Preliminary Engineering Phase

Preliminary Engineering is the second phase of the PDP. The purpose of Preliminary Engineering is to begin the process of collecting more detailed information by conducting field investigations, other technical studies, and engineering. This work builds upon and refines the information and analyses produced during the Planning Phase and many tasks can be performed concurrently, as appropriate. A primary product of this phase is the recommendation of the preferred alternative for a project.

Develop Preliminary Alternatives

1: Feasibility Study Development

The Feasibility Study is designed to analyze alternatives in order to identify a preferred alternative, or multiple alternatives, through the PDP. This flexibility with the Feasibility Study is dependent on the PDP Path designated by the Project Manager. Project Managers have the authority to adjust Feasibility Study tasks in order to align the project needs and deliverables with the project scope. A Feasibility Study is not required for Path 1 projects.

Typically for Path 2 and Path 3 projects the product of the Feasibility Study is the preferred alternative. For very simple projects, the preferred alternative may be the only consideration. Typically on Path 4 and Path 5 projects, the outcome of the Feasibility Study will be a limited number of alternatives to be studied further. Regardless of the project path, developing the Feasibility Study is not intended to be a lengthy process.

Project related tasks that are important in the development of alternatives include, but are not limited to:

- Planning Level Traffic, Field Survey and Aerial Mapping
- Capacity Analysis
- Typical Sections
- Preliminary Alignment and Profile
- Cross-Sections
- Geotechnical Deliverables
- Mapping
- Environmental Analysis
- Public Involvement and Stakeholder Coordination *
  (* especially for Path 3, Path 4, and Path 5 projects)

The initial set of alternatives should be broad enough to allow for a wide range of possible solutions, while at the same time taking into account the project’s relative size and scope. The alternatives identified and examined at this level should be considered feasible solutions to the transportation problem. The Project Manager should consider items such as pavement type and thickness, minor geometric improvements to improve safety or traffic flow, alternate structure types, or possible structure rehabilitation. The no-build alternative should be considered for all projects, as it serves as a baseline condition against which alternative strategies will be measured. For Path 1 through Path 3 Projects, the alternatives under study can be more design-specific in nature than alternatives for projects defined as Path 4 or Path 5.
Once a preferred alternative is chosen upon completion of the Feasibility Study for a Path 2 or 3 project, Stage 1 and Stage 2 design can begin concurrently with NEPA studies and permits, as appropriate for the project and prior to approval of the environmental document. Understand that moving forward in this manner, while allowed, is done at some assumption of risk that the Project Manager will have to consider.

In all cases, the alternatives should encompass the critical elements identified in the Purpose and Need Statement. These critical elements provide one component of the comparative measures through which the project team evaluates the alternatives under consideration.

The project team should evaluate the alternatives based on a variety of comparative measures. Examples of comparative measures include: quantifying the number of impacts identified through technical analysis, costs, long-term versus short-term solutions, and stakeholder involvement. An Alternatives Comparison Matrix can facilitate the comparison of feasible alternatives. A stakeholder meeting may be necessary to provide a forum for reviewing the evaluation matrix, discussing the rationale for eliminating alternatives, and selecting the feasible alternative(s) proposed for advancement.

The Project Manager can choose to hold a feasibility study meeting that is a meeting of experts on the team (including consultant(s), FHWA, Central Office and District staff, etc.), convened to make decisions about the project and document those decisions. This is advisable for Path 2 and 3 projects and can streamline aspects of the project schedule. It is a focused meeting, taking place in one day or a half day to make feasibility study decisions. The documentation for the meeting would be the meeting minutes, supplemented with mapping and any other additional information necessary to document the decisions made by the team. This documentation would constitute the project feasibility study.

A recommended table of contents for the Feasibility Study can be found in Appendix F.
Preliminary Engineering Phase

2: Perform Environmental Field Studies

Based on the potential for environmental impacts, as documented in the secondary source review (the PIP) in the Planning Phase, a determination is made on the required level of environmental field studies and agency coordination for each environmental resource.

Field Studies are used to quantify, and qualify, the characteristics of the natural and man-made environment. Initial environmental field studies are conducted on the alternatives and documented in the Alternative Evaluation Report (AER). Reports generated from these field studies help to determine whether further investigation and agency consultation is warranted. If Office of Environmental Services (OES) staff concludes that additional environmental field studies are necessary to refine impacts, the work is conducted only within the preferred alternative. For cultural resources, the District must submit a Section 106 Request for Review to OES prior to having any Phase I field work scoped and initiated.

