptions for any exceedance of reportable concentrations/standards.
3. Evaluation of historic site use and fill quality using online tools, available geotechnical data, and existing boring logs.
4. A locus plan showing the boundaries of any existing disposal sites and any other potential sources of hazardous materials that could impact the proposed project area.
5. Estimation of total project excavation, onsite reuse, and disposal quantities, cuts, fills, and reuse areas. The backup information for estimating soil quantities, including assumptions for onsite reuse etc. shall also be provided. For select projects involving a more complex scenario of hazardous materials-related impacts, MassDOT Environmental may request that the Consultant produce a memorandum outlining a strategy for managing expected impacts. The memorandum shall include a locus plan showing the boundaries of any existing Release Tracking Numbers (RTNs), details of reportable conditions discovered as part of sampling, applicable MCP reporting exemptions, soil management strategy, and Release Notification Forms (RNFs) that must be filed prior to advertising. This service, if requested, will be coordinated and compensated outside the ***Standard Scope of Consultant Services.***

**Note: *Subsurface investigation and collection of samples for hazardous materials concerns is not considered part of the standard scope of consultant services, and shall not be conducted without prior review and approval from MassDOT Environmental.***

The backup for estimating soil quantities, including assumptions for onsite reuse etc. shall be provided to MassDOT. The written description shall include the steps the Consultant took to maximize on-site reuse of material, explanation of why material must be disposed off-site (if proposed by the Consultant) and provide estimated bid items and quantities for soil disposal in MassDOT contracts. All soil that cannot be reused on-site must be documented and fully accounted for under Bid Items 181.11 through 181.14. The estimated off-site disposal tonnages for Bid Items 181.11 through 181.14 should be based on actual cut fill sheets for the project area and a desktop evaluation of potential contamination within and/or immediately adjacent to the project area. Quantifying estimates for Bid Items 181.11 through 181.14 must be supported by the Hazardous Materials assessment submitted by the Consultant. Bid Items and volumes for off-site disposal of contaminated groundwater should be based on Consultant’s knowledge of the proposed work, site history, history of surrounding properties, and publicly available information regarding groundwater contamination through MassDEP’s database. Bid Item 183.1 is typically paid per gallon so care shall be taken during design to include a reasonable estimate of the volume of water to be treated. Many contracts only include small volumes as placeholders. Although the actual volume will be dependent on Contractor means and methods, the Consultant should make a reasonable estimate.

### 155 Project Development Meetings and Public Hearings

Prepare for and hold public meetings and public hearing(s) as agreed upon by MassDOT and the Consultant.

### 156 National Environmental Policy Act / Massachusetts Environmental Policy Act (NEPA/MEPA) Determination

Determine the appropriate level of documentation in the NEPA process (Categorical Exclusion, Environmental Assessment (EA) or Environmental Impact Statement (EIS)) and the MEPA process (Environmental Notification Form (ENF) or Environmental Impact Report (EIR)) by meeting and coordinating early with MassDOT, FHWA and other government agencies, local boards and commissions, and conducting public meetings, as agreed upon in the Scope of Services.

Typically, the NEPA and MEPA Environmental Documents for major projects are prepared jointly, that is, as either an EA/EIR or as an EIS/EIR. In some cases, the NEPA and MEPA documents are prepared and processed separately. The Consultant shall perform the tasks described in Sections 157 through 167, as agreed upon by MassDOT and the Consultant.

### 157 NEPA – Categorical Exclusion (CE)

MassDOT Environmental will prepare a draft Categorical Exclusion (CE) Determination Checklist for Federal-Aid Actions in accordance with the most recent *Programmatic Agreement For Approval Of Categorical Exclusions Between The Federal Highway Administration And The Massachusetts Highway Department*, and Federal Highway Administration Regulation 23 CFR § 771.117 (1987), unless otherwise requested for Consultant preparation. The Consultant is responsible for Section 4(f) *de minimis* legal notice filing and fee, as requested by MassDOT Environmental.

### 158 NEPA – Environmental Assessment (EA)

Prepare an Environmental Assessment (EA), in accordance with FHWA’s NEPA regulations (23 CFR 771), that includes a description of the proposed project; the alternatives under consideration; the social, economic and environmental impacts of the alternatives; avoidance, minimization and mitigation measures; and a section on comments and coordination. See FHWA Technical Advisory T6640.8A, dated October 30, 1987.

After a public hearing is held and the preferred alternative is agreed to, update the EA, as necessary, to include the Finding of No Significant Impact (FONSI) and to reflect any changes resulting from comments from federal, state, and local agencies and the general public. This document should also include the disposition of comments from these agencies and the general public.

### 159 NEPA – Draft Environmental Impact Statement (EIS)

Prepare a Draft EIS, in accordance with the NEPA regulations (23 CFR 771), that includes a description of the purpose and need for action; the proposed alternatives; the affected environment; the social, economic, and environmental impacts of the alternatives; avoidance, minimization and mitigation measures; and comments and coordination. See FHWA Technical Advisory T6640.8A, dated October 30, 1987.

### 160 NEPA – Final Environmental Impact Statement (EIS)

Prepare a Final EIS, in accordance with FHWA’s NEPA regulations (23 CFR 771), that includes any changes, new information, or further developments on a proposed project, with an emphasis on those that result in substantial environmental impacts. This Final EIR should describe the basis for the selection of the preferred alternative; include a transcript of the public hearing; copies of comments received from agencies and the public with responses to these comments; and a Record of Decision. See FHWA Technical Advisory T6640.8A, dated October 30, 1987.

If there are changes, new information, or further developments on a proposed project that result in significant environmental impacts not identified in the most recent distributed version of the Draft or Final EIS, the Consultant shall perform the following task:

### 161 NEPA – Supplemental Environmental Impact Statement (EIS)

Prepare a Draft Supplemental EIS and a Final Supplemental EIS, in accordance with FHWA’s NEPA regulations (23 CFR 771), that briefly describes the proposed project, the reason(s) why a supplement is being prepared, and the status of the previous Draft or Final EIS. These documents should also summarize the previous Draft or Final EIS. The Draft Supplemental EIS and the Final Supplemental EIS need only to address those changes or new information that is the basis for preparing the supplement and that was not addressed in the previous Draft or Final EIS.

As defined by FHWA’s NEPA regulations (23 CFR 771), occasionally there is a lapse in time on a proposed project that requires the following task to be conducted.

### 162 NEPA – Reevaluation

Prepare a NEPA Reevaluation, in accordance with FHWA’s NEPA regulation (23 CFR 771), that describes any changes to the proposed project, its surroundings and impacts, and any new issues identified since the Draft EIS, Final EIS, EA, or FONSI. It should also appropriately discuss the decision as to whether a Supplemental NEPA document is needed.

### 163 MEPA – Environmental Notification Form (ENF)

Prepare an ENF and associated correspondence to various agencies, as necessary, in accordance with MEPA and its Regulations 301 CMR 11.00. Prepare associated filing attachments, such as a distribution list and public notice; responses to comments, as necessary; and attend public meetings. Determine if the project is subject to MEPA’s most recent Environmental Justice protocols and amended regulations and prepare necessary ENF or Expanded ENF (EENF) documentation. Prepare a detailed schedule outlining draft submissions and deliverables to meet the MEPA filing.

### 164 MEPA – Draft Environmental Impact Report (DEIR)

Prepare a DEIR in accordance with MEPA and its Regulations 301 CMR 11.00. Include analyses necessary to adequately address environmental issues contained in the Executive Office of Energy and Environmental Affairs (EEA) Scope on the ENF. Also include necessary preparation for attending a public meeting, if required. Use this task for preparation of Single EIRs (SEIRs) or Rollover EIRs in accordance with MEPA’s most recent Environmental Justice protocols and amended regulations.

### 165 MEPA – Final Environmental Impact Report (FEIR)

Prepare an FEIR in accordance with MEPA and its Regulations 301 CMR 11.00. Include analyses necessary to adequately address environmental issues contained in the EEA Scope on the DEIR. Include responses to public and agency comments and Draft Section 61 Findings. as defined by the MEPA Regulations (301 CMR 11.00), if there is any material change to a proposed project or a lapse in time, the Consultant shall perform the following task:

### 166 MEPA – Notice of Project Change

Prepare a Notice of Project Change that includes a detailed discussion of any changes in the information provided in any previous MEPA document. If, as a result of the Notice of Project Change, there is a determination that the project change or lapse in time may result in significant environmental consequences, the Consultant may have to perform the following task:

### 167 MEPA – Supplemental Environmental Impact Report

Prepare a Supplemental EIR, in accordance with the Massachusetts Environmental Policy Act and MEPA Regulations 301 CMR 11.00. Include analyses necessary to adequately address environmental issues contained in the EEA Scope for the Supplemental EIR.

### 168 Reserved

### 169 Reserved

### 170 USACE Section 404 Massachusetts General Permits (MGPs)

Prepare backup documentation for Pre-Construction Notification Category I or Self Verification permitting under the U.S. Army Corps of Engineers (USACE), New England Division General Permit upon request. Backup documentation may include the information generated in accordance with the requirements of Section 2.4.2.5, *Environmental Requirements for the Preliminary (25 Percent) Design Submission* of the *Project Development & Design Guide*. Preparation of the submission shall include the application form, text describing the proposed work, impacts, mitigation measures, any required Mitigation Plan and Stream Visual Assessment Protocol evaluations. The permit application shall be prepared in accordance with the latest guidance and/or checklist from MassDOT.

