

NEPA Design Engineering and Design Activities

Environmental Evaluation and Documentation:

Environmental evaluation and documentation requires some level of engineering and design activities to identify environmental affects. Project Development needs to determine the level of engineering and design activities by asking the question "How much engineering and design do we need to complete the required Environmental Consequences Worksheets?" For projects with well defined scope and limited alternatives very limited engineering and design activities are needed. The Environmental Evaluation and Documentation for these projects needs to be completed early in Project Development.

Engineering and Design activities to support a project's preferred alternative are listed below. It is not the intent to provide step by step activities since activities overlap. Consultant solicitation, selection and negotiations are not included. Value engineering studies are not listed but the timeline can be found in the FDM. For less complex projects with well defined scopes or alternatives many engineering and design activities may not be needed to define the preferred alternative.

Initial Program Estimate:

See DTIM Program Management Manual for complete program development including local projects.

- Establish a First Line Purpose and Need for the Project
- Environmental Document Type is Identified
- Reviews Meta-manager Data
- Program Level Project Scope
- Sets WisDOT Program (e.g. majors, 3R) and Funding
- Develops LET Schedule
- Develops a First Line Estimate.
- Project is Initialized with Concept Definition Report

Project Level Scoping and PMP Approval:

Project scoping evaluates existing data and project needs. Applicable proposed design standards are presented. An early public involvement plan is discussed. Project scoping with environmental scoping provides for early project coordination with environmental and other various Departments functional areas. Project estimate, schedule, purpose and need and environmental document type are refined.

Gather and Analyze Existing Conditions:

Gathering and analyzing the existing facility will provide the background as to how the facility operates, provides project support for the Purpose and Need, provides assessment of deficiencies, locations of sensitive environmental areas, and the existing and proposed land use from local governments. An analysis of existing conditions must be gathered before reasonable environmental evaluation can be initialized.

The following is a list of resources and activities that assists in defining and analyzing existing conditions and needs

- As-Built Construction Plans (typical and cross sections, roadway geometrics, alignments, access management)
- Traffic Characteristics
- Crash Data and Analysis
- Roadside Safety Features (clear zone, slopes, barriers, fixed objects, signs)
- Controlling Features (topographic, environmental, utilities)
- Sensitive Resources (archeological sites, historic sites, flood plains, specialized populations, recreational areas, parks, wildlife resources, aquatic resources)
- Engineering Surveys (such as cross sections, topography, and drainage information)
- Hazardous Materials Investigation
- Existing Right of Way Lines
- Utilities and Railroad Locations, Owners, Potential Conflicts

- Permits (special use permits, access permits)
- Geotechnical Reports
- Pavement Structure and Conditions
- Hydrology and Hydraulics Conditions
- Structures Types and Conditions
- Pedestrian and Bike Use
- Land Use Maps (environmental, MPOs, population, soils,)
- Transportation Maps of Alternative Modes of Travel

Design Standards:

Evaluate the following controls for establishing a safe, operational, community sensitive project design.

- Functional Classification
- Design Year
- Traffic Volume Controls
- Highway Improvement Type (reconstruction, 3R, preventive maintenance, other)
- Location (urban, rural, transitional)
- Topography
- LOS
- Access Tier
- Highway Capacity, Land Use
- 13 Controlling Geometric Design Standards Criteria (minimums and desirables)
- Non-Controlling Geometric and Technical Design Standards (clear zone, median width, design vehicle, intersection sight distance, bridge railing and others)
- Bike and Pedestrian Standards
- Context Sensitive Design Considerations

PMP Preliminary Plan Phase:

The project's purpose and need (safety, operational, existing conditions, and deficiencies) have been identified as have social, economic and environmental concerns. Various Technical Section Functional areas have been identified to provide support in the development of the Environmental Evaluation and Documentation.

Reasonable alternatives are developed and considered balancing the guidelines for geometric/technical design with the needs of the stakeholders and the environmental concerns and effects.

The following are engineering and technical design activities for developing alternatives.

- Survey and Mapping : U.S. Public Land Survey System corners, points of intersection (PIs), and points required for photogrammetric applications, alignment surveys
- Proposed Geometric Design: 13 FHWA Controlling Geometric Design Standards and non-controlling design standards.
- Preliminary Typical Sections including Clear Zones and Lateral Offsets (mainline, side roads, ramps, auxiliary lanes, bike and pedestrian)
- Preliminary Alignments Mainline and Sideroads, Interchanges (horizontal, vertical, clearances, SSD, grades)
- Preliminary Cross Sections (desirable standards for slopes, ditches, flow lines, bike accommodations)
- Intersection Controls (angle of intersection, intersection sight distance, turn lanes, design vehicle, traffic signals, roundabouts)
- Interchange Types and Locations.
- Preliminary Details (erosion control, traffic staging, drainage control, storm sewer, culverts),
- Right of Way: Identify existing right of way including easements, identify land ownership public/private or tribes. Approximate the proposed right of way and costs. Identify property affected and impacts.
- Utilities: Type and location of existing utilities, easements, sensitive or difficult needs. Reasonable alternatives will need to balance utility adjustments. Identify approximate utility adjustments and costs.