If warranted, the following studies are conducted:

- Ecological (water resources, plant and animal species, terrestrial habitat, farmland)
- Phase I History/Architecture survey (following a Section 106 Request for Review)
- Environmental Site Assessment (hazardous waste, landfills)
- Social and Economic Resources (environmental justice, Title 6, community issues)
- Section 4(f) properties (parks, recreation areas, wildlife/waterfowl refuges and historic sites)
- Preliminary analysis of Section 6(f) resources (i.e., identification of presence/absence).
- Preliminary noise analysis.

The amount of data collected and coordination will vary based on the impacts associated with the project. For example, some projects may be cleared through one of OES’ streamlined agreements, while other projects may require more detailed documentation and additional coordination efforts. OES has established mechanisms for streamlining the environmental process for some resources. These processes exist in the form of Memoranda of Agreement (MOAs), Letters of Agreement (LOAs), and Programmatic Agreements (PAs). The streamlined processes should be evaluated for applicability to the project during this phase.

Prior to conducting the field studies, the Project Manager ensures that letters are mailed to property owners and tenants notifying them of ODOT’s intent to access their property.

Individual field survey reports present the results of technical field studies conducted within the feasible alternatives. These results are added to project mapping that began development in the Planning Phase. In addition to the results of the field surveys, the updated project mapping includes all available information regarding the approximate locations of homes and businesses, as well as any other pertinent data from the field. The project management team should be aware that there is sensitive data that can be on mapping used by the project team, but should not be included on mapping exhibited or distributed at public meetings. Specifically, the location of archaeological sites and threatened and endangered species should not be publicly disclosed.

Field checks verify the accuracy of the information prior to submissions of the mapping to the ODOT District and ODOT-OES.
Once the District and OES approve the results of the feasible alternative field studies, the Project Manager coordinates scheduling of public involvement activities, as necessary.

Refer to ODOT-OES’ website for more information regarding environmental studies.

3: Alternative Evaluation Report

The Alternative Evaluation Report (AER) is designed for concurrent processing of preliminary engineering and environmental work, as a project moves through the PDP. Under FHWA’s new flexibility regarding the level of engineering that may be done early in project development, ODOT is now able to take advantage of using preliminary engineering level work to aid in the determination of a preferred alternative, in conjunction with NEPA analysis.

An AER will not be compiled for Path 1 and 2 projects, and it is unlikely that a Path 3 project will have one prepared. The AER is primarily used on Path 4 and 5 projects, but may be used for a complex Path 3 project.

All work carried out during evaluation of the alternatives will be documented in the Alternative Evaluation Report. The AER will discuss environmental and design issues, then recommend a preferred alternative. Once a preferred alternative is chosen, Stage 1 and Stage 2 design can begin concurrently with NEPA studies and permits, as appropriate for the project and prior to approval of the environmental document. Understand that moving forward in this manner, while allowed, is done at some assumption of risk that the Project Manager will have to consider.

The primary purpose of preliminary engineering is to establish and develop the design parameters to a level of detail comprehensive enough to generate an accurate scope, schedule, and budget for the remainder of the design. On projects with multiple alternatives (other than the no-build alternative), preliminary engineering also should provide a level of design that allows for a better informed selection of the preferred alternative.

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**Alternative Evaluation Report Components**

- Executive Summary
  - Introduction/Background
  - Alternatives
  - Traffic Analysis
  - Roadway Assessment
  - Drainage Assessment
  - Structure Assessment
  - Geotechnical Assessment
  - Right of Way Assessment
  - Utility/Railroad Assessment
  - Environmental Analysis
  - Public Involvement
  - Alternative Comparison
  - Recommendations
Preliminary Engineering Phase

Preliminary engineering aids in the prevention of late-stage design changes. Preliminary design provides a level of plan development that allows for a comprehensive analysis of all design issues and a thorough review, and comparison, by the appropriate stakeholders.

The preliminary engineering should provide enough detail so that the intent, design parameters, costs, and impacts of the project are clearly discernable. The detail should be such that a final design Scope of Services can be established. The Scope of Services aids in refining the project schedule and gives the design team a solid base upon which to complete the plans.