### 171 USACE Individual Section 404 Permit

Coordination with the U.S. Army Corps of Engineers (USACE) shall be conducted for project review pursuant to the USACE Highway Methodology. The application shall be prepared and submitted to the USACE pursuant to Section 404 of the Federal Clean Water Act following completion of the Phase I review. The application shall be submitted to the Regulatory Branch, New England District. Preparation of the submission shall include the application form, text describing the proposed work, impacts, mitigation measures, any required Mitigation Plan, any required Stream Visual Assessment Protocol evaluations, and abutter notification. The application shall include evidence of consultation with other agencies, such as the U.S. Fish and Wildlife Service, the National Park Service, Environmental Protection Agency, and Massachusetts Coastal Zone Management, as necessary. The permit application shall be prepared in accordance with the latest guidance and/or checklist from MassDOT.

### 172 U.S. Coast Guard Bridge (USCG) Permit

Prepare an application for a U.S. Coast Guard (USCG) bridge permit pursuant to Section 9 of the Rivers and Harbors Act and the General Bridges Act. A Coast Guard bridge permit is not required if the waterway is not considered navigable by the USCG and is not tidal or, if tidal, used only by recreational boating, fishing, and other small vessels less than 21 feet long, as determined by consultation with the local harbor master or other appropriate local official. Prior to application preparation, coordination shall occur with the USCG to determine if a navigational impact report shall be required.

The application shall be submitted to the District Bridge Administration, First Coast Guard District. Preparation of the application shall include the application form, text and plans in accordance with the USCG Permit Application Checklist in Section 2.4.2.5, *Environmental Requirements for the Preliminary (25 Percent) Design Submission* of the *Project Development & Design Guide*, and all associated meetings and agency coordination. The public hearing for the project can be held as a joint hearing with the USCG. The permit application shall be prepared in accordance with the latest guidance and/or checklist from MassDOT.

### 173 Programmatic Section 4(f) Evaluation

Prepare a Programmatic Section 4(f) Evaluation in accordance with associated programmatic Section 4(f) Evaluation and Approval Processes. There are five nationwide programmatic Section 4(f) evaluations: projects that involve historic bridges; projects that involve minor amounts of parkland, recreation areas, wildlife and waterfowl refuges; projects that involve minor amounts of land from historic sites; bikeway projects; and projects where the use of the Section 4(f) property will result in a net benefit to the Section 4(f) property. See FHWA Technical Advisory T6640.8A, dated October 30, 1987, FHWA Section 4(f) Policy Paper, dated July 20, 2012, and associated Programmatic Section 4(f) Federal Notices, Regulations, and Policy Papers.

Prepare legal notice and fee.

### 174 Draft Individual Section 4(f) Evaluation

Prepare a Draft Individual Section 4(f) Evaluation that includes a description of: the proposed project, the Section 4(f) property, impacts on the Section 4(f) property, avoidance alternatives and their impacts, measures to minimize harm, and a discussion of the results of preliminary coordination with agencies having jurisdiction over the Section 4(f) property. See FHWA Technical Advisory T6640.8A, dated October 30, 1987 and FHWA Section 4(f) Policy Paper, dated July 20, 2012.

### 175 Final Individual Section 4(f) Evaluation

Prepare a Final Section 4(f) Evaluation that includes all information required for a Draft Section 4(f) Evaluation, formal comments and responses from all agencies, and a discussion of the basis for the determination that there are no feasible and prudent alternatives to the use of Section 4(f) land. See FHWA Technical Advisory T6640.8A, dated October 30, 1987 and FHWA Section 4(f) Policy Paper, dated July 20, 2012.

### 176 Wetland Resource Area Delineation

Conduct wetland resource area delineation in accordance with the Massachusetts Wetlands Protection Act (WPA), the Federal Clean Water Act, the *Corps of Engineers Wetlands Delineation Manual (1987 edition),* andguidance in *Clarification and Interpretation of the 1987 Manual*, dated March 6, 1992. Include all field time associated with delineating the wetland boundaries and time attending local, state, and federal site meetings to review and verify wetland boundary lines. If applicable, documentation must be provided on state Appendix G Wetland Delineation Forms or US Army Corps Wetland Determination Forms for submittal to regulatory agencies. If the project scope is likely to result in the need for wetland mitigation, conduct preliminary identification of suitable mitigation areas. If the project scope includes new or replacement stream crossings, establish a representative channel bankfull width.

### 177 WPA Abbreviated Notice of Resource Area Determination (ANRAD)

Prepare an ANRAD in accordance with the WPA to obtain approval from the local conservation commission of state wetland resource area boundary lines. Tasks include preparation of all associated forms and backup documentation, coordination during review, site walks, and attending conservation commission meetings.

### 178 WPA Request for Determination of Applicability (RDA)

Prepare and submit an RDA in accordance with the WPA to determine if work within the 100-foot or 200-foot buffer zones of certain wetland resource areas is subject to the WPA and whether or not it will have an impact on wetland resource areas. Tasks include preparation of all associated forms and backup documentation, coordination during review, site walks, and attending conservation commission meetings.

### 179 WPA Notice of Intent (NOI)

Prepare and submit an NOI to the local conservation commission in accordance with the WPA. Tasks include preparation of all associated forms and backup documentation, permit plans, coordination during review, site walks, and attending conservation commission hearings. The permit application shall be prepared in accordance with the latest guidance and/or checklist from MassDOT.

### 180 WPA Variance

Prepare and submit a variance to the DEP in accordance with the WPA. Tasks include preparation of all associated forms and backup documentation, permit plans, coordination during review, site walks, and attending conservation commission hearings. The permit application shall be prepared in accordance with the latest guidance and/or checklist from MassDOT.

### 181 Chapter 91 License/Permit Application

Prepare an application for a Chapter 91 License or a Chapter 91 Permit in accordance with the Massachusetts Chapter 91 Waterways Act. Tasks include preparation of the application form, backup documentation, and plans/Mylars in accordance with Chapter 91 submission requirements. The permit application shall be prepared in accordance with the latest guidance and/or checklist, and template plans from MassDOT.

### 182 Water Quality Certification (WQC)

Prepare an application for a WQC in accordance with the Massachusetts Surface Water Quality Standards, 314 CMR 4.00. Tasks include preparation of the appropriate state application form, WQC Standard Form for applicable projects, supporting documentation, plan preparation, stormwater report (unless otherwise directed by MassDOT), and sediment analysis, when applicable. The permit application shall be prepared in accordance with the latest guidance and/or checklist from MassDOT.

### 183 Coastal Zone Management Consistency Review

Prepare material for a Consistency Review pursuant to the Massachusetts Coastal Zone Management Program. Tasks related to agency coordination and meetings are included, as agreed upon between MassDOT and the Consultant.

### 184 Wildlife/Rare Species Assessment

Prepare a wildlife habitat assessment, vernal pool study, and/or a rare species study, in accordance with associated regulations and/or as required by the Massachusetts Natural Heritage and Endangered Species Program, EPA, USACE, DEP, or local conservation commissions.

### 185 Essential Fish Habitat Assessment

Prepare an assessment that describes and identifies potential impacts to Essential Fish Habitat (EFH) (*i.e.*, waters and substrate necessary for fish to spawn, breed, feed or grow to maturity) within the project limits, in accordance with associated EFH regulations and as required by the USACE for the Section 404 regulatory review process and the National Marine Fisheries Service (NMFS). The assessment shall first include an evaluation of whether the project is eligible for the FHWA-NMFS Programmatic Agreement (PA) for Essential Fish Habitat Evaluation and its associated consultation form. When not eligible for the PA, the current simplified consultation form from the NMFS Greater Atlantic Regional Office webpage shall be used. When an adverse effect on EFH is determined to be substantial, an expanded EFH shall be required.

**186 Section 7 Consultation – Endangered Species Act**

Prepare programmatic, informal, or formal consultations in accordance with Section 7 of the Endangered Species for species regulated by the United States Fish & Wildlife Service and/or NMFS. The scope of services shall include any associated field work or research necessary to complete the consultation.

### 187 Impaired Waterbody Assessment and Water Quality Data Form

Determine if there are Impaired Waterbodies, as evaluated per the requirements of Section 303(d) of the Federal Clean Water Act, affected by highway runoff generated in the project area by completing the Water Quality Data Form (WQDF). Conduct preliminary identification of Stormwater Control Measures (SCMs) with the Pre-25% and 25% design submission and ensure all stormwater regulatory site assessments (e.g. borings and test pits) are incorporated into the scope of work. Document the incorporation of SCMs in the stormwater management system by submitting an updated WQDF at the Pre-25% submission and every subsequent design stage, in excel and PDF format.

### 188 Noise Studies

Conduct a Type I acoustical study to evaluate whether the proposed roadway improvements have the potential for highway traffic noise impacts at nearby sensitive receptor locations. Evaluation of potential noise impacts will be conducted in accordance with the FHWA *Procedures for Abatement of Highway Traffic Noise and Construction Noise (effective July 13, 2011)*. The evaluation will use the Federal Highway Administration’s Traffic Noise Model (TNM) version 2.5. Best available data for existing and future roadway traffic inputs, terrain, and land use will be utilized. If noise impacts are determined, then an evaluation of potential noise barrier(s) will be assessed following MassDOT’s feasibility and reasonableness criteria. The work shall include data collection, noise measurement, noise modeling and documentation of findings.