- Railroad: location, owners, right of way, railroad schedules, sight distances
- Evaluate Access Management Needs
- Hydrology and Hydraulics: For each alternative develop preliminary hydrology and hydraulic design applied to the drainage basin. Including location, size, type of major crossings and culverts that influence preliminary highway design. Typically small culvert type structures are completed in Final Design.
- Structures: Determine location, type, size, flow capacity, typical section, and aesthetics of proposed structures.
- Geotechnical Investigation Including Borings. Cause of instability and pavement problems of the existing highway assists in the development of alternative alignments. Geotechnical reporting of geology, potential unstable soils, major geological features, material type (solid rock, unconsolidated material), water conditions, and availability of materials on site and off sight also assist in reasonable alternative development.
- Pavements: Evaluates the cause of pavement distress of existing pavements assists in the development of proposed pavement structure alternatives (pulverize, overlay, sub grade stabilization...). For conceptual purposes pavement structures used on similar highway projects could be used.
- Permits: Identify permits required for each alternative (COE, DNR, Coast Guard, US Fish and Wildlife)
- Hazardous Material Assessments
- Construction Buildability and Concerns
- Design Exceptions
- Cost Estimates, Project agreements

Initiate Public involvement and CSD to allow for the opportunity for input and comments from stakeholders regarding the reasonable alternatives. Operational Planning meeting, local officials meetings, and public informational meetings are a few of the opportunities for agencies, stakeholders and the public to contribute to the design. Public coordination must be continuous throughout the project development.

Environmental document Types such as draft EIS, EA and CE are initiated.

Identify the Reasonable and Feasible Alternative(s):

After reasonable and feasible project alternatives have been identified and the information is plotted and documented further analysis is needed to assess the effectiveness of each alternative to the project objectives. Typical Project Objects include

- Fulfilling the Purpose and Need
- Fulfills the Operational and Safety Needs of the Users and the Highway Functional Classification
- Is Cost Effective
- Avoids, Minimizes or Mitigates Environmental Impacts
- Is Context Acceptable (design is sensitive to the land use, incorporates stakeholders input, System linkage, transportation model interface, demonstrates well defined decision making process)
- Minimizes Maintenance Costs

After the in depth analysis of the alternatives one or more alternative may be eliminated.

EA-FONSI Environmental Class Action Projects:

Considering the social, environmental, engineering, economic and public impacts a preferred alternative shall be identified for EA – FONSI projects. The preferred alternative shall be presented as the preferred alternative in the Environmental Assessment at the public hearing, if required, and in the FONSI.

Once the EA identifies the preferred alternative and prior to the FONSI it is reasonable that addition engineering detail would be requested to mitigate or avoid environmental impacts.

DEIS-FEIS-ROD Environmental Class Action Projects:

The Draft EIS (DEIS) should state all alternatives under consideration, and that a decision will be made only after a reasonable public outreach effort has been completed, and the public hearing results and public

comments have been evaluated. Considering the social, environmental, engineering, economic and public impacts a preferred alternative shall be identified for the Final EIS and ROD.

Once the preferred alternative is identified it is reasonable that additional engineering detail would be requested to mitigate or avoid environmental impacts.

PMP Preliminary Plan Review Phase with Preferred Alternative:

The following support section engineering and design activities reports/findings can be provided. The information may result in modifications to the preferred alignment/alternative;

- 30% Plan Review Meeting. Exhibits can include typical sections, plan profile, drainage details, traffic control staging, cross sections other appropriate detail sheets, estimate of quantities, cost estimate.
- Drainage Report: culvert sizing, storm water management.
- Geotechnical Report
- Pavement Design Report
- Structure Report/Plans. Substructure and superstructure details, large cross-drain designs
- Continue Preliminary Utility review
- Continue Railroad Coordination
- Develop a Traffic Management Analysis/Plan
- Update State/Local Agreements
- Set Pre-final Geometrics and Right of Way
- Obtain Final Agricultural Impact Statement
- Prepare Draft Exception to Standards Report (if needed)
- Prepare Draft Design Study Report

The NEPA Design Process concludes with the final approved environmental decision document.