As part of the preliminary engineering activities, the utility companies are contacted and asked to locate their underground facilities within the project area. Utilities which conflict with the proposed project work are identified for relocation. The District Utility Coordinator is contacted to determine estimated utility reimbursement cost. Early coordination with the ODOT District Railroad Coordinator is important to ensure that railroad companies are involved early in the process.

In addition to the AER, all actions directly related to the project must be included in the environmental document. For example, the new location of a natural gas line that is moved "off-project" must be considered when evaluating the impacts of an alternative for the environmental document.

The Project Manager will determine if a Constructability Review will be conducted concurrent with the Preliminary Engineering Review. The intent of a Constructability Review is to check the potential construction strategies, techniques, and logistical issues. The review also checks construction durations, and alternative designs. It identifies labor and material availability, access for large equipment, project phasing, and the conceptual maintenance of traffic.

Preliminary Engineering should be conducted on all applicable projects to a level of detail that provides:

- Accurate costs for all feasible alternatives
- An accurate Scope of Services for final plan development
- A comprehensive analysis of design issues
- Preliminary Construction Limits
- Geotechnical data

Although it is not the intent of this document to detail all of the elements included in a Preliminary Engineering submittal, the "Typical Alternative Evaluation Engineering Elements" below provide a set of general guidelines which can be used to help establish a reasonable level of detail for a typical preliminary engineering submittal. For a more detailed explanation of Preliminary Engineering refer to ODOT’s *Location and Design Manual, Volume 3, Section 1400.*
A recommended table of contents for the Alternative Evaluation Report can be found in Appendix F.

4: Alternative Evaluation Report Submittal

The Alternative Evaluation Report (AER) gets submitted to District and Central office for review. The Project Manager is responsible for ensuring that the respective offices get an opportunity to review, and provide comments on the document, to ensure that an effective decision-making process is taking place.

The AER submission includes a matrix or summary of advantages and disadvantages for each alternative from a design perspective. The results of the environmental field studies and the conceptual relocation studies should also be summarized to show the advantages and disadvantages for each alternative. It is the combination of both design and environmental factors that contribute to the selection of the preferred alternative.

5: Stakeholder Consultation/Public Involvement (Alternatives Review)

An important activity during Preliminary Engineering as a project advances through the development process is coordination with stakeholders of the alternatives under consideration. As stated in the Introduction to this manual, a stakeholders list for a project typically includes Federal, State, and local agencies, community organizations, special interest groups, and the general public.

It is the Project Manager's responsibility to determine the appropriate stakeholders to be involved in project development, as appropriate for the project. The Project Manager also should consider what form of public involvement is necessary and appropriate for a project. If a project requires a public meeting, the Project Manager should work with the District Public Information Officer to advertise the date, time, and location of the public meeting.
For Path 4 and 5 projects, stakeholder consultation will occur after completion of both the Feasibility Study and Alternative Evaluation Report (AER) because of the complexity of these projects.

For Path 3 projects, this consultation will occur at the completion of the Feasibility Study. On occasion, a complex Path 3 project may also require preparation of an AER; therefore this coordination would also occur at the completion of the AER, as with Path 4 and 5 projects.

As stated earlier in this chapter, a Path 2 project will not have an AER, and may only rarely have a Feasibility Study prepared. In those circumstances, the Project Manager will have to ensure that the Feasibility Study is coordinated with stakeholders.

With larger, more complex projects such as some Path 3 and all Path 4 and Path 5 projects, the Feasibility Study and AER will be shared with resource agencies for their use and information in order to facilitate ongoing discussions between ODOT and those agencies.

Comments received from the agency, stakeholder, and public review of the Feasibility Study and/or AER are addressed as the project continues through development.

6: Stage 1 Design

Once a preferred alternative is chosen, Stage 1 design can begin concurrently with NEPA studies and permits as appropriate for the project. Stage 1 design can commence prior to the environmental document being approved. As stated previously, remember that moving forward in this manner is done at some assumption of risk that the Project Manager will have to consider.

Prior to beginning Stage 1 Design, the Project Manager establishes a project review meeting with, at a minimum, representatives from the design, planning, and environmental staff to discuss outstanding issues. The Project Manager should consider including other discipline representatives such as District utility, railroad, and construction staff.