## SECTION 200 FUNCTIONAL DESIGN REPORT

A Functional Design Report documents the process undertaken in Section 100 to determine the preferred alternative and the parameters for design. Much of the work for the following tasks will be started or completed during the Pre-25% process to support development; this section allows for refinement of the preferred alternative based on feedback at the Over-The-Shoulder (OTS) and formal documentation of the details of design. Refer to the *Project Development Guide* for more information concerning Project Planning Reports. Also, refer to the *Traffic and Safety Engineering 25% Design Submission Guidelines.*

### 201 Evaluate Existing Conditions / Context

Expanding upon the content of the Pre-25% Scoping Checklist, provide a narrative of the existing study area including lane configurations, presence of pedestrian, bicycle and transit facilities, key dimensions, design speed, posted speed, Speed Regulations, functional classification, landscape considerations, environmental constraints, existing utilities, roadway context, roadway users, etc. Include a project locus map.

### 202 Conduct Safety Analysis

Collect, tabulate, and analyze the crash data and document trends and causes. Prepare crash rate work sheets, collision diagrams, collision mapping as required. Review safety with respect to the Safety Review Prompt List if a Road Safety Audit was not performed in Section 100.

### 203 Evaluate Signal Warrants

For intersections that did not go through the ICE process during Pre-25%, collect, tabulate, and analyze traffic count data with respect to the MUTCD Traffic Control Signal Needs (Warrants) based on the existing geometric conditions to determine if signals are justified.

### 204 Operational Analysis for Existing Conditions

Determine Peak-Hour Factor, Truck Percentage, and applicability of pedestrian phasing. Determine, tabulate, and discuss Level of Service (LOS), volume-to-capacity ratio, vehicle delays and average and 95th percentile Queue calculations. Analyze Existing Traffic Volumes (No Build).

Perform Systems Analysis for closely spaced and/or coordinated systems. Follow the Traffic 25% Design Guidelines Submissions for information regarding selecting an analysis tool and presenting the scope for analysis, subject to approval by the MassDOT HQ Traffic and Safety Engineering section.

Perform operational analysis for the following roadway components:

* Signalized Intersections
* Un-signalized Intersections
* Roundabouts
* Basic Freeway Segments
* Weaving Area Segments
* Multi-lane Highways
* Two-Lane Highways
* Arterials

Present LOS results graphically.

### 205 Establishment of Basic Design Controls and Evaluation Criteria

Establish basic design controls such as:

* Roadway Context
* Roadway Users
* Transportation Demand
* Measures of Effectiveness
* Target Speed
* Design Speed
* Sight Distance

Establish evaluation criteria for assessing each alternative.

### 206 Development of Alternatives

Expanding upon the technical memorandum written in Section 100,provide a discussion of alternatives considered. Include a discussion on typical sections (including bicycle, pedestrian and transit facilities), horizontal and vertical alignment, and how the following were considered:

* ROW impacts / mitigations
* Environmental impacts / mitigations
* Landscape impact, mitigation and enhancement
* Safety
* Mobility
* Utility Impacts and Constructability
* Clear Zone

### 207 Operational Analysis for Future Conditions

Analyze Future Traffic Volumes (in both No-Build and Build). Where volume and geometric conditions allow, evaluate roundabout alternative in addition to traditional intersection design. Perform Systems Analysis for closely spaced and/or coordinated systems. Perform operational analysis for the following roadway components:

* Signalized Intersections
* Un-signalized Intersections
* Roundabouts
* Basic Freeway Segments
* Weaving Area Segments
* Multi-lane Highways
* Two-Lane Highways
* Arterials

Present LOS results graphically.

### 208 Preferred Alternative

Provide a detailed description and graphical presentation of the preferred alternative, incorporating feedback received at the Pre-25% OTS.

### 209 Complete Streets

Document how the project addresses bicycle, pedestrian and transit user accommodation in accordance with Complete Streets policies and the principles of the *Project Development and Design Guide* and associated Engineering Directives. Address desirable accommodation parameters and the context and impacts associated with the selection of the project cross-section, including impacts to trees, adjacent natural areas, neighborhoods, and the landscape in general.

### 210 Traffic Management

Prepare a Construction Management Outline providing a description of all major construction components of the project and how vehicle, pedestrian, and bicycle accommodations will be maintained.

### 211 Conclusion and Recommendation

Provide a conclusion and recommendation.

### 212 Report Preparation

Prepare a report detailing the various design alternatives with appropriate graphics, descriptive text and cost estimates justifying the recommendations presented.

## SECTION 220 DESIGN JUSTIFICATION WORKBOOK

The Federal Highway Administration (FHWA) has established 10 controlling criteria as defined in 23 CFR 625, which must be adhered to when designing a roadway improvement project. MassDOT has adopted this policy and applies the requirements of 23 CFR 625 to all projects regardless of funding source, and has added 4 additional controlling criteria. Chapter 2 of the *Project Development and Design Guide* (Guidebook) and Engineering Directive E-20-001 describe the Design Justification Process in detail.

The Design Justification Workbook standardizes the preparation of Design Justifications and streamlines MassDOT’s review process. The Design Justification Workbook must follow the workbook template available on mass.gov.

### 221 Evaluate the Controlling Criteria

Compare the recommended values of the controlling criteria of Chapter 2 of the Guidebook and E-20-001 to the proposed values. Revisit those features that do not meet the recommended values and work toward developing a design that is consistent with current recommended design standards.

### 222 Perform Incremental Evaluation

For each of the controlling criteria that do not meet the current recommended design criteria, prepare the additional documentation as noted in the workbook template. This documentation should include a discussion of alternatives evaluated and an incremental comparison of impacts and costs associated with each alternative.

### 223 Complete and Certify the Workbook

Complete the Design Justification Workbook by including a project description, executive summary, and all supplemental information as noted in the workbook template. Stamp and certify the Design Justification Workbook. Prepare formal written responses to all comments received regarding the Design Justification Workbook and update the workbook as required.

## SECTION 230 INTERCHANGE JUSTIFICATION/MODIFICATION REPORT (IJR/IMR)

### 231 Prepare an IJR/IMR

Prepare an IJR/IMR, in accordance with the FHWA’s eight policy criteria (23 USC 111) for the FHWA approval for the project that proposes new or revised access to existing Interstate facilities. Access approval may be a two-step process. The first step could be a finding of operational and engineering acceptability in accordance with the eight policy requirements. The second step could be the final FHWA approval which constitutes a Federal Action, and as such, requires that NEPA procedures are followed.

MassDOT will consult with FHWA for their latest policy for preparing an IJR/IMR and advise the designer on whether their participation will be needed in any meetings with FHWA. If meetings are required, they should be included in this task.

## SECTION 300 25% HIGHWAY DESIGN SUBMISSION

### 301 Utility Coordination

Contact utility companies to verify locations of existing utilities and to assess impacts to those facilities. Ensure that the proposed design addresses impacts associated with accommodating both existing and proposed utilities. Provide a list of utility companies that may be affected by the proposed work, as part of the 25% submission. Follow the latest utility engineering directives.

### 302 Subsurface Utility Exploration (SUE)

Perform the level of Subsurface Utility Engineering (SUE) required given the project scope per the latest utility engineering directives and direction from the DUCE.

### 303 Additional Field Visit

Perform an additional field visit if required following the Pre-25% Procedure to verify or document existing conditions or perform further investigation.

### 304 Meetings and Liaison

Attend coordination meetings with MassDOT, the community, utility-owners, local commissions, and others. Prepare and distribute minutes of the meetings.

### 305 Preliminary Horizontal Geometry

Develop horizontal geometry based on the proposed cross section, horizontal clearances, the proposed design speed, terrain and other factors as described in Chapter 4 of the *Project Development and Design Guide*. Develop horizontal roadway geometry at intersections.

### 306 Preliminary Vertical Geometry

Develop vertical geometry based on the proposed design speed giving consideration to drainage, vertical clearances, construction cost, the interface with the proposed horizontal geometry and other factors as described in Chapter 4 of the *Project Development and Design Guide*.

### 307 Cross Section Studies

Conduct iterative horizontal and vertical geometry refinements for critical cross sections based on the interface with the proposed roadway cross-section and existing features. Include relevant features on abutting properties that would be affected by construction work.

### 308 Prepare Cross Sections

Prepare cross sections to determine the tops and bottoms of slope. Evaluate the impacts to resource areas, trees, and neighborhoods. Evaluate slope impacts and the need for retaining walls and determine the limits of work at driveways.

### 309 Plot Proposed Layout and Easements

Plot proposed alterations to existing layouts and proposed permanent or temporary easements and rights of entry, based on the limits of work determined by the cross sections, including public utility easements if necessary.

### 310 Pavement Design

Prepare a pavement design in accordance with the Guidebook for review by MassDOT. Perform pavement cores, prepare pavement design checklist, determine DBR value, and assemble traffic data. For bridge R&R projects refer to the latest MassDOT Memorandum on standard bridge deck pavements.

### 311 Typical Sections

Prepare representative typical sections for mainline, ramps and secondary roadways. Label the location of roadway crown line; describe the method of banking, guardrail location, pavement structure and material types in accordance with Standard Nomenclature and Materials Specifications.

### 312 Construction Details

Provide details of key features not satisfactorily described in the *Construction Standard Details*. Key details shall include the labeling of key materials in accordance with the Standard Nomenclature and Materials Specifications.

### 313 Hydrological Studies and Hydraulics Report

Investigate hydrological characteristics of rivers and streams in the vicinity of the project based on storm frequencies commensurate with roadway functional classification and MassDOT standards. Prepare calculations to determine the size of opening to accommodate the design flows. Prepare a hydraulics report with pertinent data and recommendations.

Any work required for Hydraulics Studies and Reports for bridges over water shall be completed under Task 708.

### 314 Preliminary Drainage Studies

Investigate project impacts on existing surface and closed drainage systems. Evaluate hydraulics and structural adequacy of existing culverts. Establish preliminary limits of proposed open and closed drainage system improvements and outlet locations, identifying any potential BMP locations to address water quality and peak rate concerns.

### 315 Lane Configurations

Assess travel lane configurations at intersections and at weaving and merging sections to establish traffic requirements/capacities.

### 316 Traffic Signals

Prepare signal plans depicting signal head type, quantity, and location and include the sequence and timing chart and preferential phasing diagram. Additional guidance regarding the Traffic related details required for the 25% Design Submission is described in the Traffic and Safety Engineering 25% Design Submission Guidelines.

### 317 Signs and Pavement Markings

Prepare preliminary sign and pavement marking plans for all proposed facilities.

### 318 Traffic Management

Develop a general methodology for constructing the proposed project to minimize the impact to all facility users and abutters, while at the same time addressing construction costs and constructability. Prepare preliminary temporary traffic control plans. The preparation of these plans should include a preliminary estimate that takes into account the use of police and/or flaggers to be used for traffic control.

### 319 Preliminary Landscape Design

Assess impacts to trees, significant vegetation, habitat, viewsheds, and other landscape features within and adjacent to project limits that may result from constructed improvements or construction activities. Incorporate input from public process. Propose preservation and restoration measures to mitigate losses and improve the landscape.

Landscape architectural services may be required for bike and shared use paths, roundabout landscape areas, work in and adjacent to park land, stormwater basins, wetland planting, cultural and natural resource areas, and instances where projects integrate transportation with public spaces or residential areas. See the Guidebook and the MassDOT Landscape Restoration Policy for guidance. In addition, arborist services may be required to assess the potential removal or pruning of existing trees that could be impacted by the proposed work. Coordinate with MassDOT Landscape Design as necessary.

### 320 Preliminary Utility Design

The Consultant shall design alterations of utilities that are located within the public ROW, which may be required due to construction of the project, except in cases such as alterations of fire or police signal systems or other systems where, in the opinion of the Engineer, public convenience or safety requires such alterations to be designed and performed by the particular public agency involved. Insofar as practical, and as approved by the Engineer, designs of such alterations of utilities by the Consultant shall conform to the requirements and design standards of the particular public agency involved. These should be submitted in the design plans in accordance with the most recent utility directives and submission policies.

In connection with all alterations of utilities that need to be performed by others, whether publicly or privately owned, and in connection with alterations of facilities of public transit systems or railroads, the Consultant shall furnish to the agencies involved data needed for their design of the alterations, including data regarding possible interference with other facilities. The Consultant shall review designs prepared by other agencies in connection with the work under this Contract and shall coordinate all alterations, whether designed by him/her or by others. In the case of utility or railroad alterations to be designed at the expense of the Commonwealth by other agencies, such as state or municipal departments, utility owners or railroad companies, the Consultant shall assist MassDOT in obtaining cost estimates from those agencies. This effort should include quantifying private utility work and documenting utility pole relocation.

### 321 Constructability Review

Review the proposed project to ensure that the project does not present unusual matters that would unduly increase the cost of the project or present potential scheduling delays during construction resulting in claims for extra work. Particular attention must be given to the proposed construction staging, available right of way, and utility relocation staging.

### 322 Quality Control (QC) Review

Perform review of the quality and accuracy of the documents to ensure that key aspects of the information to be presented to MassDOT are prepared in accordance with the *Guidebook*, the *Standard Specifications for Highways and Bridges* and the most recent Supplemental Specifications, Standard Nomenclature and Engineering Directives. Particular attention is directed to Chapter 2 of the *Guidebook* for the 25% submission requirements. The design should also be reviewed for conformity to design standards. Deviations from the controlling criteria defined in Chapter 2 of the *Guidebook* and in E-20-001 must be documented under Section 220, Design Justification Workbook.

### 323 Preliminary Construction Cost Estimate

Prepare a preliminary cost estimate using MassDOT’s Weighted Average Bid Application (WABA). The estimate should be prepared with a level of detail commensurate with a 25% submittal. Refer to Chapter 2 of the Guidebook for the 25% cost estimating requirements. The utility items should be itemized for the construction cost estimate.

### 324 25% Contract Plans

Prepare miscellaneous plan sheets for presentation of the proposed project. These shall include but not be limited to the following, as required: Title Sheet, Index, Key Plan, Boring Plans, Boring Logs, Construction Plans and Drainage Plans.

### 325 Submission Checklists

Prepare and submit the 25% Highway Design and Traffic Checklists.

### 326 Modifications and Revisions

Revise the plans and other design submission documents accordingly, prior to scheduling the public hearing, in order to properly present the nature and extent of the project to the public at the hearing.

### 327 Value Engineering (VE)

On projects requiring VE studies, the Consultant shall participate in a VE review to be conducted by an independent VE Team retained by MassDOT. Effort of the Consultant under this task will include the preparation of materials, project presentations, and field visits to familiarize the VE Team with the Project.

The VE Report shall be in accordance with the FHWA definition and application of Value Engineering as published in the *Federal Register* on September 5, 2014, as well as in accordance with the most current FHWA Value Engineering Policy. The effort will also include follow up with the VE Team and MassDOT to review and discuss VE recommendations and make accepted revisions to the project.

### 328 Construction Contract Time Determination

At the 25% design stage, the Consultant must provide MassDOT with the anticipated construction duration. This preliminary duration shall be determined based on the known scope of work, outcomes of early utility coordination, current proposed staging and anticipated traffic management plan. A full Construction Contract Time Determination (CCTD) performed by a Scheduler is not required until the 75% design and beyond.

### 329 Incentives/Disincentives

If required by MassDOT, the Consultant shall provide additional support services to develop contractor performance-based incentives and disincentives (I/D). The work under this task may include development of the following items:

1. Road User Impact Calculations
2. Acceleration Schedules

Road User Impact Calculations (RUC)

These shall be generated using the traffic information that has been gathered during the design phase and shall be analyzed and presented in accordance with the standards that have been identified as part of the American Association of State Highway and Transportation Officials (AASHTO) User and Non-User Benefit Analysis for Highways (September 2010 or latest addition), and in accordance with MassDOT’s current policies and procedures.

Acceleration Schedules

In support of the development of the I/D analysis and the RUC analysis, the Consultant may be directed by the Project Manager to provide several alternative Contract Time Determination Schedules (CTDs) to assist MassDOT in the finalization of parameters that will be provided to the contractors for their performance based incentive.

### 330 Respond to 25% Comments and Comment Resolution Meeting (CRM)

Prepare a formal written response to all comments received regarding the 25% review and address revisions stemming from the Design Public Hearing that MassDOT and the Consultant deem necessary. Attend a CRM to resolve any further review comments and responses. Provide MassDOT with written minutes of the meeting.

## SECTION 350 DESIGN PUBLIC HEARING

Coordinate with the MassDOT Project Manager to verify requirements for the hearing as far as process, accessibility, participation, virtual and hybrid requirements, and consultant services.

### 351 Hearing Preparation

Prepare the graphics and other visual aids per the negotiated scope of services to display at the public hearing. Prepare a public hearing handout. All hearing documents must be fully accessible and meet all ADA and WCAG requirements for being posted on mass.gov.

### 352 Design Public Hearing

Attend Design Public Hearing where the project will be presented to the public; respond to questions. Assist MassDOT in preparing written responses to feedback received from concerned individuals as a result of the hearing.

## SECTION 400 75% HIGHWAY DESIGN SUBMISSION

### 401 Reserved

### 402 Field Reconnaissance / Field Survey

Conduct a field review of the proposed project interface with adjacent properties, streets, drives, drainage, utilities, wetlands, etc. Define additional survey needs, if needed, and verify that conditions have not changed significantly since the original survey as defined in the *MassDOT Plan Preparation Guidelines for Consultants Preparing Right-of-Way Plans*.

Services of a certified arborist may be required to provide assessment and recommendations for trees to be retained that are in close proximity to construction. In particular, assessment may be required for sidewalk construction or relocation, trenching for utilities, relocation of overhead utility wires, shared use paths, bike corridors, and temporary construction access.

### 403 Meetings Liaison and Coordination

Attend meetings and provide the liaison necessary to advance the design of a project. Coordinate and attend meetings with MassDOT’s Boston and District Offices, community representatives, and/or planning agencies, as determined in the project scoping process. Provide MassDOT with minutes of the meetings.

### 404 Utility Coordination

Contact utility companies affected by the proposed work to provide an update since 25% early coordination. Discuss project impacts, including vegetation impacts, and note the locations of relocated utilities (poles, pipes, etc.) on the plans. Include estimate and special provisions for publicly owned utility work that is to be performed by the construction contractor.

### 405 Final Horizontal Design Geometrics

Adjust the horizontal geometry based on the 25% review comments and comments stemming from the Design Public Hearing. Plans must clearly show all aspects of the horizontal geometry, including curve components such as Point of Curvature (PC), Radius (R), DELTA, Length of Curve (L), Tangent (T) and Point of Tangency (PT) along with a description of roadway widths, station equations and horizontal offsets between survey baseline and design centerline.

### 406 Final Vertical Design Geometrics

Adjust vertical geometry based on 25% review comments and comments stemming from the Design Public Hearing. Plans must clearly show all pertinent aspects of the vertical geometry including Stopping Sight Distance (SSD), Passing Sight Distance (PSD), Grade 1 (G1), Grade 2 (G2), Length of Vertical Curve (L), K (factor), station and elevation of Point of Vertical Curvature (PVC), Point of Vertical Tangency (PVT) and Point of Vertical Intersection (PVI). Profiles are to be prepared in accordance with the *Guidebook*.