Stage 1 Design refines and builds upon the preliminary engineering design completed for the AER. It provides a level of detail necessary to begin Preliminary Right-of-Way Plans, allows for an accurate estimation of required right-of-way acquisition, and allows for a refined estimate of construction costs.

A list of elements to assist in the establishment of a typical Stage 1 Design submittal is presented in the text box. The list is not all-inclusive, and all of the listed design elements are not required for every project. Project managers have the discretion to determine which tasks are needed based on the project scope and when a combined Stage 1/Stage 2 submittal will suffice. See ODOT’s *Location and Design Manual, Volume 3, Section 1400* for a complete list.
Preliminary Engineering Phase

Typical Stage 1 Design Elements
- Refined typical sections
- Earthwork design
- Design exceptions
- Guardrail length
- Existing property lines
- Title and deed research
- Subsurface utility exploration
- Utility dispositions
- Subsurface investigation
- Cross-sections with final flow line elevations
- Ditch designs
- Finalize post construction storm water BMP Design
- Drive and interchange details
- FAA clearance analysis
- Pavement design
- Refined construction, ROW acquisition, and utility reimbursement cost
- Noise wall/retaining wall plans
- Sewer design (plan/profile)
- Refined construction limits for right-of-way
- Culvert design (no headwall details)
- Structure Preliminary Design

7: Project Management for Preliminary Engineering Phase

This particular phase of a project entails a tremendous amount of work and effort from a variety of professionals. The Project Manager will need to ensure that regular communication among the project team members occurs. Project Managers should be prepared to make adjustments, as necessary, due to changes in having more project detail available.

Flexibility is important in providing the continuity needed for managing transportation projects over a long period of time. In addition to meetings and schedules, Project Managers may consider other tools such as well-defined quality control processes, change management processes, contingency plans and communication plans for measuring project success and managing risk.

7.1: Meetings

The Project Manager is responsible for holding regularly scheduled meetings. The project team and relevant decision-makers should be invited to meetings to ensure that the project is advancing according to the established scope, schedule and budget. Additionally, it is a time for the project team to evaluate the team’s organization, resources and responsibilities. Each meeting should be well organized and documented for the project file. The project team should depart from meetings understanding the objectives, goals and tasks scheduled for completion.
7.2: Update Schedule

A project schedule should be developed for the Preliminary Engineering Phase. The project schedule should be a Gantt chart that includes:

- Project milestones
- Products to be developed
- Start and finish dates for each task

The project’s description, funding information, and schedule should be updated as appropriate in Ellis.

8: Cost Estimates and Milestone Dates

The Project Manager should update the schedule in Ellis to reflect any changes as a result of the alternatives discussion, written design scope, determination of environmental documentation, or other project information. The following costs should be updated:

- Roadway/Interchange costs
- Right-of-Way costs
- Utility cost estimates

9: Transitioning to Environmental Engineering

Prior to completing the Preliminary Engineering Phase and moving the project forward to the Environmental Engineering Phase, there are several tasks that the Project Manager must ensure are completed during the Preliminary Engineering Phase. These are key elements resulting from decisions made during the Preliminary Engineering Phase that must be completed before the Project Manager can move the project into the Environmental Engineering Phase.

These critical elements of the overall project plan of action form the basis for the work to be undertaken during the Environmental Engineering Phase. During the Environmental Engineering Phase, the project team will begin the process of gathering more and detailed information by conducting technical studies, developing more detailed engineering, and refining the plan to involve and inform stakeholders and the public.

- Further define goals, roles, and responsibilities for all project team members.
- Understand what commitments are being made for the next PDP phase(s).
- Know milestones and critical path factors for project.
- Conduct technical studies as appropriate for Preliminary Engineering Phase.
- Perform environmental field studies and refine impacts.
- Prepare waterway permit determination.
- Recommend preferred alternative.
- Conduct first Value Engineering Study for Preliminary Engineering.
- Conduct first constructability review (if needed).
- Finalize Feasibility Study.
Preliminary Engineering Phase

- Address agency, stakeholder, and public comments.
- Finalize Stage 1 Design for preferred alternative.
- Update project cost estimates (construction, utility reimbursement, environmental studies, and right-of-way acquisition).
- Update milestone dates as appropriate in Gantt chart and Ellis.
- Scope for the Environmental Engineering Phase should be in place with contract(s), schedule with deliverables, and budget.