### 407 Pavement Design

Respond to Pavement Design Engineer’s review comments and prepare a detailed pavement design with updated data sheets, per the *Guidebook*. For bridge R&R projects refer to the 11/12/09 MassDOT Memorandum on standard bridge deck pavements.

### 408 Typical Cross Sections

Finalize the typical cross sections ensuring that materials and dimensions are clearly labeled in accordance with the proposed pavement structure approved by the Pavement Management Section.

### 409 Plot Cross Sections

Adjust cross sections to ensure that the slope limits and treatments of each cross section are crafted to suit the specific site locations. Individual cross sections should be evaluated regarding guardrail locations, gravel box detail, pay limits, wetland replication areas, grading impacts on trees within and immediately adjacent to project limits, and the need for subdrains and retaining walls.

### 410 Plot Proposed Layout and Easements

Adjust the plans based on the limits established by the final cross sections to ensure that adequate right of way is available to perform the work. Existing layout lines, proposed alterations and any temporary or permanent easements must be clearly labeled.

### 411 Construction Plans

Update the Construction Plans based on MassDOT comments in accordance with the *Guidebook* and the current MassDOT CADD template. Each item of work within the project limits must be clearly labeled. Drawings must be formatted as described in the *Guidebook*.

### 412 Grading and Tie Plans

Prepare grading and tie plans as applicable showing detailed information regarding proposed curve geometry and grades.

### 413 Drainage and Water Supply Plans

Clearly show all existing and proposed drainage and water supply installations. The drainage and water supply design must address all work required to accommodate the proposed roadway improvements.

During the Project’s design development, the plan presentation of proposed drainage facilities will show rim and invert elevations. These will be included in a separate CADD layer, so that they can be frozen off in the PS&E documents. These elevations shall not be shown on the final plans.

### 414 Traffic Signs

Identify locations for all warning, regulatory and route marker signs. Indicate on the construction plans the disposition/status of existing sign structures.

### 415 Guide Sign Design and Overhead Directional (OD) Elevations

Indicate proposed locations of all ground mounted and overhead guide signs. Develop panel legends and calculate size. Prepare a Sign Summary Sheet. Design support foundations and include calculations. Draft guide sign details and overhead sign elevations.

### 416 Traffic Signals and Plan Preparation

Include designs for traffic signal installations, supports, and foundations. Develop traffic signal specifications. Finalize phasing details and prepare the traffic signal plans. Coordinate location of control boxes with pedestrian movement, sight distance requirements, and operational requirements.

### 417 Pavement Markings and Plan Preparation

Design and layout the roadway pavement markings, stop lines, cross walks, gore markings, etc. Prepare pavement marking plans.

### 418 Traffic Management Plans and Details

Finalize the construction staging. Prepare the temporary traffic control construction plans in accordance with the MUTCD such that sufficient information is provided to demonstrate a feasible means of constructing the project. The level of detail shall recognize that the actual traffic management plan implemented by the contractor may vary from that shown on the plans. A more definitive estimate for the use of police/flaggers will be made based on the finalization of the traffic control plans/traffic management plans.

### 419 Highway Lighting Plans and Details

Complete the highway lighting distribution system, control equipment, wiring schematics, and other relevant details. Provide a photometric analysis to assess lighting efficiency and impacts to abutters and wildlife, if required.

### 420 Landscape Design and Plan Preparation

Provide landscape architectural design services to refine preliminary design per PDDG guidance. Coordinate with MassDOT Landscape Design as needed. Refinement may require additional field visits. Landscape designer may be required to participate in design review meetings. Develop and submit construction plans and details, grading plans if required, specifications, and estimate.

### 421 Construction Phase Erosion and Sediment Control

Detail the sequencing, material placement and measures to control the potential damage to adjacent properties, wetlands, bodies of water, etc. Show and note proposed erosion and sediment (E&S) control measures, including temporary seed, compost topdressing, jute mesh or biodegradable matting, and/or other E&S controls where necessary, on the plans and include those items in the specifications and estimate. Provide drainage calculations that correspond to the proposed type and location of controls.

### 422 Miscellaneous Contract Plans

Update miscellaneous plan sheets for presentation of the proposed project. These shall include the following, as required: Title Sheet, Index, Key Plan, Boring Plans, Boring Logs, Typical Sections, and Special Details.

### 423 Quantity and Cost Estimate (Weighted Average Bid Application)

Prepare a detailed estimate using MassDOT’s Weighted Average Bid Application (WABA). Also prepare a calculation book based on the latest edition of the Standard Nomenclature. Check that every item of work shown on the plans has a pay item. Refer to the Standard Specifications for Highways and Bridges, Supplemental Specifications and Chapter 18 of the Guidebook for guidance on estimating various items.

Provide tracking of significant changes (greater than 10%) since the 25% estimate.

### 424 Special Provisions

Prepare draft special provisions based on the latest editions of the *Standard Specifications for Highways and Bridges* and *Supplemental Specifications*, and verify that every item in the estimate that is listed in the Standard Nomenclature with an asterisk (\*) has a special provision. Ensure that special provisions are drafted only when absolutely necessary to describe a specific or unique activity to be performed by the contractor.

### 425 Constructability and Quality Control (QC) Reviews

Perform an independent review of the project using an experienced engineer, who is not directly involved in the preparation of the contract documents. The review shall focus on the practicality of constructing the project based on access to site, equipment needs, material properties, etc. Also provide an overall review of the plans, specifications and estimate for conformity to the *Guidebook*, the *Standard Specifications for Highways and Bridges*, the latest *Supplemental Specifications*, the *Bridge Manual*, the *Construction and Traffic Standard Details*, and the latest Engineering and Policy Directives.

### 426 Submission Checklist

Prepare and submit the 75% Design Checklist.

### 427 Bottom Up Estimate and Reconciliation (if required)

**a) Bottom Up Estimate and Reconciliation**

When required, as identified by one of the criteria i-iv below, the Consultant shall perform bottom-up cost estimates at the 75% design stage, 100% design stage and at PS&E stage for lump sum items. Bottom-up cost estimates will not be required for standard items with other units of measure. A bottom-up cost estimate is a cost estimate that is based on a detailed breakdown of labor, materials, equipment and production rates. The Consultant shall perform bottom-up cost estimates for lump sum items if the Project:

1. has an estimated construction cost of at least $15 million;
2. has an estimated construction cost of at least $6 million and is complex (e.g., includes complex traffic sequencing, construction over a waterway, utility relocation, right of way issues, or railroad coordination), as determined by MassDOT;
3. includes accelerated construction techniques;
4. or on an as needed basis as determined by MassDOT.

**b) Basis of Estimate Narrative**

As part of the 75%, 100% and PS&E design submissions, the Consultant shall submit a “Basis of Estimate Narrative” to MassDOT. Failure to submit a Basis of Estimate Narrative with a design submission may result in MassDOT’s rejection of the cost estimate.

The form of the Basis of Estimate Narrative shall be in accordance with the sample template provided by MassDOT.

**c) Quality Control Procedures**

The Consultant shall submit its Quality Control (QC) Procedures for performing cost estimates to MassDOT for review and approval prior to commencing work on the Project. As a minimum requirement, the Consultant shall detail the roles of each individual performing the estimate (quantity survey, pricing, constructability, means-and-methods), and provide a description of how quantities will be checked, and how pricing computations will be maintained.

**d) Independent Cost Estimating**

For reliable and accurate construction cost estimates for projects, MassDOT may engage an Independent Estimator (IE) to develop independent cost estimates at various design stages of the Project.

If this is required the Consultant is responsible for responding to the IE’s comments, reconciling documents generated by the Consultant and documents generated by the IE, and for revising the construction contract documents if deemed necessary by MassDOT.

**e) Reconciling Estimates**

The Consultant shall cooperate with MassDOT to reconcile its cost estimates with those of the Independent Estimator. If requested, the Consultant shall provide information and documentation to MassDOT in addition to the documentation and information set forth above.

MassDOT shall draft the reconciliation statements on estimates. The Consultant may be required to review the reconciliation statements for validity and, as directed by MassDOT, shall resolve and incorporate the cost estimates contained in the reconciliation statements in future submittals on the Project.

The Consultant shall also collaborate with MassDOT to determine whether alternatives may reduce the Project costs or schedule, and to identify these alternatives. Alternatives include, but are not limited to, constructability approaches. MassDOT and the Consultant will agree on a scope and fee adjustment for the Consultant’s preparation of alternatives.

### 428 Construction Contract Time Determination

This language applies to all Projects with Project Utility Coordination Form and/or Incentives/Disincentives.

The Consultant shall prepare a Construction Contract Time Determination (CCTD) Schedule which sets forth an estimate for a reasonable duration of the construction contract, utilizing the details of the estimate for all projects that involve a Project Utility Coordination Form or Incentives/Disincentives that MassDOT chooses to offer the Contractors.

The CCTD Schedules at the 75% (INITIAL), 100% (UPDATED) and PS&E (UPDATED) design stages provide MassDOT with a basis to determine whether the Construction Contract Duration represents a reasonable approach to constructing the Project, to allow constructability issues to be addressed prior to design completion, to assist the Consultant with the requirements to validate that the contract plans/documents support a constructible approach, and to assist MassDOT in the review of the Contractor’s Baseline Schedule Submission.

The Consultant shall employ an experienced construction scheduler to prepare construction schedules at the 75%, 100% and PS&E design stages. The Scheduler must have a minimum of 5 years of construction scheduling experience, and may be an employee of the Consultant.

**a) Critical Path Method Scheduling**

The CCTD Schedule shall use a Critical Path Method (CPM) and shall be developed and maintained using software approved by MassDOT (Primavera is preferred for consistency with MassDOT’s construction specifications and master schedule). An evaluation of critical resources, shift differential, overtime, proposed methods, and all limitations of operations shall be included in the CCTD Schedule.

Based upon consultation with MassDOT the Consultant will be required to respond to any comments and update, explain or incorporate any MassDOT provided data, such as production factors, and/or revise the CCTD Schedule, as MassDOT determines necessary.

The Consultant shall submit a CCTD schedule following the 75%, 100% & PS&E submission of each construction cost estimate. The CCTD schedule submission will be due three (3) weeks after the construction cost estimates have been approved by MassDOT.

If required, the data from the bottoms up cost estimate for Lump Sum items (e.g., crews, equipment, production rates, quantities, construction sequence), must be used in the development of the CCTD Schedule. The Scheduler shall develop the logic (activity relationships) and activity durations using data from the estimate. Production rates and labor hours shall be used to develop reasonable crew hours based upon a reasonable crew composition. This evaluation shall also consider the intended construction sequence, construction seasons, and other construction time related aspects, such as any requirements to relocate utilities and Incentive/Disincentive provisions.

**b) Milestones and Access Restraints**

The Consultant shall develop Contract Milestones and Access Restraints (to the Project site) including those identified to support the utility coordination developed as part of the Project Utilities Coordination Form and those needed to support the implementation of Incentives and Disincentives that should be included in the construction contract provisions, and shall include them in the CCTD schedule.

**c) Limitations of Operations – Construction Constraints**

The Consultant shall identify significant implications of construction constraints as may be determinable, and reflect them in the cost estimate and schedule, including, but not limited to restrictions from temperature, noise, vibration, permitting, approved materials, emergency response and community events, as part of the Project Utility Coordination form. The Consultant shall include all of the resulting PUC form information in their CCTD and shall provide MassDOT a furnished PUC form in the Contract Documents. This effort also includes the development of access restraints (restrictions that clearly define when the contractor can start work in a specific area allowing for the third-party Utility to complete their work) into the Contract Documents. The Consultant shall identify any early utility work, permitting or Right of Way activities that must be performed prior to the Contractor N.T.P. These early coordination activities shall be identified and included in the CCTD updates. If some construction activities are to be performed during the winter months (grouting of precast units; placing of closure pour slabs; etc.) make sure those tasks are identified and appropriate language is added to Subsections 8.03 and 8.10.

**d) Elements**

The Consultant shall include the following time (contract duration) related elements are included in the CCTD Schedule:

* 1. Preparation of a work plan and mobilization prior to starting physical work;
  2. Preparation of critical submittals;
  3. Review of critical submittals by the Consultant (MassDOT will provide standard submittal review durations to be used in the CCTD schedules);
  4. Procurement/ordering of materials;
  5. Fabrication and delivery of long-lead items;
  6. Time necessary to complete each activity, as itemized in the Construction cost estimate;
  7. Testing;
  8. Commissioning (moveable drawbridges only);
  9. Winter restrictions;
  10. Environmental permitting or landowner restrictions;
  11. Agency/utility/city restrictions;
  12. Sequencing/logic required to complete the work;
  13. Utility restraints and utility relocation milestones; and
  14. Early/Critical coordination activities

1. Early Utilities
2. Remaining Right of Way
3. Permits that the Contractor must obtain

**e) Quality Control Procedures**

The Consultant shall submit its Quality Control (QC) procedures for the performance of CCTD to MassDOT for review and approval prior to commencing work on the Project. As a minimum requirement, the Consultant shall detail the roles of each individual performing the planning schedule (utilization of estimating information, logic, durations, constructability, means-and-methods), and provide a description of how the schedule will be developed, monitored and approved by the Consultant.

### 429 Incentives/Disincentives with Road User Calculation

Refer to Standard Task Description 331 (Incentives/Disincentives) which details the effort involved in this task for the 25%, 75%, 100% and PS&E Submissions.

### 430 Traffic Control Agreement Preparation

Evaluate the need for a Traffic Control Agreement (TCA) and prepare the draft agreement based on the template provided by MassDOT. TCAs are generally required on all Federal Aid projects on municipally owned roadways.

### 431 Respond to 75% Comments and Comment Resolution Meeting (CRM)

Prepare a formal written response to all comments received regarding the 75% review. Attend a CRM to resolve any further review comments and responses. Provide MassDOT with written minutes of the meeting.

## SECTION 450 100% HIGHWAY DESIGN SUBMISSION

### 451 Reserved

### 452 Finalize Plans

Prepare a set of plans addressing all comments received from the 75% review. Ensure that the plans are clear and are prepared in accordance with Chapter 18 of the *Guidebook* and the current MassDOT CADD template.

### 453 Finalize Special Provisions

Review the special provisions to ensure that the special provisions do not duplicate those with respect to Division II of the *Standard Specifications*. Review the Method of Measurement and Basis of Payment for every item in order to ensure that the special provisions are clearly defined and not ambiguous.

### 454 Prepare Detail Sheets

Prepare Detail Sheets in accordance with Chapter 18 of the *Guidebook*. All items of work not adequately reflected on the plans are to be described in the Detail Sheets.

### 455 Finalize Quantity and Cost Estimate (W.A.B.A. and Calculation Book)

Prepare Detail Sheets, Quantity Sheets, and a Cost Summary Sheet. Finalize calculation book in accordance with Chapter 18 of the *Guidebook*. Prepare calculations for all items of work that have a pay item. Identify any non-participating work. The estimate submitted shall be prepared using MassDOT’s Weighted Average Bid Application (WABA).

Provide tracking of significant changes (greater than 10%) since the 75% estimate.

### 456 Quality Control (QC) Review

Perform an independent review of the project using an experienced engineer, who is not directly involved in the preparation of the contract documents to perform an independent review of the project. Refer to the MassDOT web site for the latest edition of all reference documents, Engineering Directives and Policy Directives. Verify that the plans, specifications and estimate are prepared in accordance with these documents.

### 457 Submission Checklist

Prepare and submit the 100% Highway Design Checklist.

### 458 Bottom Up Estimate and Reconciliation (if required)

Refer to Standard Task Description 427 (Bottom Up Estimate and Reconciliation) which details the effort involved in this task for the 75%, 100% and PS&E Submissions.

### 459 Construction Contract Time Determination

Refer to Standard Task Description 428 (Construction Contract Time Determination) which details the effort involved in this task for the 75%, 100% and PS&E Submissions.

### 460 Incentives/Disincentives

Refer to Standard Task Description 331 (Incentives/Disincentives) which details the effort involved in this task for the 25%, 75%, 100% and PS&E Submissions.

### 461 Traffic Control Agreement Submission

Update the draft Traffic Control Agreement (TCA) and submit the final TCA to the Traffic Regulations Unit for processing.

### 462 Respond to 100% Comments and Comment Resolution Meeting (CRM)

Prepare a formal written response to all comments received regarding the 100% review. Attend a CRM to resolve any further review comments and responses. Provide MassDOT with written minutes of the meeting.

## SECTION 500 RIGHT OF WAY

The Consultant or MassDOT shall prepare right of way plans as specified in the *Guidebook*, the current versions of the MassDOT CAD Standard, the Plan Preparation Guidelines for Consultants preparing Right of Way Plans, QA/QC Form for Consultants preparing Right of Way Plans, and as noted in applicable FHWA policies and regulations. Preliminary right-of-way plans shall be with the 25% design submission.

Right of Way plans are required at each design stage submittal until plans are accepted for State right-of-way projects. Right of Way plans are required at each design stage submittal for municipal right-of-way projects.

The size, form and arrangement of right of way plans shall conform to the general requirements for highway plans as specified in the *Guidebook,* the current versions of the MassDOT CAD Standard, QA/QC Form for Consultants preparing Right of Way Plans and the Plan Preparation Guidelines for Consultants preparing Right of Way Plans.

**Preliminary Right of Way plans** shall be prepared prior to holding the 25% Design Public Hearing. Existing data, details and all proposed work shall be prepared in such a manner as to be readily discernable. These plans shall remain in the preliminary stage until after the layout has been duly filed in the Registry of Deeds.

The Consultant shall, as required, provide MassDOT with copies of the preliminary right of way plans for coordination and informational purposes, particularly as this may relate to changes in parcel dimensions or title names.

Deeds and plans of the abutting property owners shall be used to verify the location of all the abutter’s property lines. **GIS data layers are not to be used to establish abutters property lines; precise or approximate.** Electronic copies of the research materials and any updates shall be maintained throughout the right of way process. All research materials are to be made available to MassDOT during the preparation of the Preliminary Right of Way Plans.

Relative to **Layout and Taking Plans and Orders of Taking,** the Consultant shall prepare and submit to MassDOT, for approval by the Layout Engineer when impacting State Highway Layout, all the instruments which are required to be recorded in the Registry of Deeds in connection with the acquisition of any interest in real estate made necessary by the work to be performed under this Contract. These instruments shall consist of plans, descriptions and orders of taking for advance takings, alterations, layouts and/or easements. The preparation of these instruments shall conform to standard MassDOT practices. Drawings shall be plotted on polyester film, except in the case of Land Court plans, which must conform to Land Court standards, samples of which may be obtained from the Engineer. All plan sheets to be recorded shall be signed and stamped with the seal of a Land Surveyor registered in the Commonwealth of Massachusetts, who shall be in charge of the work. The Massachusetts Professional Land Surveyor shall be a full-time employee of a firm prequalified by the MassDOT Architects & Engineers Review Board in category “S3 - Layout Document Preparation.” For any projects impacting municipal right-of-way, this process needs to be followed but instead of submitting to the Layout Engineer submit to the community compliance administrator and the municipality’s legal counsel.

Abutter’s property lines shall be verified with updated deeds and plans. The Professional Land Surveyor shall maintain and update electronic copies of the research materials throughout the taking document process.  All research materials are to be made available to MassDOT Highway Division during preparation of the Layout Plans and written instruments.

Any registered land subdivisions required for this project shall be submitted to and approved by the Land Court.

MassDOT shall handle the recording and filing of these instruments, affecting MassDOT State highway layout. The municipality shall be responsible for the recording and filing of these instruments affecting municipal layout. MassDOT shall also handle the appraisal and settlement of all land damages, including negotiations with property owners. The municipality shall also be responsible for the appraisal and settlement of all land damages, including negotiations with property owners when they acquire Right of Way.

### 501 Preliminary Right of Way Plans

Review the relationship between the limits of work necessary to satisfactorily construct the proposed improvements and the existing layout. Determine appropriate limits of alterations to existing layouts, railroad sidelines, takings, permanent easements, temporary easements, etc. Prepare Preliminary Right of Way Plans in accordance with Chapter 18 of the *Guidebook*, the current versions of the MassDOT CAD Standard and the Plan Preparation Guidelines for Consultants preparing Right of Way Plans. The Right of Way Plans include Title Sheet, Legend, Abbreviation and Project Description, Typical Sections, Parcel Summary Sheet, Location Maps and Property Plan Sheets.

### 502 Layout Plans and Order of Taking

Prepare Layout Plans based on the approved Preliminary Right of Way Plans. Show lengths and bearings of all lines and calculate areas. The Layout Plans shall be prepared in accordance with Chapter 18 of the *Guidebook,* the current versions of the MassDOT CAD Standard and the Layout Plan Preparation Guidelines, and shall include the proposed layout lines, property lines, railroad sidelines, corner markers, names of property owners, parcels to be taken, access and non-access points and the locations of all bounds. The preparation of a Decree Plan shall be included, if required.

### 503 Written Instrument

The Written Instrument for the Layout and Order of Taking shall be prepared in accordance with MassDOT Policy. The Written Instrument shall be carefully checked against the Layout Plan.

### 504 Quality Control (QC) Review

Perform a separate review of the quality and accuracy of the preliminary Right of Way plans to ensure that key aspects of the information to be presented to MassDOT are prepared in accordance with Chapter 18 of the *Guidebook*, the current versions of the MassDOT CAD Standard and the Plan Preparation Guidelines for Consultants preparing Right of Way Plans. Ensure that previous comments on the preliminary Right of Way plans are addressed satisfactorily for the next submission.

## SECTION 600 GEOTECHNICAL DESIGN

The Consultant shall conduct an investigation of sub-surface conditions of sufficient scope to permit determination of general soil characteristics and depth to bedrock as a basis for the proper design of roadway and highway structures.

In order to properly make the determination of underground conditions, the Consultant shall submit to the Engineer for approval a proposed program of borings, test pits, plate bearing tests or other field or laboratory tests, along with an estimated cost for performing such work.

The Engineer may limit, reduce or extend the sub-surface investigation program proposed by the Consultant, or the Engineer may specify in detail the type, extent and details of sub-surface investigations that are to be conducted by MassDOT forces or by such other means as the Engineer may determine. In any case, the Consultant shall lay out the work in detail and prepare necessary plans and contract documents for the approved work.

The Environmental Services Division shall be consulted for a determination of environmental permitting requirements for the sub-surface investigations. The Consultant shall be responsible for the preparation of any environmental permit applications required for the sub-surface tests.

Any required subcontracts shall be performed in accordance with the relevant provisions of Division I of the Standard Provisions, General Requirements and Covenants.

Field inspectors shall be furnished by the Consultant only if MassDOT inspectors are not available and only after written authorization is granted by the Engineer as to the number of inspectors to be provided.

The Consultant shall be responsible for properly identifying, describing and classifying soil and rock encountered in sub-surface investigations pursuant to the standard of care. The Consultant shall visually and manually examine all soil samples and rock cores and shall certify in writing to the Engineer, when, where and who examined such soil samples.

The Consultant shall prepare reports covering all sub-surface investigations and soils analyses and shall submit these reports to the Engineer. A sufficient number of copies of these reports, as determined by the Engineer, shall be submitted by the Consultant for review and retention by MassDOT and for submission to the FHWA.

The Consultant shall either have in its employ an engineer capable of performing the basic soils and foundation work or engage the services of a soils engineer, the cost of which is to be included in the General Fee as a direct expense.

Employees of the Consultant or the geotechnical subconsultant may not function as inspectors if the drilling contractor is owned by or affiliated with the Consultant or geotechnical subconsultant.

Inspectors provided by the Consultant for inspection of geotechnical borings, soil sampling and field-testing shall be performed by:

* A certified soils technician, who is knowledgeable in current policy and procedures for field inspection of geotechnical exploration programs and shall have a minimum of one year of boring inspection field experience, or
* A holder of a Bachelor of Science degree in civil engineering, geology or equivalent, plus three months of boring inspection field experience.

To achieve certification, soils technicians must satisfy the rules and procedures of the certification program, as prepared by the National Institute for certification in Engineering Technologies (NICET) in their current editions of the following documents:

* “Program Detail Manual” for certification in the field of geotechnical engineering technology
* Section II and IV of the NICET manual entitled Engineering Technician and Technologist Certification Program”

Inspectors shall be capable of making independent site modifications regarding the extent and/or location of the subsurface investigations required.

The inspector shall have the responsibility of certifying that the drilling contractor’s procedures for conducting soil sampling and in-situ testing work, such as undisturbed samples, vane shear tests, piezometer installations, etc., are performed in accordance with the relevant specifications and current practices.

The inspector shall follow the MassDOT’s boring inspection procedures, which include, but are not limited to the following: an inspector’s check list for site work, scope of work and description of the subsurface operations; special provision items and supplemental specifications; visual identification of soil and rock samples; standard penetration tests and soil descriptions; and standard operating procedures for recording daily boring activities.

### 601 Research Available Subsurface Data

Research, compile, and evaluate available subsurface and foundation data relative to the project site (plans, maps, etc.).

### 602 Field Reconnaissance

Conduct a field inspection at the project site to view site conditions, consider existing and proposed substructures, foundation elements, and assess requirements for the subsurface investigation plan.

### 603 Subsurface Investigation Plan

Prepare a subsurface investigation plan (boring, probing, testing type, location, depth, etc.) in accordance with the *Bridge Manual*. Revise and resubmit after MassDOT review. Prepare the specifications and estimates if the boring contract is to be paid for with direct expenses.

### 604 Subsurface Investigation Inspection

Conduct on-site inspections during subsurface operations. Follow inspection procedures, coordinate activities between the Consultant and MassDOT, and verify and record quantities for records and payment.

### 605 Office Studies, Analysis and Testing

Review soil/rock samples and field/laboratory test results. Evaluate the foundation options and determine parameters for foundation design.

### 606 Geotechnical Report

Prepare and edit the Geotechnical Report in accordance with the *Bridge Manual* and other guidelines. Correlate the contents of the report with the project construction plans.

### 607 Meetings, Reviews and Liaisons

Coordinate and meet with MassDOT for reviews, revisions, and advancement of project submittals.

### 608 Plans, Specifications and Estimates

Prepare and finalize geotechnical related details and items for the plans, special provisions, and estimates.

## SECTION 700 PROJECT DEVELOPMENT – STRUCTURAL

The Consultant shall establish the site parameters and constraints that will impact the design and construction of the bridge structure through a field investigation, review of information related to the existing structure (if any), review of available hydraulic and scour data, geotechnical data, environmental information, and cultural resource information, hazmat information. The Consultant shall use this information to determine the most appropriate type of structure for the site that addresses these parameters and constraints to be pursued in the Final Bridge Design work.

### 701 Field Investigation

Conduct a field inspection to review the bridge site and adjacent conditions, and establish project parameters and constraints. Evaluate the ground and river survey to determine the parameters for bridge design.

### 702 Determine Bridge Configurations

Collaborate with the highway designer to determine the vertical and horizontal alignments and typical cross-sections for both the roadway over and the roadway under. Determine a preliminary span length and vertical bridge clearance.Provide accommodations on the bridge for both existing and proposed utilities.

### 703 Preliminary Structural Analysis

Determine bridge types as per scope of services. Perform a preliminary structural analysis to determine the approximate superstructure depth.

### 704 Comparative Design and Cost Analyses

Evaluate those alternate bridge structure types that are appropriate to the site based on considerations of highway design parameters, traffic safety, impacts to surrounding properties and environmentally sensitive areas, traffic management, constructability, and aesthetics. Cost shall only be used to select between alternates that have been determined to be equally appropriate to the site based on the Type Selection Worksheet.

### 705 Preliminary Structures Report Preparation

Prepare a Preliminary Structures Report where scope of services includes an investigation of rehabilitation verses replacement. The report shall evaluate the structural components that have less capacity than required for statutory live load, and shall justify the recommendation for rehabilitation or replacement.

### 706 Bridge Type Selection Worksheet Preparation

Prepare a Type Selection Worksheet per the MassDOT *Bridge Manual* detailing the various design alternatives for the bridge, complete with appropriate graphics, descriptive text and cost breakdowns justifying the recommendations presented.

### 707 Meetings and Liaison

Attend meetings and coordinate with MassDOT during the preparation of the Type Study Report to advance the work. Respond to MassDOT review comments.

### 708 Hydraulics Study and Report (Bridges over Water)

Review the hydrological analysis and hydraulics report relative to the size of the hydraulics opening. Perform all calculations necessary to determine the size of the opening required to accommodate the design flows. Prepare a Hydraulics Report that presents pertinent data and recommendations.

## SECTION 710 SKETCH PLANS

### 711 Establish Boring Locations

Determine the locations for the proposed bridge borings based on an approved structure type. Coordinate the boring program and the geotechnical design with MassDOT’s Geotechnical Section. Prepare the boring location plans. Revise and resubmit after MassDOT review, if required.

### 712 Reserved

### 713 Sketch Plan Development

Prepare Sketch Plans for each structure in accordance with the MassDOT *Bridge Manual*. Submit review copies together with the foundation report to MassDOT. Check to ensure that the proposed design and construction staging plan addresses the cost and scheduling impacts associated with accommodating both existing and proposed utilities. Review the boring logs and foundation reports. Perform geometric design calculations.

### 714 Meetings, Coordination and Liaison

Participate in MassDOT Sketch Plan review meetings. Prepare responses to agency comments and plan revisions, as necessary. Provide coordination during the soils testing program and prior to the preparation of the soils and foundation reports being provided by the geotechnical staff or a subconsultant.

### 715 Constructability Review

Review the design of the proposed structure to ensure that the structure does not present any unusual matters that would unduly increase the cost the project or present potential scheduling delays during construction resulting in claims for extra work. Particular attention must be given to the proposed construction staging and available right of way.

### 716 Submission Checklist

Prepare and submit Bridge Section Checklist.

## SECTION 750 FINAL BRIDGE DESIGN

### 751 Structural Design – Superstructure

Prepare the design calculations and perform an independent design check of the calculations for all superstructure components in accordance with the MassDOT *Bridge Manual*.

### 752 Structural Design – Substructure

Prepare the design calculations and perform an independent design check of the calculations for all substructure components, including any cofferdams and permanent excavation support system requirements in accordance with the MassDOT *Bridge Manual*.

### 753 Bridge Layout Geometrics

Prepare the design calculations and perform an independent design check of the bridge geometric calculations, including framing, layout, critical clearance and elevation of footings, layout and ties, etc.

### 754 Contract Drawings

Prepare the structural drawings in accordance with the MassDOT *Bridge Manual* and check the drawings for content and accuracy.

### 755 First Review Submission

Prepare and submit the bridge design plans for MassDOT review and subsequent resolution of the comments and recommendations received from MassDOT.

### 756 Quantity Cost Estimates

Prepare the quantity calculations, and perform an independent check of the quantity calculations of the bridge items and related cost estimates.

### 757 Special Provisions

Prepare the bridge special provisions in accordance with the MassDOT *Bridge Manual*.

### 758 Second Review Submission

Prepare and submit updated final bridge designs plans for MassDOT review and subsequent resolution of MassDOT comments and recommendations.

### 759 FHWA Reviews

On projects requiring FHWA oversight, provide copies of First and Second Bridge Plans for submission to FHWA for review. Respond to FHWA comments.

### 760 Meetings and Liaison

Participate in meetings and coordinate in scheduling and advancing the bridge design.

### 761 Constructability and Quality Control (QC) Review

Perform an independent review of the project by an experienced engineer who is not directly involved in the preparation of the contract documents. Review shall focus on the practicality of constructing the structure based on access to site, equipment needs, material properties, etc. Provide an overall review of the plans, specifications and estimate for conformity to the *Guidebook*, the *Standard Specifications for Highways and Bridges*, the latest *Supplemental Specifications*, the *Bridge Manual*, the *Construction and Traffic Standard Details*, and the latest Engineering and Policy Directives.

### 762 Submission Check List

Prepare and submit Bridge Section Check list.

## SECTION 800 PS&E SUBMISSION

Upon approval of the plans submitted for the 100% design submission, the Consultant shall proceed with the preparation of the contract plans and documents in accordance with the relevant guidelines set forth in the *Guidebook*, the *Bridge Manual*, the *Standard Specifications for Highways and Bridges*, and other related publications as listed in Division I.

### 801 Reserved

### 802 Finalize Plans, Specifications and Estimate

Ensure that all comments from the review of the 100% design submission and from the review of the P.S.& E. submission are addressed and reflected in the contract documents.

### 803 Combine Highway and Bridge

Ensure that the highway plans accurately depict the approved bridge design and that the index correctly identifies the page numbering of the bridge plans. Combine Special Provisions and Estimate into one package that eliminates redundancy and ambiguity.

### 804 Quality Control (QC) Review

Have an experienced engineer who is not directly involved in the preparation of the contract documents perform an independent review of the project. Log on to the mass.gov website for the latest reference documents such as Engineering Directives and Policy Directives, and verify that the Plans, Specifications and Estimate are prepared in accordance with these documents. Review all environmental permits and ensure that the contract documents provide a means of compensating the construction contractor for performing work described in the permits.

### 805 Finalize Bottom Up Estimate and Estimate Reconciliation (if required)

Refer to Standard Task Description 427 (Bottom Up Estimate and Reconciliation) which details the effort involved in this task for the 75%, 100% and PS&E Submissions.

### 806 Finalize Construction Contract Time Determination

Refer to Standard Task Description 428 (Construction Contract Time Determination) which details the effort involved in this task for the 75%, 100% and PS&E Submissions.

### 807 Finalize Incentives/Disincentives

Refer to Standard Task Description 331 (Incentives/Disincentives) which details the effort involved in this task for the 25%, 75%, 100% and PS&E Submissions.

## SECTION 900 CONSTRUCTION ENGINEERING

The Consultant shall provide construction phase services for items of work identified in the Scope of Services. Compensation for all construction phase services shall be made on a Costs Plus a Net Fee basis, as described under Division I, regardless of the payment method used for other services specified under this Contract. Construction phase services shall generally fall within the major categories described hereafter, unless otherwise specified under this Contract or directed by the Engineer.

The Consultant shall furnish consultations and interpretation of the Contract drawings and specifications as may be required by the Engineer. No payment will be made for visits to the work site in relation to errors or omissions made by the Consultant or to insufficient data in work previously submitted by the Consultant.

The Consultant shall also make its services available during construction for visits to the work site for consultations regarding additional design services or unforeseen problems required by the Engineer. Payment for additional construction phase services, if required and approved by the Engineer, shall be made in accordance with Division I.

The Consultant shall review and take appropriate action upon the contractor’s submittal of shop drawings, samples of construction material, and product data, as required in the construction contract documents, but only for conformance with the design concept of the Project and with the information given in the construction documents. In its review of the shop drawings, the Consultant is entitled to rely on the information provided, and the stamp and certification of the submitting Contractor as described in the Construction Contractor’s general conditions. Review of shop drawings, product data and samples of construction material shall not include review of dimensions, quantities, calculations, weights, fabrication processes, construction means and methods, coordination of trades or safety factors related to construction.

The purpose of the Consultant’s site visits and observations is to become generally familiar with the progress and quality of the work to determine, in general, if the work is proceeding in accordance with the design intent of the contract documents. The Consultant shall not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of work. On the basis of these on-site observations, the Consultant shall endeavor to keep the Engineer informed of portions of the work which the Consultant discovers are not proceeding in accordance with the design intent of the contract documents.

### 901 Pre-Bid Services

Review and respond to inquiries from MassDOT related to the bid documents. Participate in Pre-Bid Conference. Provide written responses to contractor’s questions.

### 902 Pre-Construction Conference

Attend the Pre-Construction Conference, if required. Answer questions and prepare the minutes of the meeting.

### 903 Highway Shop Drawings and Signal Layout Plans

Review lighting, traffic signals, and sign shop drawings, including foundations and supports; and perform an operational site inspection. Prepare signal layout plans based on as-built conditions in accordance with the MassDOT standard CADD template drawing.

### 904 Bridge and Wall Shop Drawings

Review and approve or take other appropriate action upon structural shop drawings for conformance with the contract documents.

### 905 Bridge Construction Procedures

Review and approve or take other appropriate action according to the Bridge Manual regarding the conformance of the bridge demolition and erection procedures to the contract documents.

### 906 Furnishing Advice and Field Visits

Provide assistance to MassDOT in interpreting the contract documents. Conduct field visits to the project site during construction as requested by the Engineer to provide consultation on design intent, assistance in addressing unforeseen conditions and/or similar matters, as requested by the Engineer.

Provide written responses to Requests for Information submitted by Contractors.

Provide landscape architectural services for nursery inspection and for field consultation for landscape planting and related construction. Provide wetland specialist services for wetland mitigation inspection and monitoring during and after wetland construction.

Attend or call into status and coordination meetings with MassDOT, the Contractor and the Municipality held at the Field Office or virtually. The occurrence of meetings shall be determined by the complexity of the project.

Conduct a site visit to observe the traffic signal equipment to determine when the work is substantially complete. Completed work generally conforms to the contract documents and is acceptable. Generate a punchlist and conduct a final site visit to determine if the punchlist has been adequately addressed. Provide a letter for recommended acceptance of signal equipment to the District Traffic Engineer.

### 907 Geotechnical Construction Evaluation

Provide a technical recommendation to resolve unanticipated foundation issues encountered during all phases of construction.

### 908 Bridge Rating and Photographs

Visit the project site and evaluate structures for conformance to the contract documents. Take photographs of completed structure. Prepare the Bridge Rating Report.